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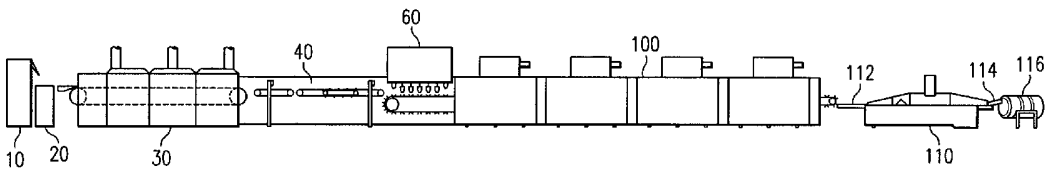

(57) Abstract: The system and method for molding a shaped snack chip use various components to form chips having depth such as a bowl-shaped tortilla chip. Essentially flat chip preforms are fed to a series of molds (64) disposed about a mold conveyor (68). The preforms are then passed along for shaping by a mold and plunger conveyor (60). A continuous conveyor (82) with plungers (80) extending outward is synchronized to operate in conjunction with the mold conveyor. At desired and determined intervals, a multiple of plungers extend downward and into the molds thereby molding the chip preforms into shaped chips. The shaped chips are evacuated from the molds and subjected to additional processing.

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APPLICATION FOR
UNITED STATES LETTERS PATENT

FOR

SYSTEM AND METHOD FOR MOLDING A SNACK CHIP

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BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to an improved system and method for molding a snack chip and, in particular, to a system and method for molding a scoop-shaped snack chip. The system and method allows a shaped snack chips to be molded at a relatively high production rate while producing a substantially uniform product.

2. Description of Related Art

Snack chips and other food products are frequently made to assume a desired shape. Often, these shapes are merely ornamental in design to assume an interesting shape that appeals to consumers. Sometimes, snack product shapes assume a utilitarian function. One such function is to retain liquid mixtures such as dip, salsa, bean dip, cheese dip, and the like.

When a consumer chooses to eat a chip with dip, the consumer typically holds a single chip and immerses a portion of the chip into the dip. The consumer then transfers the dipped chip to his mouth for eating. Often though, the desired quantity of dip fails to adhere sufficiently

to the chip or is lost during the transfer process. This problem is particularly noticeable when the chip is flat or relatively flat. Additionally, round or triangular flat chips are often too large to insert into a jar or fail to retain a sufficient quantity of dip on the chip surface during removal of the chip from the jar. With traditional chips, some are too large to consume in one bite. When this occurs, the dip on the uneaten portion of the chip frequently slides off creating a mess and a dissatisfied consumer.

To help retain dip, snack chips have been made with curved surfaces. Shaped snack chips allow the consumer to scoop up a desired portion of dip without losing a significant quantity during transfer to the mouth for eating. Further, shaped chips are more maneuverable for insertion into a jar or can of packaged dip such as salsa. The utilitarian shapes known include for example ridges, scoops, taco-shaped, spoon-shaped, and bowl-shaped. Of these, a bowl-shaped chip is particularly desirable as it has a retaining wall or edge surrounding the entirety of the chip.

The process for making a shaped chip, especially a bowl-shaped chip, is more complex as compared to traditional flat chip manufacturing processes. With traditional chip production, the dough or masa is extruded or sheeted into a desired chip shape. The shaped chips are toasted to add some stiffness prior to frying. To equilibrate moisture, the toasted chips are passed through a proofing stage. After proofing, the chips are transferred to a fryer for dehydration of the product for consumer packaging. As the chips have a relatively flat shape, no shaping systems are needed or required after the chips are extruded or sheeted.

For making a shaped snack chip, an alternative process is shown in U.S. Patent No. 6,129,939 to Fink et al. A form fryer produces a shaped snack chip by placing chips into a bowl-shaped mold cavity and frying the chip therein. Form frying however requires a specialized

dedicated fryer where a fryer is manufactured specifically to handle the molds. A fryer such as this is more complex and has a relatively lower manufacturing capacity compared to a free fryer. A stream of hot oil is used to retain chips in the molds. A cascading oil assists in maintaining the chips in proper position. With this process, a higher oil quality is needed because the oil turnover rate is longer than the typical frying process which causes increased oil degradation over time. A higher oil quantity extends the shelf life and improves flavor of the finished chips

Consequently, a system and method for forming a shaped snack chip that can operate at a high production capacity is desired. Such a system and method should be capable of producing shaped snack chips while keeping the costs associated with the chip manufacturing equipment and production with industry standards.

SUMMARY OF THE INVENTION

The present invention is an improved system and method for molding a shaped snack product such as bowl-shaped tortilla chips. The invention utilizes a sheeter for forming a sheet of dough (masa) into pieces that is fed to a toaster via a conveyor. The essentially flat shaped pieces, which for example could be hexagonal shaped pieces, are fed into one or more high temperature toasting ovens to add rigidity to the chips for the steps to follow. After toasting, the partially dried chip is conveyed to a piece alignment system. The piece alignment system aligns the chips prior to a plunger and mold conveyor system, which provides shape to the chips. The piece alignment system comprises a series of belts whereby the ranks (rows) of chips can be adjusted for proper placement for the plunger and mold conveyor. After the product is plunged in the mold conveyor, the chips pass through at least one oven for reducing chip moisture and providing additional rigidity for frying. Thereafter, the chips are ejected from the molds and are inputted into a fryer where the chips attain their final packaging moisture. Following frying, the chips are passed through an optional salter where salt and/or flavoring is added. The chips are then passed along for packaging for consumers. Particularly, the system and method are designed to have a high production rate while avoiding the use of rate limiting equipment. The above as well as additional features and advantages of the present invention will become apparent in the following written detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic perspective view of a system for making shaped snack products;

FIGURE 2 is a side elevation view of a shaped snack chip produced in accordance with the invention;

FIGURE 3 is a schematic side elevation view of the toaster and piece alignment system portion of the system shown in **Figure 1**;

FIGURE 4 is a schematic elevation view of the toaster, piece alignment system, and plunger and mold conveyor portion of the system shown in **Figure 1**;

FIGURE 5 is a schematic plan view of the alignment belt of the piece alignment system of the system shown in **Figure 1**;

FIGURE 6 is a schematic perspective view of a sensor array of the piece alignment system of the system shown in **Figure 1**;

FIGURE 7 is a schematic perspective view of the piece alignment system and plunger and mold conveyor portion of the system shown in **Figure 1**;

FIGURE 8 is a schematic perspective view of the plunger and mold conveyor of the system shown in **Figure 1**;

FIGURE 9 is a schematic perspective view of mold racks in accordance with the invention;

FIGURE 10 is a schematic elevation view of a plunger belt in accordance with the present invention;

FIGURE 11 is a schematic perspective side view of a plunger in accordance with the present invention; and

FIGURE 12 is a schematic perspective bottom view of a plunger in accordance with the present invention.

DETAILED DESCRIPTION

In **Figure 1**, a process for forming a shaped snack chip is shown. Sheeter **10** forms a sheet of dough that is fed to toaster **30** via conveyor **20**. Conveyor **20** transfers the essentially flat shaped raw chips, which for example are hexagonal shaped chips. The flat shaped dough or chip is then fed into a high temperature toasting oven **30** for adding rigidity for the following steps. The partially dried chip is then fed to a piece alignment system **40**. The piece alignment system **40** aligns the product for feeding to a plunger and mold conveyor **60**. Plunger and mold conveyor **60** imparts a shape to the chips. After the product is plunged to the mold shape, the chips pass through a multizone dryer **100** for reducing chip moisture. Thereafter, the chips are ejected from the molds and are fed into a fryer **110** where the chips attain their final packaging moisture. Following frying, the chips are passed through an optional salting drum **116** where salt and/or flavoring is added. Thereafter, chips **200** shown in **Figure 2**, are passed along for packaging for consumers.

In one embodiment, sheeter **10** has sheeter rollers and a conveyor **20** mounted in a common frame as a single unit (not shown). Sheeter **10** receives the dough at an inlet. The dough can be comprised of corn, wheat, rice, or other grains and mixtures thereof. For the preferred embodiment, the dough is comprised of white dent corn. As the sheet is formed in sheeter **10**, a cutter within sheeter **10** having the initial chip shape, which for example is an essentially flat hexagon, is provided. As dough passes by a cutter within sheeter **10**, the initial chip shape is formed so that essentially flat chips **202** being produced have approximately the same shape and thickness upon exiting sheeter **10**. Chips **202** are conveyed over conveyor **20** towards toaster **30**. Optionally, conveyor **20** has a pneumatic lift system to raise the conveyor to provide access to toaster **30** as needed. This is beneficial because as formed product exits

sheeter **10** the product essentially drops a small distance onto conveyor **20**. As the physical properties of the product being sheeted may change such as the coarseness and particle size of the dough, the adhesive properties, and the moisture content, the ability to adjust this drop is beneficial to maintain product uniformity.

After the dough is sheeted into the chip product's initial shape, chips **202** are fed to toaster **30** for reducing the product moisture. Using a preferred dough of masa, the chip moisture leaving the sheeter is typically about 50 to about 52% and is reduced to about 30 to about 40%, more preferably about 37%, by toaster **30**. Chips **202** are dropped onto a rotating transfer belt **32** for passage through toaster **30**. Toaster **30** toasts chips **202** through heating with infrared (IR), radio frequency, convective, ribbon burners, direct gas fired, conductive, impingement, and microwave heating for example. In a preferred embodiment, a series of IR burners or direct flame belt heaters are used. After toasting, chips **202** are transported to piece alignment system **40**.

Preferably, the product coming forth from toaster **30** just prior to a piece alignment system **40** utilizes a bladeless transfer shown in **Figure 3 and 4**. Unlike with a bladed transfer, a bladeless transfer avoids having multiple chips adhering to the blade due to sticky residue buildup thereon, nicks in the blade from high force contact with the toaster oven belt, blade replacement, or the blade losing contact with the belt causing chips to be captured between the blade and toaster oven belt. With the bladeless transfer, a monolayer of product leaving toaster **30** is maintained more readily than with using a conventional blade assisted transfer, i.e., a doctor blade. The blade assisted transfer does not require precise spatial orientation because a doctor blade is not practical for a molding process. To achieve bladeless transfer, the terminal end of toaster oven belt **32** has a discharge roll **38** that is disposed higher than a transfer belt **42**,

about 0.2 to about 0.5 inches higher. The leading edges of the toasted chips **202** essentially lift off of toast oven belt **32** at discharge roll **38** and convey onto transfer belt **42** at a nosebar roll **44**.

Figures 3 and 4 show transfer belt **42** which is the first of several belts of the piece alignment system **40**. The speed of transfer belt **42** operates at essentially the same rate as belt **32** to facilitate the bladeless transfer. With the product essentially aligned as a monolayer of partially dried chips **202**, these chips **202** are transferred to a phasing belt **46**. Phasing belt **46** has an adjustable speed for transferring chips **202** from the speed on transfer belt **42** to the speed and position needed for mold alignment belt **50**. Once at proper speed, the product is fed to alignment belt **50**.

With alignment belt **50**, the chips are aligned by rank (rows) and file (columns) for eventual feeding to a plunger and mold conveyor **60**. Alignment belt **50** has a system for conveying the chips into essentially even ranks. Although the chips entering alignment belt **50** have essentially distinct and even files, the ranks are not sufficiently aligned for eventual feeding to the plunger and mold conveyor **60**. Therefore in one embodiment, alignment belt **50** is outfitted with a series of cleats **52** that extend upwards from alignment belt **50** as shown in **Figure 5**. These cleats **52** are moving slightly faster than alignment belt **50** and are traveling on a cleat conveyor (not shown) disposed beneath alignment belt **50**.

As such, most chips are eventually pushed along the moving alignment belt **50** so that at the exiting from alignment belt **50** the chips have essentially even ranks. To maintain even files, it is preferable that at least two cleats **52** be provided per chip **202**. Thereby, a trailing edge of chip **202** will end up disposed between at least two cleats **52**. To catch each chip **202**, the distance between two cleats **52** in a rank is smaller than the width of the chip. Upon exiting

alignment belt **50**, chips **202** are deposited on a discharge belt **54** for transfer to mold belt **68** of plunger and mold conveyor **60**.

To ensure that the majority of chips **202** passing onwards to the plunger and mold conveyor **60** are in proper alignment, a position control system is utilized with piece alignment system **40**. Further the control system is used to insure that chips **202** are deposited onto alignment belt **50** such that chips **202** will be between rows of cleats **52**. The control system compensates for the differences of the incoming speed of chips **202** being fed into the piece alignment system **40** and the positioning needed for the plunger and mold conveyor **60**. If not positioned properly within a determined acceptable range for the plunger and mold conveyor **60**, then a number of chips **202** will not be positioned properly into the molds of the plunger and mold conveyor **60**.

Therefore, a chip sensor **48** is positioned to operate in conjunction with piece alignment system **40**. In a preferred embodiment, chip sensor **48** is positioned above phasing belt **46** and/or discharge belt **54**. However, chip sensor **48** can be positioned at a number of locations along the system for forming a shaped snack chip **202**. An optical sensor such as a photocell array can detect chips **202** to effectively determine their relative position. Other sensors can be employed however such as laser, ultrasonic, cameras, and color contrast.

The control system uses the information gathered from chip sensor **48** to determine the average rank position of chips **202** as to whether chips **202** are approaching on target, too early, or too late. Based upon this average computed position, an adjustment to the overall system is made if needed to insure that piece alignment system **40** is delivering essentially uniform ranks of chips to plunger and mold conveyor **60**. To adjust the positioning of the chips, the control system could optionally adjust one or more of the speeds of transfer belt **42**, phasing belt **46**,

cleats **52**, and/or discharge belt **54** for optimal chip delivery to plunger and mold conveyor **60**. As to positioning of the sensor, chip sensor **48** could be situated above transfer belt **42**, phasing belt **46**, alignment belt **50** at the chip entry, and/or discharge belt **54**.

For example, a photocell array **56**, utilizing chip sensors **48,** is arranged to measure the front wall of the passing chips **202** as they pass on phasing belt **46** as shown in **Figure 6**. The first and last files of these are typically not measured because these end chips **202** tend to accumulate scrap material from upstream processing. Sensing the remaining chips **202**, the average position of chips **202** in that rank can be determined. The speed of phasing belt **46** is then adjusted if necessary to assure that the following ranks of chips **202** will be fed to plunger and mold conveyor **60** at the proper speed to assure maximum alignment of chips **202** being deposited onto molds **64**.

Figure 7 shows plunger and mold conveyor **60** receiving the flat chips **202**. With a preferred dough of masa, the moisture of chips **202** is at approximately the same moisture as upon their departure from toaster **30**, about 34 to about 40%. At this moisture, the chips have enough cohesive integrity for molding.

Chips **202** are passed from discharge belt **54** to mold racks **62**. Ranks of mold racks **62** are comprised of a series of connected individual chip molds **64** for imparting the desired shape to each chip **202**. With proper sequencing, each mold **64** receives a chip properly aligned from piece alignment system **40**. Although molds **64** can be of any practical shape for a snack chip, molds **64** preferably have a bowl-shape.

Figures 8 and 9 show molds **64** that are formed by the juxtaposition of two mold racks **62**. Each mold rack **62** has a series of halves of molds **64** positioned along in ranks. Ranks of mold racks **62** travel continuously about mold belt **68**. Mold belt **68** is timed to ensure that mold

racks **62** are properly positioned for receiving the chips into molds **64** and for plunging. For example, a servo driver can properly control the timing of mold racks **62**. In a preferred embodiment, mold belt **68** is a continuous chain belt disposed around rolls **[ref. #]** as shown in **Figure 7**. As mold racks **62** begin to travel upwards around roll **66**, the top portions of mold racks **62** begin to separate apart due to the physics of having rectangular-like mold racks **62** traveling about a roll. As mold racks **62** reach the top of mold belt **68**, the top portions of mold racks **62** close together thereby forming molds **64**. To release chips 200, molds **64** open and separate to allow the chips to continue towards fryer **110**. In a preferred embodiment, multiples of mold racks **62** positioned perpendicularly to the direction of longitudinal motion of mold belt **68**. For example, 6 mold racks **62** could be disposed inline perpendicularly to the direction of longitudinal motion of mold belt **68**. As depicted, one mold rack **62** when adjoined with another mold rack **62** form 3 molds **64**. If positioned inline across mold belt **68**, ranks of 18 chips **202** can be processed simultaneously if 6 mold racks **62** are positioned per rank.

As shown in **Figure 8**, molds **64** have a bowl-shape. Other shapes are possible however such taco, oval taco, hexagonal taco, round saucer, canoe, spoon, oval, round, and more. Molds **64** are preferably only semi-enclosed in order to maximize the exposed surface area of the chip as it is further dried in dryers **100**. Mold racks **62** contain a number of halves of molds **64** such that the juxtaposition of two mold racks **62** on mold belt **68** forms full molds **64**. In the embodiment shown, six halves are disposed within a single mold rack **62** in a rectangular three by two scheme although other schemes are possible. Each half of mold **64** has its closed end towards the middle of mold rack **62**. Linking the mold halves together on mold rack **62** is a mold rack support structure **120**. As depicted in a preferred embodiment, mold rack support structure **120** is a solid mesh structure. This allows now molded chips **200** disposed in mold racks **62** to

be exposed to a greater amount of air and heat in dryers **100** as compared to a solid mold rack. Also, less material is required to form mold rack **62** which reduces costs and weight. Typically, mold racks **62** can be formed from any moldable, heat resistant material such as plastic and metal. In the preferred embodiment, mold racks **62** and, therefore, molds **64** are made from stainless steel.

Figure 9 shows a cross section view of a preferred embodiment of mold **64**. Mold rack support structure **120** confines each mold **64**. Within mold **64**, depending support arms **122** extend from support structure **120** downward and inward towards the center of mold **64** to affix to a bottom edge support **124**. Bottom edge support **124** forms a partially open ring to support the shaped snack chip **200**. At a top portion of depending support arm **122**, a plateau edge **126** provides a resting surface for flat chips **202** yet to be plunged. When flat chip **202** is initially deposited into mold **64**, plateau edges **126** support chip **202** over the open space of mold **64**. To help retain chip **202** within mold **62**, one or more barbs or beveled edges can be provided. As shown, optional upper and lower barbs **130** and **132** are disposed towards the top portion of the each depending support arm **122**. Once the chip **202** is pressed into mold **64**, the top edge will likely abut barbs **130** or **132** on several of depending support arms **122**. As chip **202** is stamped into a mold **64**, it assumes the mold's shape to form chip **200**, which is a bowl-shape as shown in **Figure 2**. Additionally, the chips can be given additional features of shape by modifying the shape of plunger inserts **80**. Should a chip **202** be misaligned and not completely inserted into mold **64** by a plunger insert **80**, the resulting chip produced will still generally have a scoop or bowl shape, although possibly not centered. This is because a portion of chip **202** will still be contacted by plunger insert **80**. The portion of chip **202** contacted is forced into mold **64** which thereby produces a shaped chip **200**.

To reduce the loss of chips not deposited into a mold **64**, an optional feature of retaining chips can be provided. Fingers (not shown) can be provided to prevent a vertically oriented chip **202** from falling through the space between two mold racks **62** should a chip 202 not land into a mold **64**. These fingers are attached to the base portion of mold rack **62** around bottom edge support **124** to extend between mold racks **62**. Thereby, the fingers will support any vertical chips **202** as it travels along plunger and mold conveyor **60** and dryer **100**. While these chips will not be plunged, they are retained to increase the product yield.

Figure 10 shows plunger inserts **80** disposed along plunger belt **82** of plunger mold conveyor **60**. Plunger inserts **80** are typically comprised of a moldable material such as silicone, rubber, plastic, or metal. Softer materials such as silicone, rubber, or plastic are preferred. Insuring that plunger inserts **80** will be aligned above the corresponding opening of mold **64**, mold racks **62** and plungers **80** are carried longitudinally along on mold rack belt **68** and plunger belt **82**, respectively, and are synchronized to operate together. Once chip **202** is disposed properly on mold **64** at plateau edges **126**, a plunger insert **80** extends downward pushing chip **202** into mold **64**. In operation, an individual plunger insert **80** extends into mold **64** for less than one second, generally only about 0.4 seconds. By minimizing the time that plunger insert **80** extends into mold **64** reduces the likelihood of product shearing effects caused from mechanical wear and thermal expansion. Further, minimizing the time reduces the amount of misalignment between plunger insert **80** and mold **64**.

Figure 11 plunger insert **80** has eight fluted edges **84** extending outward from the plunger insert's central support rod **86**. Fluted edges **84** provides ridges to the chip. With eight fluted edges, molded chip **200** will comprise an essentially octagonal shape after being plunged. In other words, each chip will have eight fluted edges. While plunger insert **80** is shown having

eight fluted edges, other quantities of fluted edges are possible depending on the shape of the chip desired. The fluted edges **84** extend from a bottom portion of plunger insert **80** upward towards flange **88** shown clearly in **Figure 12**. Flange **88** is disc shaped and is essentially parallel to plunger belt **82** in operation. The diameter of flange **88** is approximately equal to the inner width of mold **64**. Further, flange **88** extend outward from support rod **86** to approximate the inner width of mold **64**. As shown, fluted edges **84** extend from flange **88** downward towards the bottom of support rod **86**. The bottom periphery of flange, shown in **Figure 12**, approximates that of mold **64** while a top portion does not and extends linearly to provide fluted edges **204** to formed chips **200**. Fluted edges **204** allow for a point of entry and easier dipping of the finished chip in addition to providing a aesthetic appearance. Above flange **88**, support rod **86** protrudes upward with plunger mating adapter **94**. Plunger mating adapter **94** provides for the connection of plunger insert **80** to plunger belt **82**. In one embodiment, plunger mating adapter **94** is a screw bolt which is received by a plunger platform **90** that is affixed to plunger belt **82**.

Plunger belt **82** rotates above and at the same speed as mold belt **68** for suitable plunging and molding of shaped snack chips **200**. As plunger inserts **80** rotate around on plunger belt **82**, plunger inserts **80** are pressed into molds **64** at desired intervals to a sufficient depth to push chip preform 202 into the mold to form shaped snack chip 200. For appropriate timing, plunger belt **82** preferably uses a link conveyor arrangement. However, other arrangements are possible such as a walking beam or air piston plungers. With the conveyor arrangement, the plunger belt **82** is driven by a mechanical linkage powered by a support chain connected to mold belt **68**. As a set of plungers **80** rotates towards the desired interval of plunging, a cam mechanism is depressed causing one or more sets of plungers into corresponding molds **64** in a vertical motion. To actuate the cam mechanism, a plunger actuator assembly **96** is provided. After a brief interval,

the tension on the cam is released which thereby releases plungers **80** upward and out of molds **64**. In application, two rows of plungers are retained per plunger platform **90**. By having two or more rows per plunger platform **90**, the number of mechanical components is reduced and the structural integrity is improved.

Once plunging is complete and chips **200** are passed through plunger and mold conveyor **60**, chips **200** are conducted through a form dryer **100** while still retained within molds. Form dryer **100** is optionally a multizone dryer with four zones that reduces chips **200** down to a desired moisture content so that chips **200** will retain their shape after being ejected from molds **64** into fryer **110**. With a preferred dough of masa, the moisture of chips **200** after passing through form dryer **100** will be reduced to between about 23 to about 28%. Dryer **100** are hot air impingement ovens that utilize hot forced air. Other forms of drying however may be used such as infrared, microwave, or radio frequency. Optionally, a vacuum is provided from beneath mold belt **68** within form dryer **100** to aid in drying the chips. With the open structure of mold racks **62**, a relatively large surface area of chips **200** be exposed to the drying currents. In the preferred embodiment, drying is provided at a temperature of about 300 to about 400°F. The chips are reduced from an inlet moisture of about 34 to about 38% to an outlet moisture of about 23 to about 28%. At the end of the form dryers **100**, chips **200** are separated from molds **64** onto a fryer feed belt **112**.

To release chips 200, molds **64** open and separate to allow the chips to continue towards fryer **110**. To assist the release of chips **200**, an air blower beneath mold rack belt **68** can direct a stream of air or other inert fluid towards the bottoms of molds **64**. Since molds **64** are designed to be partially permeable, the air current will push chip **200** from the mold in addition to gravity. The shaped chips **200** are directed onto a fryer feed belt **112** and then into a fryer **110** containing oil.

Fryer **110** is used to bring the product to its final dryness for consumer packaging and to add flavor. With a preferred dough of masa, the chip moisture upon entering fryer **110** is about 20 to about 24%. After frying, chip **200** has a moisture content of about 0.8 to about 1.3%, more preferably about 1.1%. Also, the oil content of chip **200** is about 23 to about 25%, more preferably about 24%. The process of frying chips **200** involves feeding chips **202** from belt **112** into fryer **110**. Chips **200** are fed into fryer **110** in a random packing order whereby free-frying occurs. After free-frying, chips **200** are introduced into a paddle section for transferring to a submerger for deeper packing of chips. For evacuating chips **200** from the submerger section, multiple cascading conveyors hoist chip **200** out of the oil. Thereby, chips **200** drain any residual oil from any crevices in chips **200** as they are passed from one conveyor to the next. Chips **200** are then placed onto a fryer discharge belt **114** for feeding to an optional drum **116** or to packaging. Rotating drum **116** provides any salting and/or flavoring that is desired. Thereafter, shaped chips **200** are sent to product packaging.

Consequently, a system and method for forming a shaped snack chip that can operate at a high production capacity are desired. Such a system and method should be capable of producing shaped snack chips while keeping the costs associated with the chip manufacturing equipment and the maintenance of the chip production relatively low

The present system and method form shaped snack chips inexpensively and more efficiently at a relatively high production rate compared to prior art systems. The present invention is superior in making a shaped snack chip because costly form-frying in molds is avoided. Additionally, shaped snack chips are made more efficiently because of reduced maintenance needs compared to prior systems. This results in producing a shaped snack chip having a desired utilitarian shape useful for scooping and retaining liquid mixtures such as dips and other toppings on the chip.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that changes in form and detail may be made therein without departing from the spirit and scope of the invention.

CLAIMS:

What is claimed is:

1. A system for molding a snack chip, comprises:

a supply belt supplying essentially flat chip preforms;

a mold belt having molds disposed about a length of the mold belt for receiving and processing the chip performs;

a plunger assembly having plungers disposed across a length of the plunger assembly facing the molds wherein the plunger assembly is positioned above and operated with the mold belt; and

a means for molding the chip preforms wherein the essentially flat chip preforms are molded into a shaped snack chips.

2. The system of Claim 1 wherein the plunger assembly comprises a plunger belt that is operated synchronously with the mold belt.

3. The system of Claim 1 wherein the mold belt comprises a belt having mold racks disposed about its surface wherein a juxtaposition of at least two mold racks forms the molds.

4. The system of Claim 3 wherein one of the mold racks comprises a multiplicity of half molds supported by a mold rack support structure.

5. The system of Claim 4 wherein the one mold rack has rectangular shape with at least two half molds disposed on two opposing sides of the one mold rack.

6. The system of Claim 1 wherein one of the molds comprises a multiplicity of support arms depending from a mold rack support structure downward to a bottom edge support whereby the multiplicity of support arms form a partially open matrix for retaining the chip during molding.

7. The system of Claim 6 wherein each support arm further comprises a plateau edge at a top portion of the support arm for retaining the chip preform prior to molding, and one or more barbs disposed on the support arm for retaining the chip within the mold after molding.

8. The system of Claim 1 wherein the means for molding the chip preforms further comprises plunging the chip preforms into the molds at determined intervals by actuating one or more ranks of plungers downward and into corresponding molds having chip preforms resting on plateau edges of the molds.

9. The system of Claim 1 wherein each plunger comprises a support rod depending from the plunger assembly, and a plunger insert extending from the support rod wherein the plunger insert is adapted for extending into a mold for molding the chip perform into a shaped snack chip.

10. The system of Claim 9 wherein the plunger insert has a multiplicity of fluted edges extending outward from support rod for providing edging to the shaped snack chips.

11. The system of Claim 1 wherein the means for molding the chip preforms further comprises heating molded snack chips while retained in the molds.

12. The system of Claim 11 wherein the heating is provided by one or more air impingement ovens.

13. The system of Claim 11 further comprising a means for ejecting molded and heated shaped snack chips from the molds.

14. The system of Claim 13 wherein the means for ejecting further comprises ejecting the shaped snack chips from the molds by having the molds, which are supported by mold racks disposed on the mold belt, open and separate as the molds pass over a discharge roll supporting the mold belt.

15. The system of Claim 14 wherein the means for ejecting is further aided by an air blower positioned beneath the molds as the molds pass over the discharge roll.

16. The system of Claim 1 wherein the molded shaped snack chips produced are bowl-shaped chips.

17. The system of Claim 16 wherein the molded shaped snack chips produced are comprised of masa.

18. The system of Claim 16 wherein the molded shaped snack chips produced have a bowl-shape with fluted edges.

19. A method for molding a snack chip, comprising:

supplying essentially flat chip preforms with a supply belt to molds disposed about a length of a mold belt;

operating a plunger assembly above the mold belt wherein the plunger assembly has plungers disposed across a length of the plunger assembly facing the molds; and

molding the chip preforms by extending the plungers into the molds forming shaped snack chips.

20. The method of Claim 19 wherein the operating the plunger assembly further comprises operating a plunger belt synchronously with the mold belt, the plunger belt and mold belt having an equal number of plungers and molds across each rank.

21. The method of Claim 20 further comprising forming molds by a juxtaposition of at least two mold racks, the mold racks disposed about a surface of the mold belt.

22. The method of Claim 19 wherein the supplying of the chip preforms further comprises depositing the chip preforms onto a plateau edge disposed about the periphery of the top of each mold, the plateau edge supporting the chip preforms prior to molding.

23. The method of Claim 22 wherein operating the plunger assembly further comprises plunging the chip preforms supported on the plateau edges of the molds with the plungers to form shaped snack chips.

24. The method of Claim 23 wherein the plunging further comprises providing a multiplicity of fluted edges to the shaped snack chips by supplying fluted edges to the plungers.

25. The method of Claim 19 further comprising heating molded snack chips while retained in the molds after molding the chip preforms.

26. The method of Claim 25 further comprising ejecting the molded snack chips from the molds after heating by having the molds, which are supported by mold racks disposed on the mold belt, open and separate as the molds pass over a discharge roll supporting the mold belt.

27. The method of Claim 26 wherein the ejecting further comprises using an air blower positioned beneath the molds as the molds pass over the discharge roll.

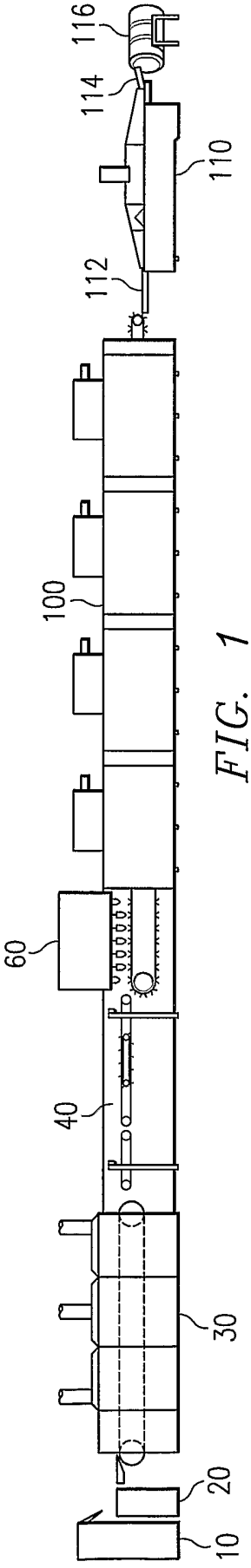

FIG. 1

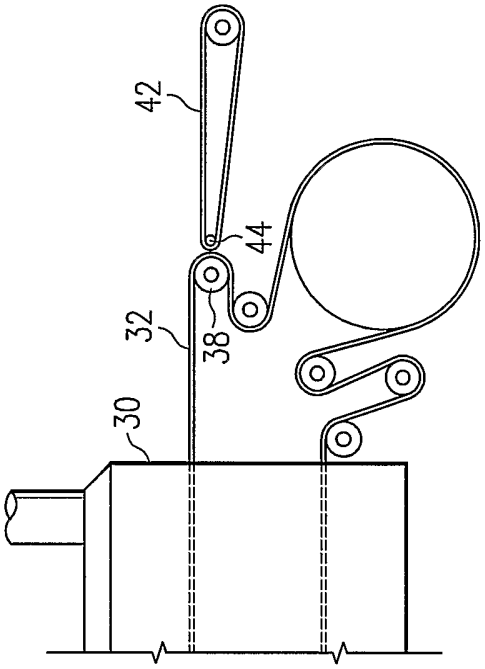

FIG. 3

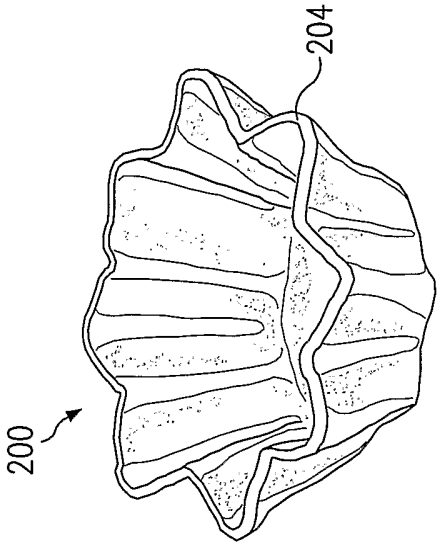

FIG. 2

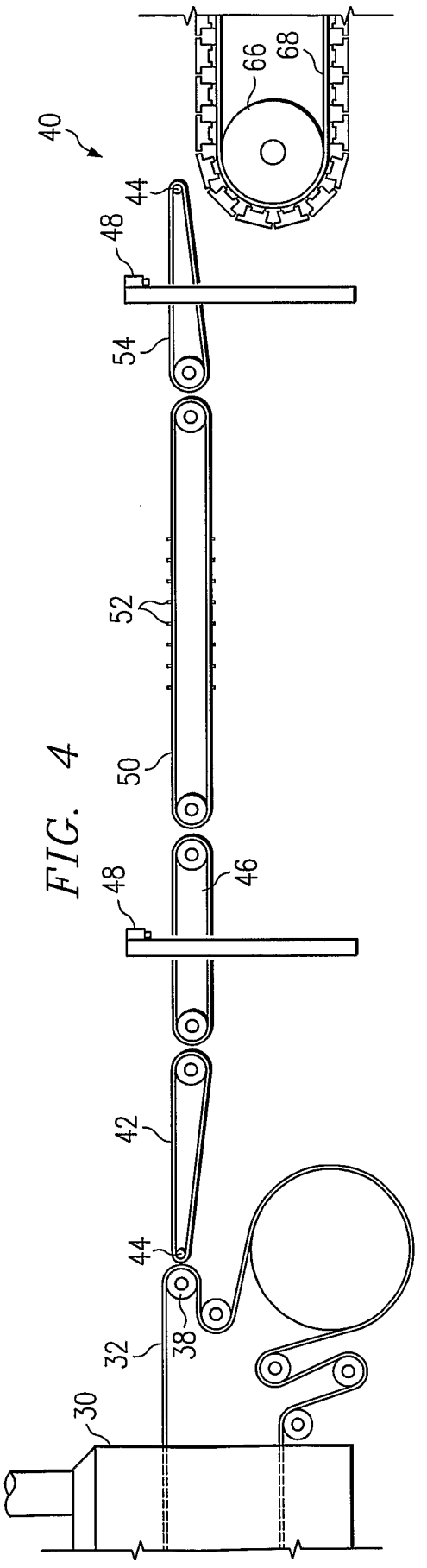

FIG. 4

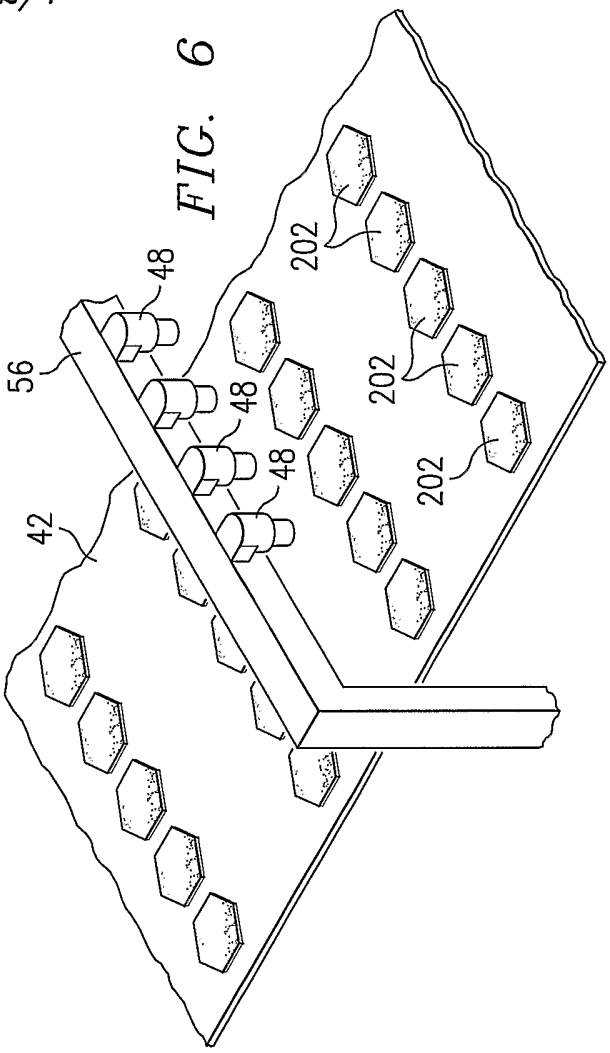

FIG. 6

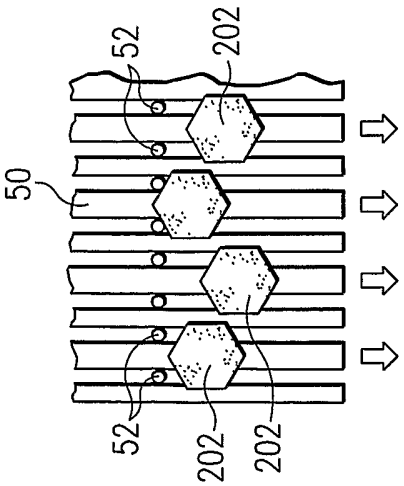

FIG. 5

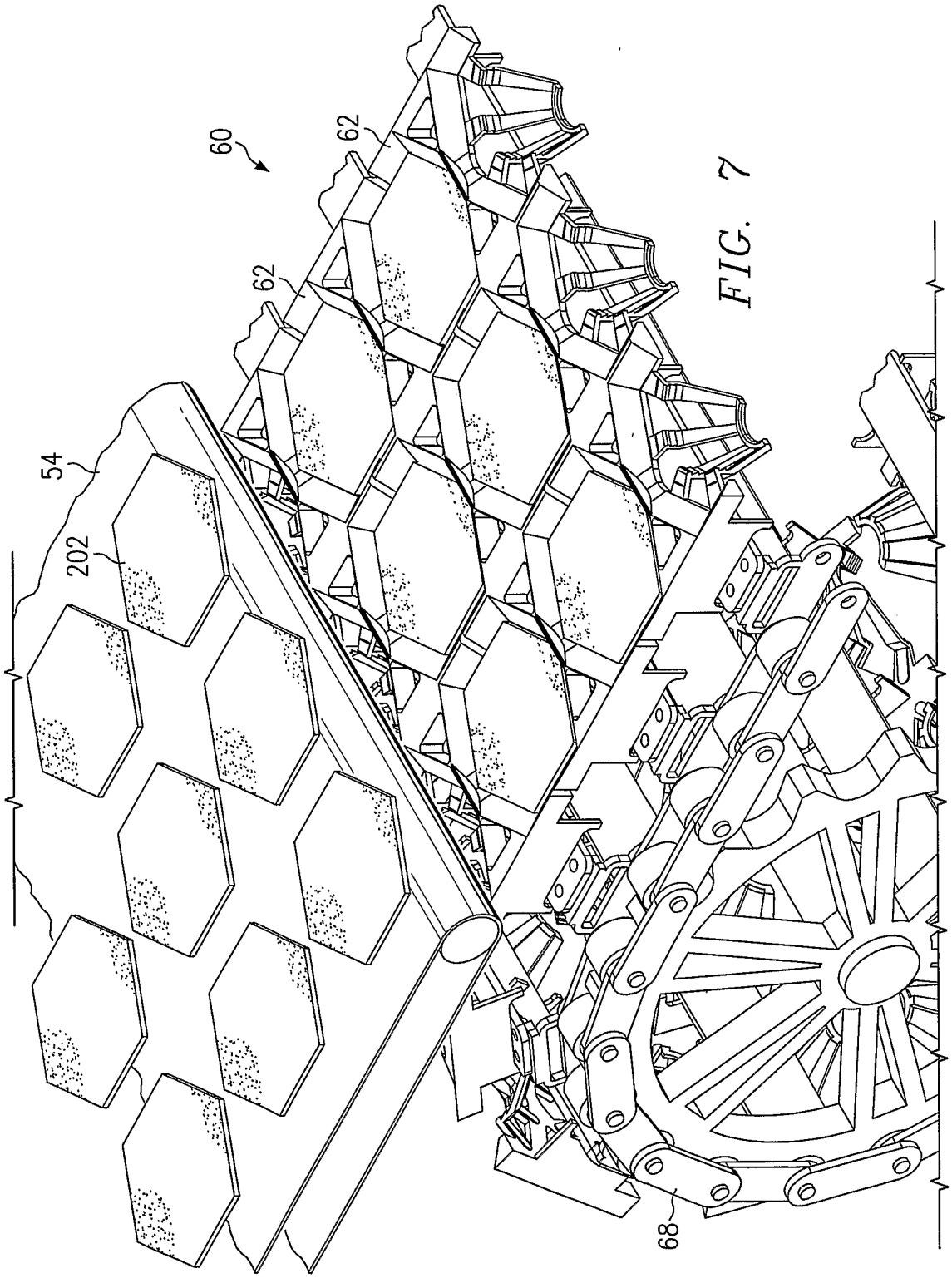

FIG. 7

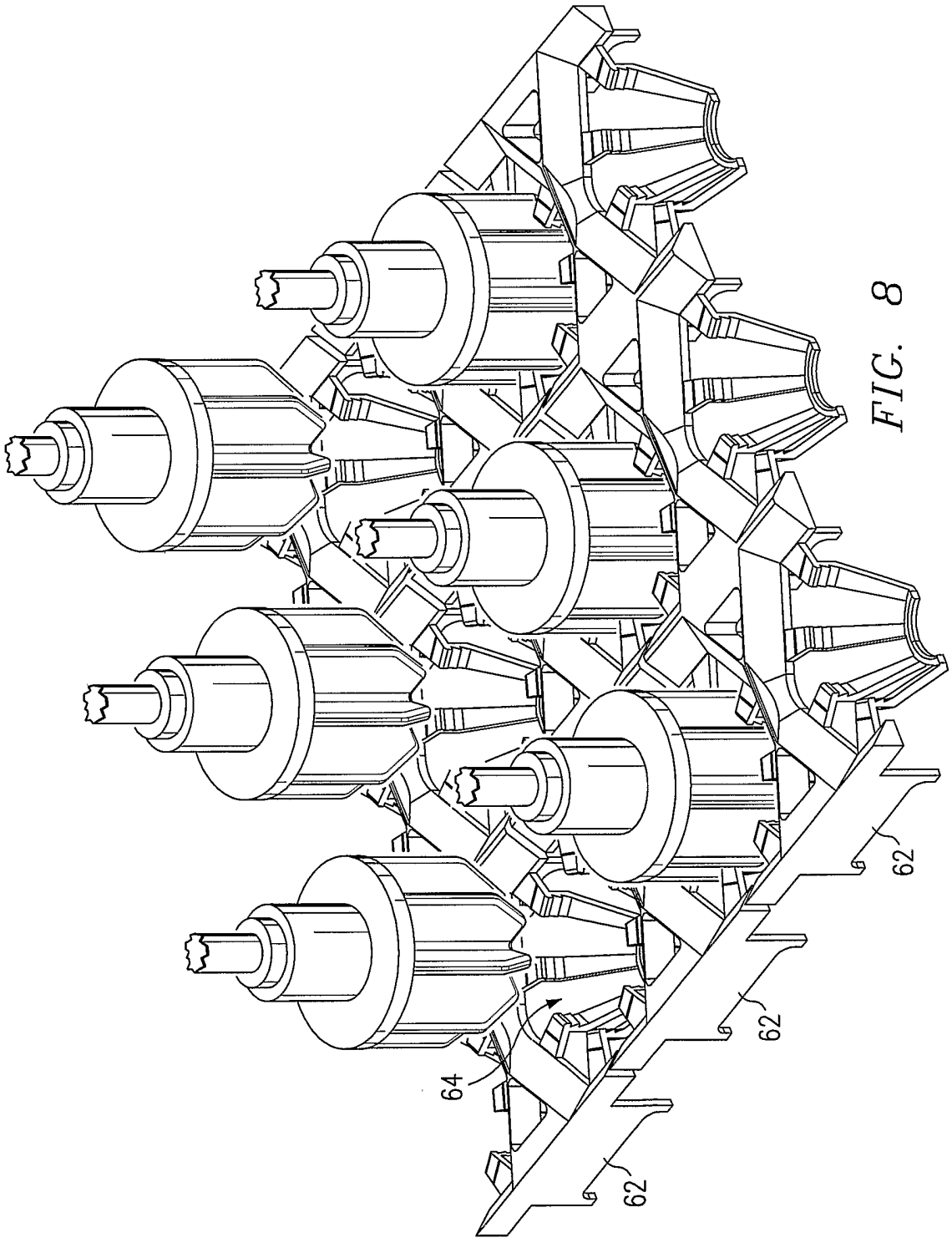

FIG. 8

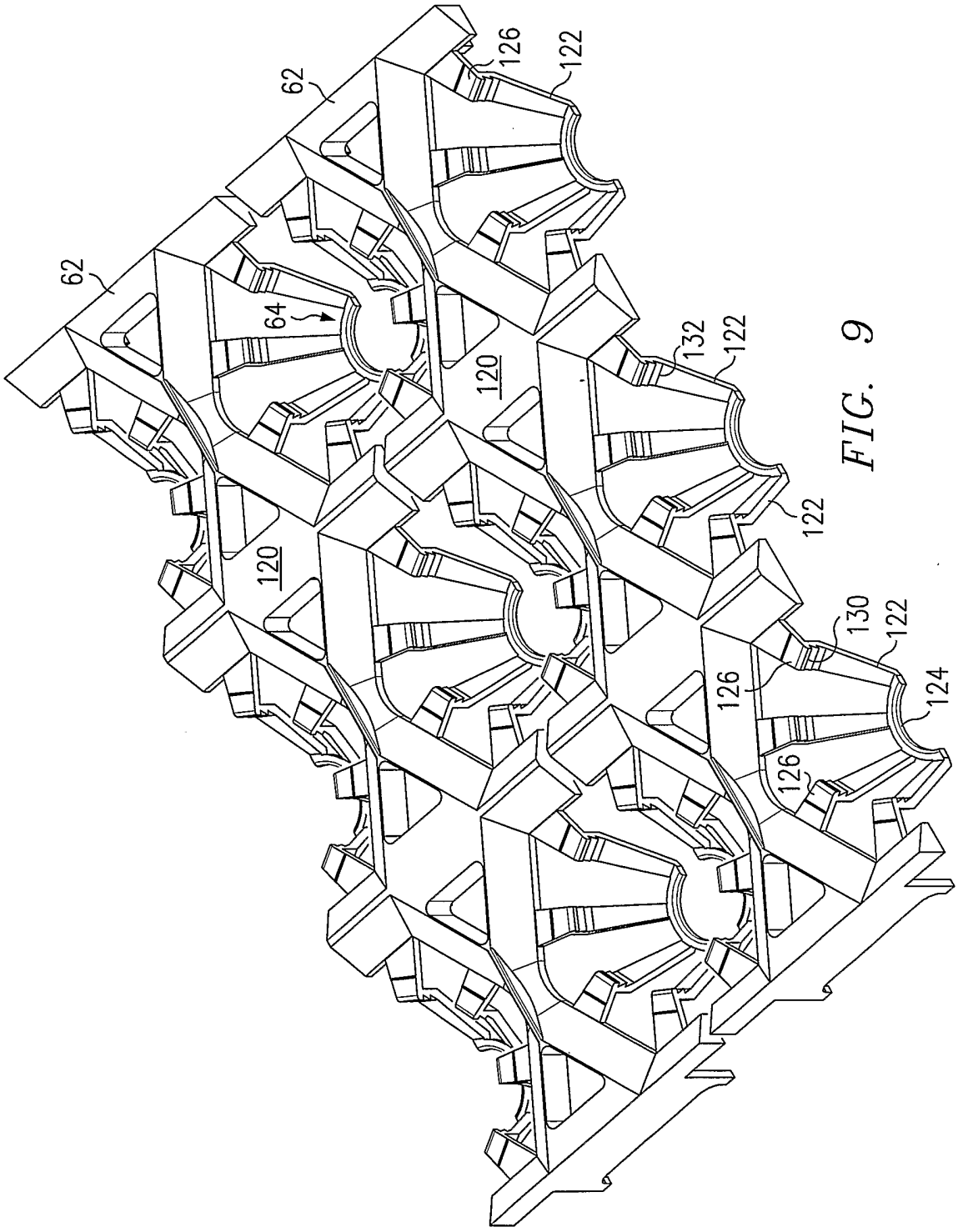

FIG. 9

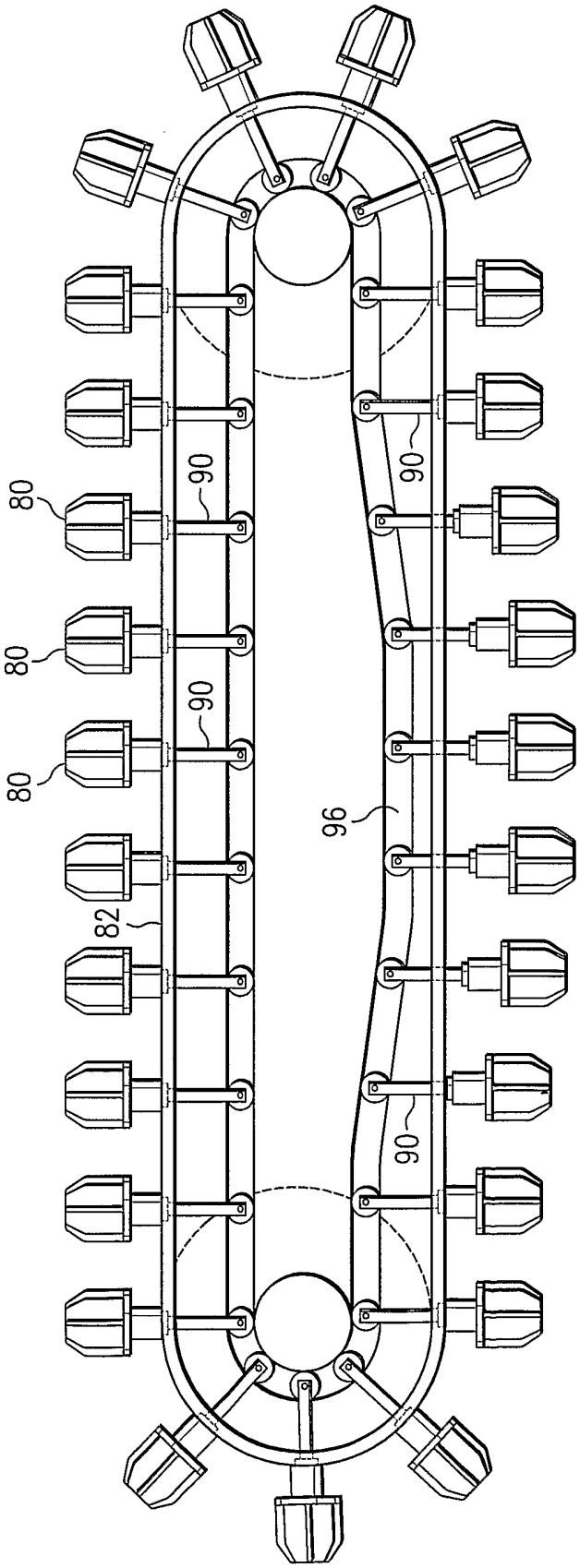

FIG. 10

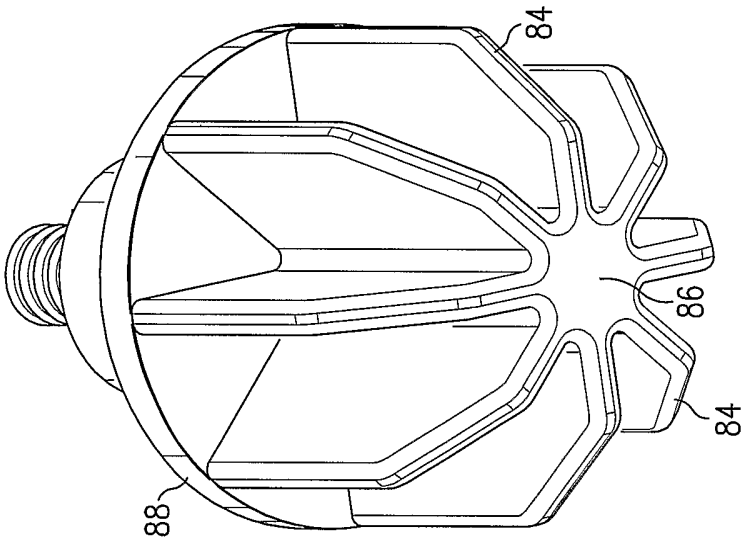

FIG. 12

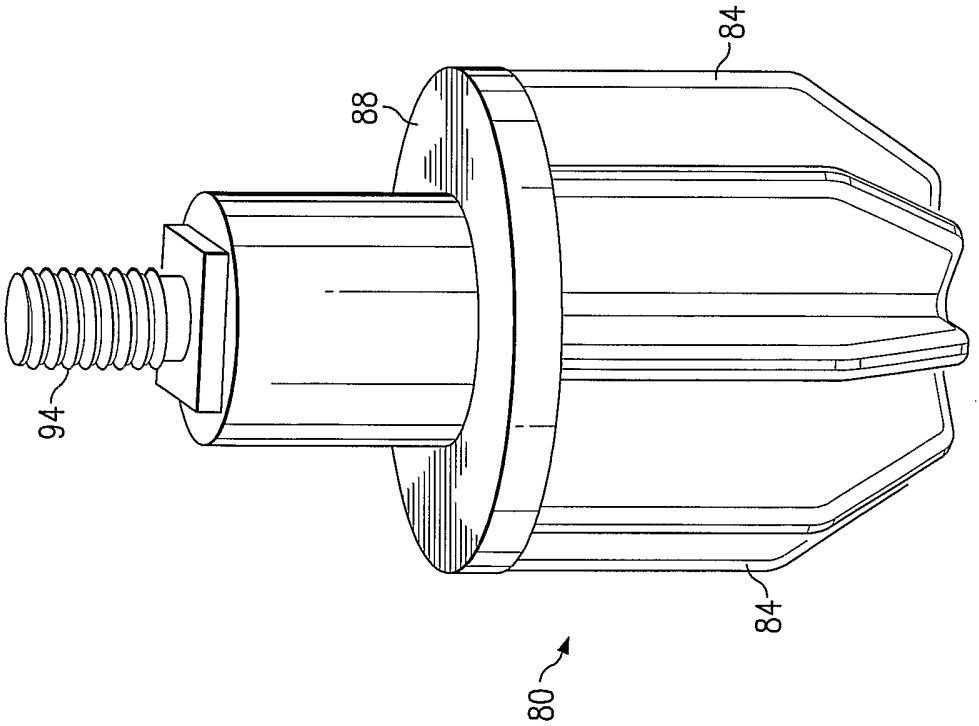

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/31915

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :Please See Extra Sheet.
US CL :426/512, 280, 505; 99/353, 355, 427; 425/259, 347, 351
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 426/512, 280, 440, 496 505; 99/353, 355, 356, 427; 425/259, 347, 351

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,901,982 A (GRINER ET AL) 26 AUGUST 1975.	1-27
A	US 3,988,875 A(FAY) 2 NOVEMBER 1976.	1-27

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 27 DECEMBER 2002	Date of mailing of the international search report 11 FEB 2003
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer GEORGE C. YEUNG Telephone No. (703) 308-3848

Form PCT/ISA/210 (second sheet) (July 1998)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/31915

A. CLASSIFICATION OF SUBJECT MATTER:
IPC (7):

A23L 1/00; A23P 1/00