

Fig. 2

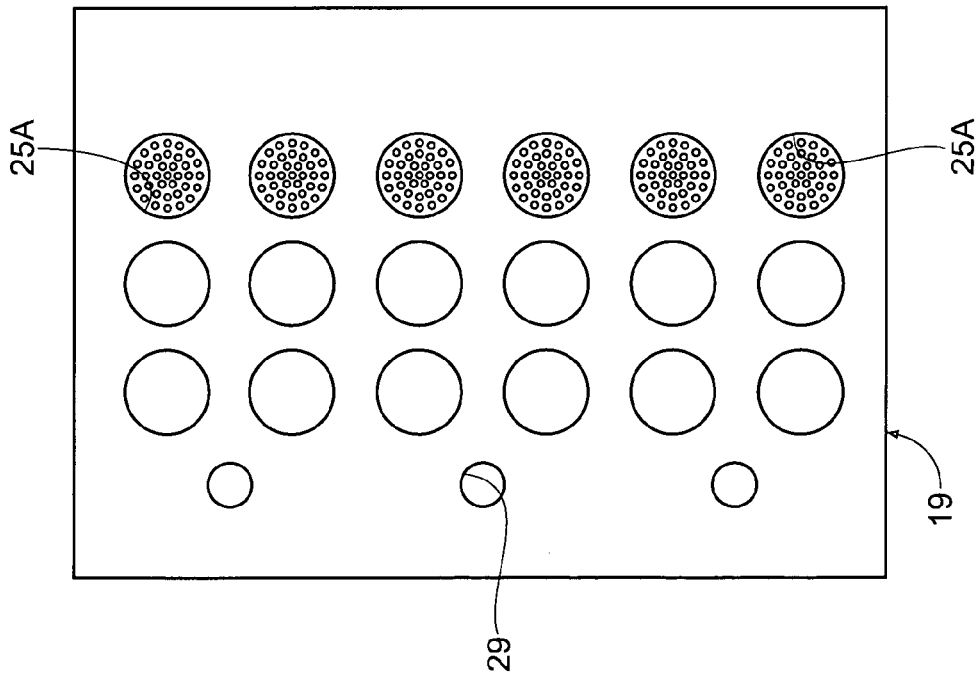


Fig. 3

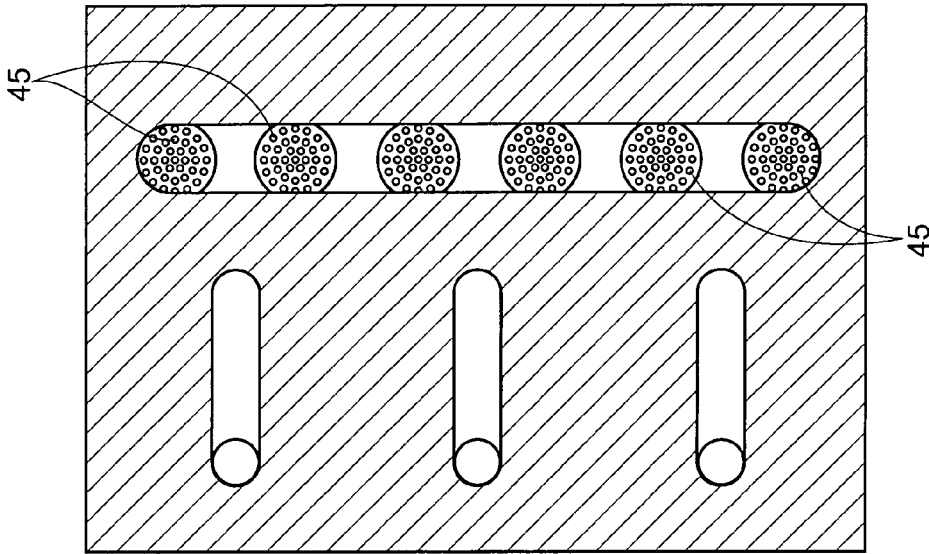


Fig. 4

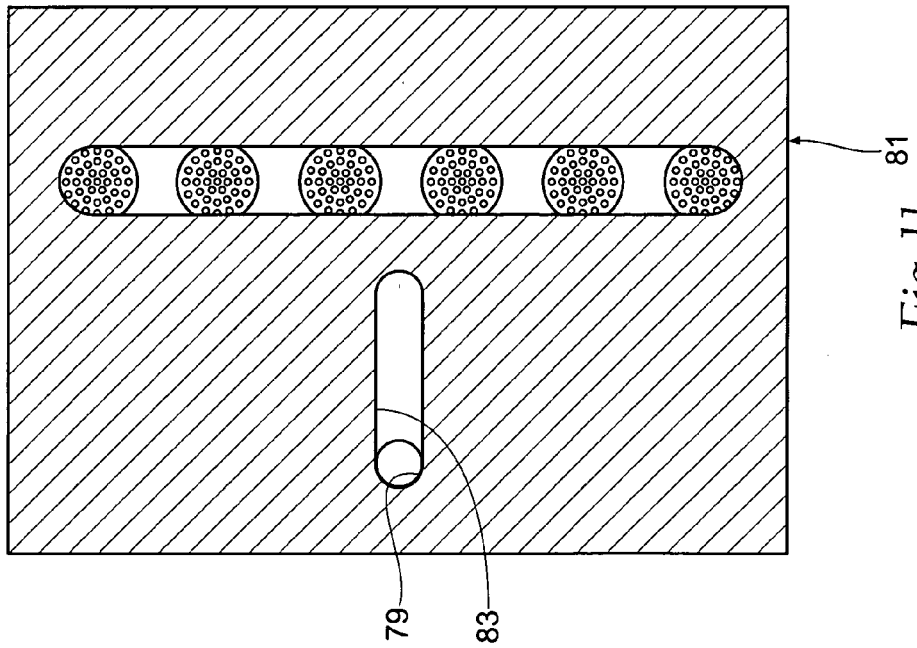


Fig. II

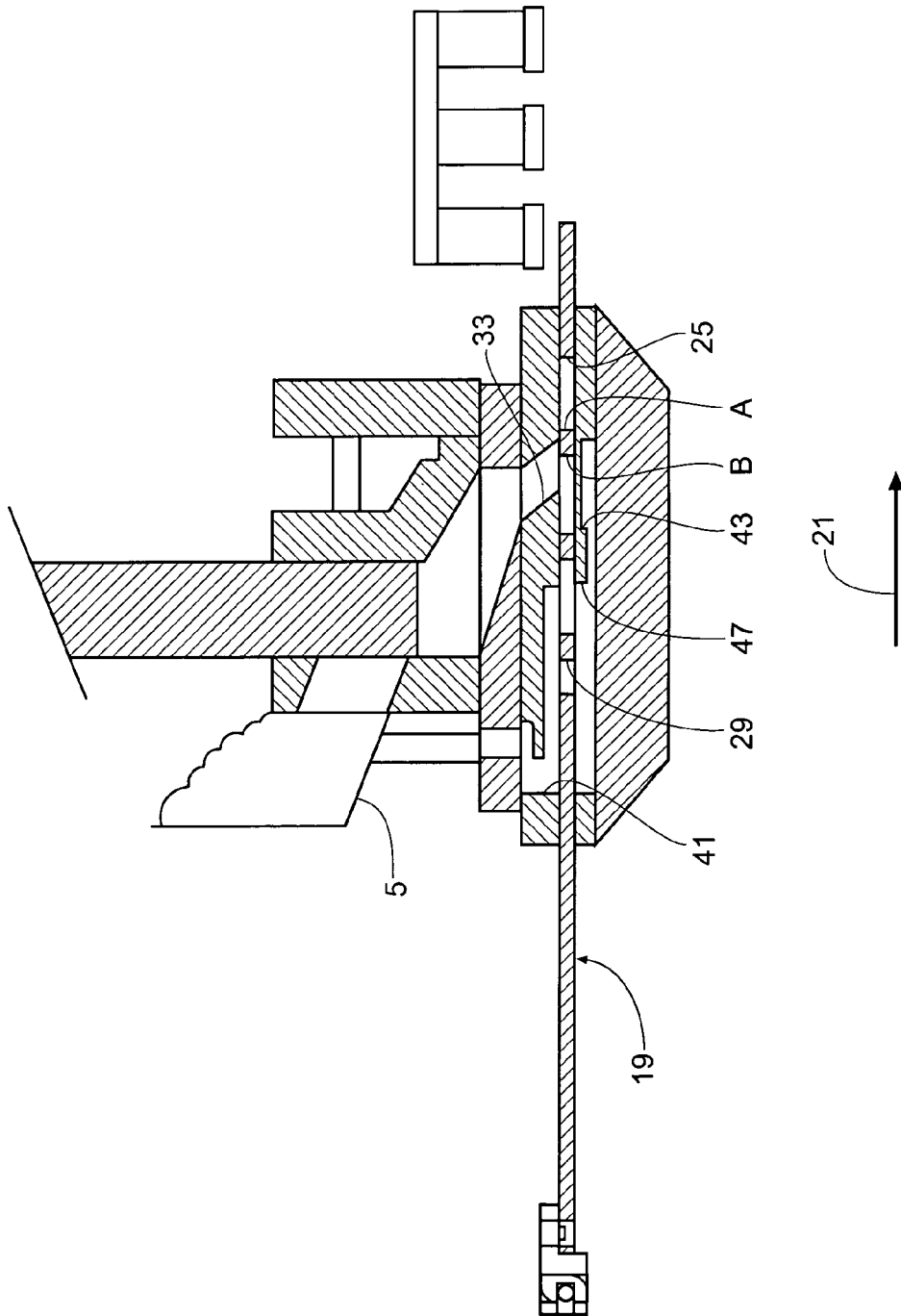


Fig. 6

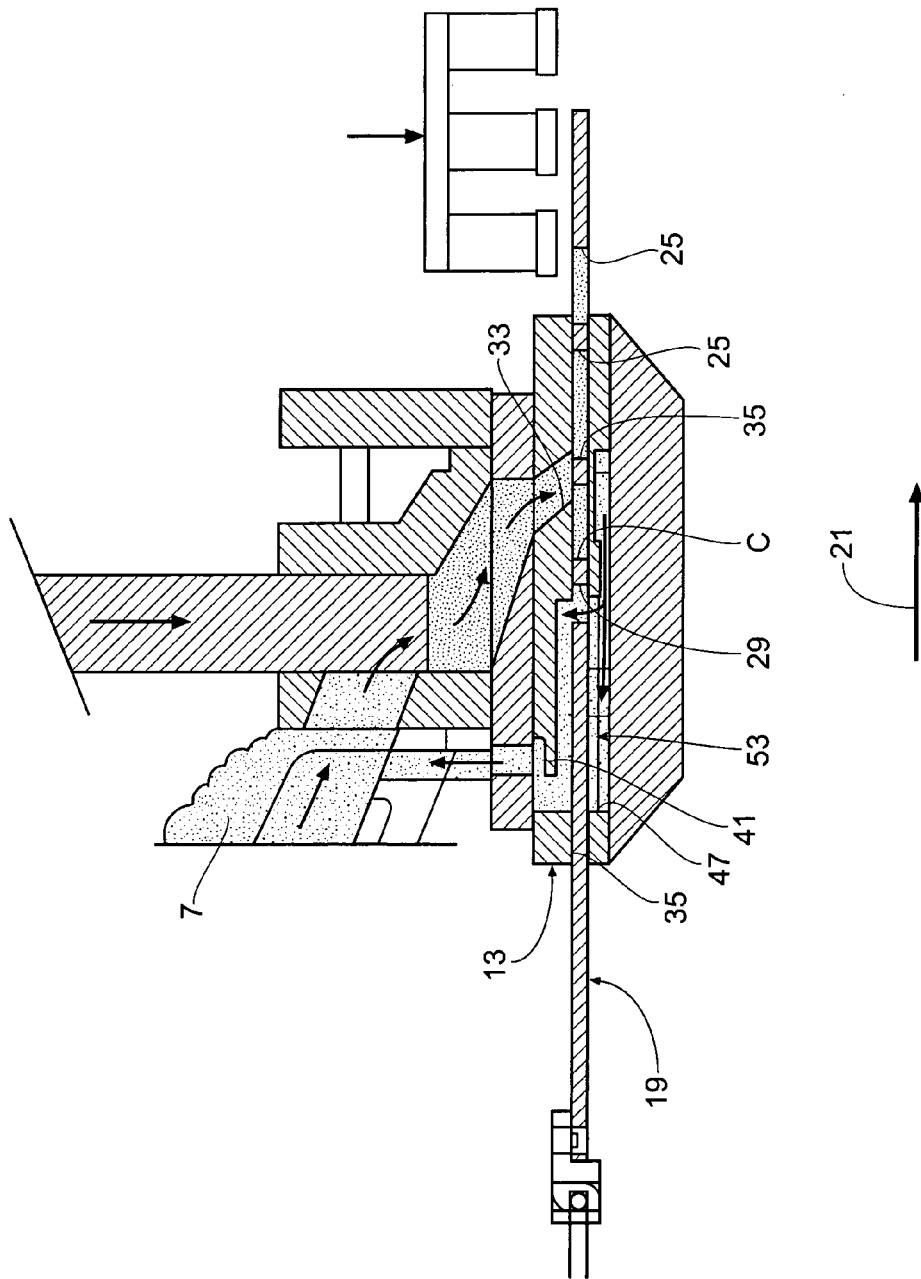


Fig. 7

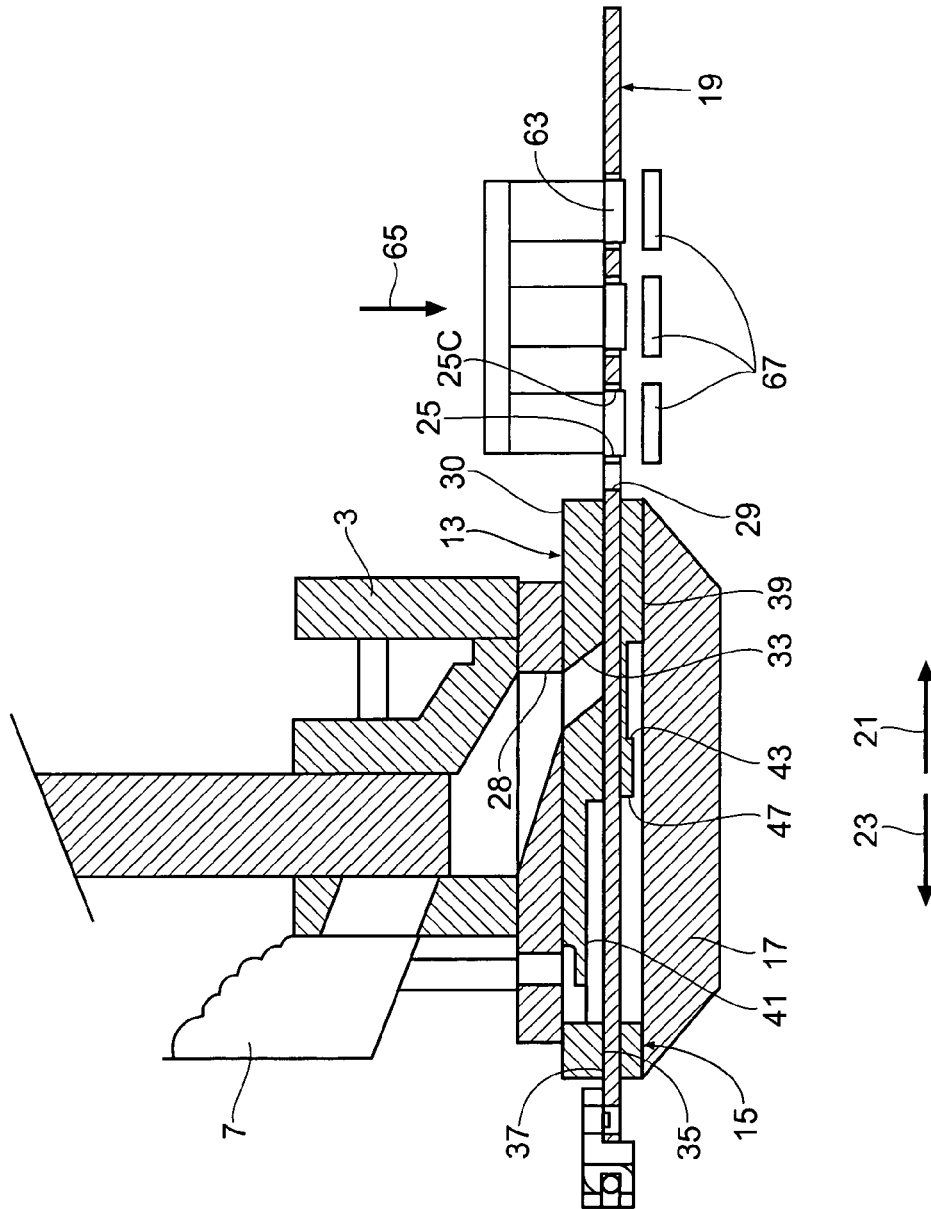


Fig. 8

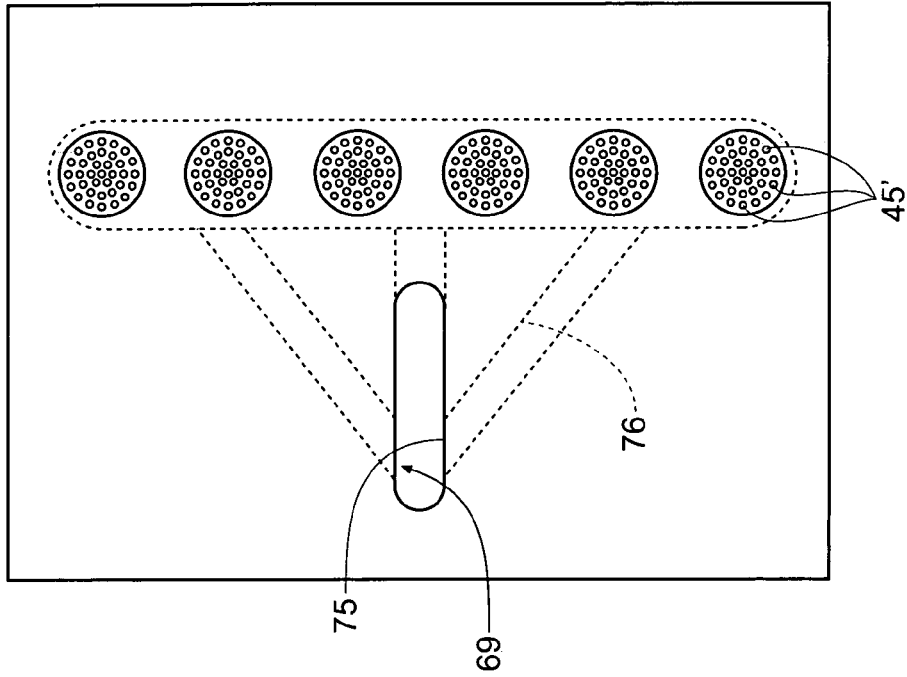


Fig. 9

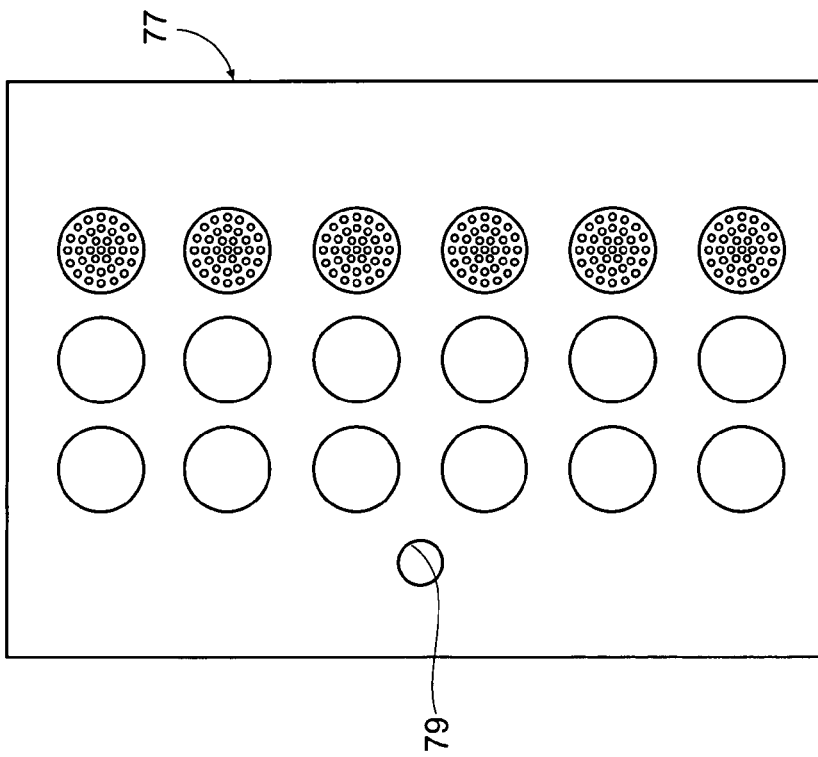


Fig. 10

VENT SYSTEM FOR FOOD PROCESSING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to processing bulk food material, and more particularly to apparatus that operates with minimal vibrations to form individual food items from bulk food material.

2. Description of the Prior Art

Various equipment has been developed to produce individual items of food products from a bulk supply. For example, machines that produce individual patties of ground meat are well known and in widespread use. Similar machines are used to produce nuggets of whole muscle meat. U.S. Pat. Nos. 4,054,967 and 4,097,961 show typical prior machines that form patties from ground meat. U.S. Pat. No. 4,872,241 describes a prior machine for making nuggets from whole muscle meat.

Briefly by way of explanation, a supply of bulk food material is forced under pressure from a hopper through one or more fill slots in a fill plate into individual cavities in a mold plate at a fill position. On the opposite side of the mold plate as the fill plate is a breather plate. Air and some juices flow through small holes and into a channel in the breather plate as the mold plate cavities are filled. The breather plate channel communicates with a vent hole through the mold plate. In turn, the mold plate vent hole communicates with an opening in the fill plate. A duct connects the fill plate opening with the food hopper.

After the mold plate cavities have been filled, the pressure on the bulk food product is reduced. The mold plate slides longitudinally in a forward stroke such that the cavities lose communication with the fill plate fill slots. The mold plate slides to an eject position where the food material is ejected from the cavities in the form of individual patties. The mold plate then slides back to the fill position, and the cycle repeats.

At the start of the mold plate forward stroke, food product continues to fill the cavities. Accordingly, some air continues to be displaced from the cavities to the breather plate. In machines with a mold plate having only one transverse row of cavities, there is an uninterrupted communication between the breather plate and the atmosphere as long as the cavities are in communication with the fill plate fill slots.

A problem arises with mold plates having a second row of cavities. When the mold plate slides in the forward stroke, the second row of cavities comes into communication with the fill plate fill slots and are filled while the mold plate is moving. However, by the time the second row of cavities has reached the fill slot, the mold plate vent hole has lost communication with the breather plate and fill plate grooves. Consequently, the air and juices displaced from the cavities become trapped in the breather plate. The pressure of the trapped air forces the mold plate against the fill plate, causing frictional resistance to mold plate sliding. The result is detrimental vibrations and chatter of the machine. The friction problem is especially acute on machines that have more than two longitudinally spaced rows of cavities.

Thus, a need exists for eliminating the lateral force on the mold plate during reciprocation.

SUMMARY OF THE INVENTION

In accordance with the present invention, a vent system for a food processing machine is provided that greatly

reduces the friction force on a reciprocating mold plate. This is accomplished by apparatus that has uninterrupted communication between a breather plate and the atmosphere at all times that cavities in the mold plate are being filled with food product.

The mold plate reciprocates in longitudinal directions between a fill position and an eject position. The mold plate cavities are arranged in longitudinally spaced transverse rows. One or more vent holes in the mold plate are part of the vent system of the invention.

A fill plate has one or more fill slots that direct food product from a storage hopper to the mold plate cavities. The fill plate has a working surface that is in sliding contact with the mold plate, and an opposed second surface. The fill plate working surface has at least one longitudinal groove that communicates with the mold plate vent hole. The fill plate groove communicates with the atmosphere. According to one aspect of the invention, the fill plate groove opens into the second surface, and a duct communicates between the second surface opening and the storage hopper.

The breather plate has a working surface that is in sliding contact with the mold plate, and an opposed second surface. Patterns of small holes in the working surface are in alignment with the front row of mold plate cavities when the mold plate is in its fill position. There is at least one longitudinal groove in the breather plate second surface. The breather plate groove communicates with the patterns of small holes and with the vent hole in the mold plate.

When the mold plate is at the fill position, food product is forced through the fill slot in the fill plate into the front row of mold plate cavities. Air and some food product are displaced by the incoming food material through the small holes in the breather plate into the vent system of the invention. There is thus no buildup of pressure in the breather plate grooves while the mold plate cavities are being filled.

It is a feature of the invention that the breather plate and fill plate grooves are long enough such that the breather plate patterns of small holes communicate with the atmosphere for all positions of the mold plate while food product is entering the cavities of all the rows. As the mold plate slides in the forward stroke, the rows of cavities subsequent to the first row are filled as they pass the fill plate fill slot. Air and food product from the additional cavity rows are displaced through the breather plate small holes and to the vent system in the same manner as with the front row of cavities, and the operation of the vent system is the same for the additional rows. Consequently, there is no pressure buildup in the vent system during mold plate reciprocation. The result is no friction force between the mold plate and the fill plate due to trapped air pressure in the breather plate.

The vent system may be composed of a single mold plate vent hole, breather plate groove, and fill plate groove. In that case, all the patterns of small breather plate holes lead to the breather plate groove. Alternately, there may be a separate groove for each of the patterns of small holes in the breather plate. In that case, each breather plate groove communicates with a corresponding mold plate vent hole and fill plate groove. According to another aspect of the invention, groups of breather plate patterns of small holes connect with shared grooves that communicate with corresponding mold plate vent holes and fill plate grooves.

The method and apparatus of the invention, using a vent system that always communicates with the atmosphere when the mold plate cavities are being filled, thus assures quiet and vibration-free reciprocation of the mold plate. Air and food product displaced into the breather plate do not build up

any pressure on the mold plate, even though the mold plate has more than one row of cavities.

Other advantages, benefits, and features of the invention will become apparent to persons skilled in the art upon reading the detailed description of the invention and studying the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified cross-sectional view of a portion of a typical food processing machine with a vent system according to the present invention and shown at the beginning of a cycle.

FIG. 2 is a view taken along line 2—2 of FIG. 1.

FIG. 3 is a view taken along line 3—3 of FIG. 1.

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 1.

FIG. 5 is a view similar to FIG. 1, but showing the machine during initial filling of the mold plate cavities.

FIG. 6 is a view similar to FIG. 5, but showing the machine during continued filling of the mold plate cavities.

FIG. 7 is a view showing further continued filling of the mold plate cavities.

FIG. 8 is a view showing completed food items being ejected from the mold plate.

FIG. 9 is a view similar to FIG. 2, but showing an alternative embodiment of the breather plate of the invention.

FIG. 10 is a view similar to FIG. 3, but showing an alternative embodiment of the mold plate of the invention.

FIG. 11 is a view similar to FIG. 4, but showing an alternative embodiment of the fill plate of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention, which may be embodied in other specific structure. The scope of the invention is defined in the claims appended hereto.

Referring to FIGS. 1—4, a machine 1 for processing food products is illustrated that includes the present invention. The machine 1 may be constructed generally along the lines of the machine described the mold plate is at the fill position.

In operation, when the mold plate 19 is in the fill position, the plunger 32 forces the food product 7 through the pump box passage 26, through the top plate passage 28, and into the fill plate fill slot 33. The food product flows through the fill slot and into the mold plate cavities 25 in the front row A. The incoming food product displaces the air in the mold plate cavities to pass through the breather plate holes 45 and into the channel 43.

In accordance with the present invention, the food processing machine 1 includes a vent system 53 that prevents buildup of pressure from the air displaced from the mold plate cavities 25 at all times that the cavities are being filled from the fill plate 13. The vent system 53 is comprised of one or more longitudinal grooves 47 in the breather plate 15. The breather plate grooves 47 are in the working surface 35, and they connect to the channel 43 by associated slots 54. As illustrated, there are three grooves 47, but more or fewer may be used if desired.

The vent system 53 further comprises longitudinal grooves 41 in the fill plate working surface 35. The fill plate grooves 41 are preferably aligned with respective grooves

47 in the breather plate 15. The fill plate also has an opening 50 from each groove 41 to the top plate 6. A duct 55 communicates from the fill plate openings 50 to the atmosphere. The duct 55 may be composed of a number of tubes 59 each aligned with an opening 50 in the fill plate. Alternately, the duct may be a lateral slot aligned with all the fill plate openings. The tubes 59 or slot lead to the machine hopper 5, which is open to the atmosphere. Accordingly, air displaced out of the mold plate cavities 25 is free to flow in the direction of arrows 61 without pressure buildup in the vent system 53 as the food product 7 fills the cavities, FIG. 5.

Looking at FIG. 6, the mold plate 19 has slid in the forward stroke 21, and the cavities 25 in the front row A have been filled. The mold plate is shown with the row B of cavities being filled from the fill plate fill slot 33. Again, air in the mold plate cavities 25B flows through the breather plate holes 45 and into the breather plate channel 43, slots 54, and grooves 47. The air flows through the mold plate vent holes 29, which remain in communication with the breather plate grooves despite the forward stroke of the mold plate. From the mold plate vent holes, the air flows through the fill plate grooves 41 and to the hopper 5.

In FIG. 7, the mold plate 19 has advanced in the forward stroke 21 such that the row C of cavities 25 is in communication with the fill plate fill slot 33. Air in the cavities 25C is displaced by the incoming food product 7 into the vent system 53.

It is seen that the mold plate vent holes 29 remain in communication with the associated fill plate grooves 41 and breather plate grooves 47 as long as any air is being displaced from the cavities 25 in any of the rows A, B, or C. As a result, air pressure never builds up in the breather plate grooves. There is thus no lateral force on the mold plate 19 urging it against the fill plate working surface 35. The mold plate is therefore able to reciprocate without friction with the fill plate 13.

In FIG. 8, the mold plate 19 is at its eject position. Knockout cups 63 advance in the direction of arrow 65 to eject the food material 7 in the form of individual patties 67 from the cavities 25. The mold plate vent holes 29 have lost communication with the breather plate and fill plate grooves 47 and 41, respectively. That is of no consequence, however, because no more air is displaced into the breather plate 15 after the cavities 25C have been filled. The mold plate is thus able to reciprocate without friction or vibration in both directions 21 and 23. Wear on the fill plate and mold plate is greatly reduced. The food processing machine can be operated at higher speeds than previously, if desired, to increase production without excessive vibration and chatter.

Turning to FIGS. 9—11, a modified vent system 69 is depicted. The vent system 69 has a breather plate 71 with patterns of small holes 45'. The breather plate 71 has a single groove 75. The groove 75 connects to the patterns of small holes 45' by one or more slots 76. The mold plate 77 has a single vent hole 79. The fill plate 81 has a single groove 83 in alignment with the mold plate vent hole 79.

In summary, the results and advantages of food processing machinery that forms individual patties 67 from ground meat and similar food material 7 can now be more fully realized. The food processing machine 1 provides both smooth operation and increased wear life of the mold plate and fill plate. This desirable result comes from the combined functions of the vent system. The vent system assures that the air that is displaced from all the mold plate cavities 25 flows freely to the atmosphere, such as by way of the hopper 5. Uninterrupted air flow is achieved because the

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mold plate vent holes communicate with the fill plate grooves and breather plate grooves whenever food product 7 is filling a row of cavities. Only after all the cavities have completely filled do the vent holes lose communication with the fill plate and breather plate holes.

Thus it is apparent that there has been provided, in accordance with the invention, a vent system for a food processing machine that fully satisfies the aims and advantages set forth above. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications, and variations as fall within the spirit and broad scope of the appended claims.

We claim:

1. A food processing machine comprising
 - a. a frame with a hopper for storing a food product;
 - b. a fill plate mounted to the frame and having a fill plate working surface with at least one longitudinal groove in the fill plate working surface that communicates with the atmosphere, the fill plate having at least one fill slot therethrough that communicates with the hopper;
 - c. a breather plate mounted to the frame and having a breather plate working surface, the breather plate defining patterns of small holes in the breather plate working surface and having at least one longitudinal groove in the breather plate working surface in communication with the patterns of small holes;
 - d. a mold plate reciprocable in longitudinal directions between fill and eject positions and having opposed first and second surfaces in sliding contact with the fill plate working surface and the breather plate working surface, respectively, the mold plate having at least one row of transverse cavities in communication with said at least one fill plate fill slot and with the breather plate patterns of small holes when the mold plate is in the fill position, the mold plate further defining at least one vent hole that is in communication with said at least one fill plate longitudinal groove and with said at least one breather plate longitudinal groove when the mold plate is at the fill position; and
 - e. means for forcing food product from the hopper through said at least one fill plate fill slot into the mold plate cavities when the mold plate is at the fill position, so that air in the mold plate cavities is displaced through the breather plate patterns of small holes and said at least one breather plate longitudinal groove, through said at least one mold plate vent hole, and through said at least one fill plate longitudinal groove to the atmosphere.
2. The food processing machine of claim 1 wherein
 - a. the mold plate has multiple vent holes;
 - b. the breather plate has multiple longitudinal grooves each in communication with a respective mold plate vent hole when the mold plate is at the fill position; and
 - c. the fill plate has multiple grooves each in communication with a respective mold plate vent hole when the mold plate is at the fill position.
3. The food processing machine of claim 1 wherein:
 - a. the mold plate has a single vent hole;
 - b. the breather plate has a single longitudinal groove that is in communication with the mold plate vent hole when the mold plate is in the fill position; and

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c. the fill plate has a single longitudinal groove that is in communication with the mold plate vent hole when the mold plate is in the fill position.

4. The food processing machine of claim 1 wherein:
 - a. the fill plate has at least one opening in communication with said at least one fill plate longitudinal groove; and
 - b. a duct communicates from said at least one fill plate opening to the atmosphere.

5. The food processing machine of claim 4 wherein the duct communicates from said at least one fill plate opening to the machine hopper.

6. The food processing machine of claim 1 wherein:
 - a. the mold plate has multiple longitudinally spaced transverse rows of cavities that sequentially communicate with said at least one fill plate fill slot as the mold plate reciprocates between the fill and eject positions; and
 - b. said at least one mold plate vent hole communicates with said at least one fill plate groove and with said at least one breather plate groove when any row of mold plate cavities is in communication with said at least one fill plate fill slot,

so that air in all the mold plate cavities is displaced to the atmosphere in response to filling the cavities with food product.

7. Apparatus for producing individual food items comprising:

- a. a hopper that holds a bulk supply of food material;
- b. a mold plate that slides in longitudinal directions between fill and eject positions, the mold plate having opposed first and second surfaces and at least one row of transverse cavities and at least one vent hole between the first and second surfaces;
- c. a fill plate having a fill plate working surface in sliding contact with the mold plate first surface and defining at least one fill slot that is in communication with the hopper and with said at least one row of mold plate cavities when the mold plate is at the fill position, the fill plate having at least one longitudinal groove in the working surface thereof that is in communication with said at least one mold plate vent hole when the mold plate is at the fill position;
- d. means for communicating between said at least one fill plate groove and the atmosphere;
- e. means for forcing food material from the hopper through said at least one food plate food slot to fill said at least one row of mold plate cavities when the mold plate is at the fill position; and
- e. a breather plate having a breather plate working surface in sliding contact with the mold plate second surface, the breather plate defining patterns of small holes generally in alignment with said at least one fill plate fill slot, and at least one longitudinal groove in the breather plate working surface in communication with the patterns of small holes and with said at least one mold plate vent hole when the mold plate is at the fill position.

8. The apparatus of claim 7 wherein:

- a. the mold plate has at least two longitudinally spaced—transverse row of cavities; and
- b. said at least one mold plate vent hole communicates with said at least one breather plate longitudinal groove and said at least one fill plate longitudinal groove when any row of mold plate cavities is in communication with said at least one fill plate fill slot.

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- 9. The apparatus of claim 7 wherein:
 - a. the mold plate has two longitudinally spaced transverse row of cavities; and
 - b. said at least one mold plate vent hole communicates with said at least one breather plate longitudinal groove and said at least one fill plate longitudinal groove when either row of mold plate cavities is in communication with said at least one fill plate fill slot. 5
- 10. The apparatus of claim 7 wherein:
 - a. the mold plate has three longitudinally spaced transverse row of cavities; and 10
 - b. said at least one mold plate vent hole communicates with said at least one breather plate longitudinal groove and said at least one fill plate longitudinal groove when any row of mold plate cavities is in communication with said at least one fill plate fill slot. 15
- 11. The apparatus of claim 7 wherein there are multiple longitudinal grooves in each of the fill plate and breather plate, and wherein there are multiple vent holes in the mold plate each in communication with a respective fill plate and breather plate longitudinal groove. 20
- 12. The apparatus of claim 7 wherein:
 - a. the breather plate and fill plate each have a single longitudinal groove in the respective working surfaces thereof; and b. the mold plate has a single vent hole that communicates with the fill plate and breather plate longitudinal grooves. 25
- 13. The apparatus of claim 7 wherein:
 - a. the mold plate has first and second longitudinally spaced transverse rows of cavities; 30
 - b. the mold plate first row of cavities is aligned with said at least one fill plate fill slot when the mold plate is at the fill position;
 - c. air in the mold plate first row of cavities is displaced by the food material and flows into the breather plate patterns of small holes and to the atmosphere in response to filling the first row of cavities with the food material; 35
 - d. the mold plate slides from the fill position toward the eject position subsequent to filling the first row of cavities with the food material and thereby brings the second row of cavities into communication with said at least one fill plate fill slot for filling with food material; and 40

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- e. air in the mold plate second row of cavities is displaced by the food material and flows into the breather plate patterns of small holes and to the atmosphere in response to filling the second row of cavities with the food material.
- 14. The apparatus of claim 11 wherein:
 - a. each of the multiple longitudinal grooves in the fill plate communicates with a respective opening in a fill plate second surface; and
 - b. the means for communicating between said at least one fill plate longitudinal groove and the atmosphere comprises multiple ducts communicating between the respective fill plate openings and the atmosphere.
- 15. The apparatus of claim 14 wherein the multiple ducts communicate between the respective fill plate openings and the hopper.
- 16. The apparatus of claim 8 wherein:
 - a. the breather plate has a single longitudinal groove in the working surface thereof that communicates with all the patterns of small holes;
 - b. the fill plate has a single groove in the working surface thereof; and
 - c. the mold plate has a single vent hole that communicates with the breather plate and fill plate longitudinal grooves when any row of mold plate cavities is in communication with said at least one fill plate fill slot.
- 17. The apparatus of claim 8 wherein:
 - a. the breather plate has multiple longitudinal grooves in the working surface thereof that communicate with the patterns of small holes;
 - b. the fill plate has multiple longitudinal grooves in the working surface thereof; and
 - c. the mold plate has multiple vent holes that are in communication with respective breather plate and fill plate longitudinal grooves when any row of mold plate cavities is in communication with said at least one fill plate fill slot.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,014,456 B2
APPLICATION NO. : 10/097147
DATED : March 21, 2006
INVENTOR(S) : Robert Toumour and Richard A. Payne

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 6, line 49, in the section beginning "e. a breathing plate" delete "e" and substitute --f--

Column 6, line 59, after "spaced" delete -- - -- (hyphen)

Column 6, line 60, delete "row" and substitute -- rows --

Column 7, line 3, delete "row" and substitute -- rows --


Column 7, line 11, delete "row" and substitute -- rows --

Column 7, line 25, after "and" start a new line beginning with -- b. the mold plate --

Column 8, line 9, delete "sec d" and substitute -- second --

Signed and Sealed this

Eighth Day of August, 2006

A handwritten signature in black ink on a light gray dotted background. The signature reads "Jon W. Dudas" in a cursive script.

JON W. DUDAS

Director of the United States Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,014,456 B1
APPLICATION NO. : 10/287028
DATED : March 21, 2006
INVENTOR(S) : Robert Tournour and Richard A. Payne

Page 1 of 1

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Column 7, line 25, after "and" start a new line beginning with -- b. the mold plate --

Column 8, line 9, delete "sec d" and substitute -- second --

This certificate supersedes Certificate of Correction issued August 8, 2006.

Signed and Sealed this

Tenth Day of October, 2006

A handwritten signature in black ink on a light gray dotted background. The signature reads "Jon W. Dudas" in a cursive style.

JON W. DUDAS

Director of the United States Patent and Trademark Office