

METHOD AND APPARATUS FOR FEEDING A DOUBLE-LAYERED FOOD PRODUCT

FIELD OF THE INVENTION

This invention generally relates to a method and apparatus for feeding a double-layered food product, and, more particularly, to a method and apparatus for feeding a food product in which an outer material envelopes an inner material.

BACKGROUND OF THE INVENTION

Well known in the prior art are apparatuses for feeding a double-layered food product, such as a Chinese bun, in which an inner food material, e.g., a bean-paste, is enveloped by an outer food material, e.g., a dough.

Such an apparatus includes a first feeder for feeding an inner food material, a second feeder for feeding an outer food material, and a double nozzle for extruding an, elongated and enveloped food product in which the outer material from the second feeder envelopes the inner material from the first feeder.

The apparatus also includes a transporting mechanism for receiving the inner and outer food materials from the corresponding feeder and transporting them to the double nozzle. Various transporting mechanisms have been devised. One type of known mechanism includes a rotatable screw or spiral that extends from under the feeders to an inlet opening of the double nozzle

such that the inner and outer food materials are propelled from the feeders to the double nozzle by the rotations of the screw.

Unfortunately, during this transporting movement by the screw, its movement when rotating often causes undesirable kneading or stirring of the inner and outer food materials. Therefore, the transporting mechanism that has the rotatable screw is unsuitable for an application with a food material, e.g., a granular bean paste, that should be neither kneaded nor stirred.

Another type of known transporting mechanism employs two pairs of vertical hoppers and a pair of vertical pistons instead of the screw, as in a feeding apparatus described in Japanese Utility-Model Publication No. 73-28548. At the upper portion of this apparatus, the pair of vertical pistons is mounted circumferentially about a vertical center axis. Under the vertical pistons, the vertical hoppers are supported circumferentially about the vertical center axis on a turret that rotates in a horizontal plane about the vertical center axis. With the rotation of the turret, one pair of empty hoppers is brought to a position for being filled with the inner food material from their upper openings, while the other one is filled with the inner food material from their upper openings. Simultaneously, the other pair of the preceding and filled hoppers is brought to a position for extrusion that is located under the pair of pistons and to a location where the corresponding piston is inserted in the corresponding hopper, and then the corresponding food material is extruded. Then this pair of the preceding filled hoppers now becomes a pair of empty hoppers and is brought to the filling position for the filling procedure, while the following filled hoppers are brought to the extruding position for the

extruding procedure, by the rotation of the turret. The filled hoppers and the empty hoppers are continuously interchanged in such a manner by the rotation of the turret

Although the hopper can be somewhat tilted in the filling position to facilitate the filling procedure via its upper opening, the hopper itself is mounted on the apparatus and thus the upper opening should be located at a relatively higher level even during the filling procedure. This arrangement tends to prevent the filling procedure through the upper opening of the hopper being smooth.

Procedures for sanitation, maintenance, and cleaning for the cylinders and the pistons should be carried out regularly. To achieve this object, it is desirable that both the cylinders and pistons can be readily removed from the apparatus. However, in the prior-art apparatus such a removing process is complicated, since the cylinders and the pistons are provided in separate sections in the apparatus. Thus the need has arisen for an enhanced apparatus that can be readily maintained.

To make a final product, which may be a spherical product, from the elongated product that is extruded from the double nozzle, there is a need for a cutting machine for cutting an elongated product into a plurality of spherical products.

Japanese Patent No. 2507847 discloses an apparatus for feeding a double-layered food product that includes such a cutting apparatus. The cutting apparatus includes a plurality of sliding blades that are driven horizontally by a cam mechanism to cut the elongated product.

The cutting apparatus is movable vertically receive the elongated product. This vertical movement of the cutting apparatus cooperates with the horizontal sliding movement of the sliding blades that are driven in a driving force by means of the same driver via a mechanical coupling. Because the directions of the two movements in the mechanical coupling are orthogonal to each other, i.e., the vertical and the horizontal, an excessive moment may occur.

Accordingly, there is a need in the art for a feeding apparatus that reduces the maintenance problems.

It is preferable that such a feeding apparatus be applicable to an operation that has no excessive moment.

Further, it is preferable that such a feeding apparatus be applicable to produce a multi-colored product, since the forgoing prior-art apparatuses typically produce a food product having an outer material of just one color.

SUMMARY OF THE INVENTION

In view of the foregoing, one object of the present invention is to provide an apparatus for producing an elongated and enveloped food product in which an outer material envelopes an inner material, but without having the forgoing maintenance problems in the prior art. In this apparatus, a first piston, which is slidably inserted in a first cylinder to be filled with the inner material, extrudes the inner material within the first cylinder, while a second piston, which is slidably inserted in a second cylinder to be filled with the outer material, extrudes the outer material within the second cylinder. Adhering means causes the extruded outer material from the first cylinder and the extruded inner material from the second cylinder to adhere to each other so as

to form the elongated and enveloped product in which the outer material envelopes the inner material in a substantially coaxial relation. The adhering means also extrudes the elongated and enveloped product from the adhering means. The first and second cylinders are made readily detachable from the apparatus by means of a mounting means.

Preferably, the adhering means is also detachably mounted by an additional mounting means. In this case, the adhering means, the first cylinder, and the second cylinder may be coupled together by a connecting means such that when the adhering means is detached from the apparatus the first cylinder, which contains the first piston, and the second cylinder, which contains the second piston, are detached from the apparatus together with the adhering means.

In one embodiment of the invention, the apparatus includes detector means for detecting that each piston reaches the end of its stroke.

To reduce waste food materials that remain within the cylinders, each piston may have a tapered convex head, and the adhering means may have two concave surfaces, each of which receives the corresponding tapered convex head of the corresponding cylinder.

To form a plurality of spherical products from the elongated and enveloped product, the apparatus may further comprise cutting means for cutting the enveloped and enveloped product from the adhering means so as to form a plurality of substantially spherical products. In each spherical product the outer material encrusts the inner material.

The cutting means may include polygonal, circumferentially arranged cutting members to form a central opening surrounded by them. The cutting members are assembled in sliding contact with each other so that they shut the central opening to cut the elongated and enveloped product that is passing through it from the adhesion means.

The cutting means may be vertically movable by means of a cam mechanism. The cutting members of said cutting means may be driven by an additional cam mechanism. In this case the cam mechanism and the additional cam mechanism may be coupled to each other by a coupling and driven together by means of the same motor in a cooperative relation. Preferably, the coupling vertically and slidably supports the cam mechanism, which is associated with the vertical movement of said cutting means, so as to permit this vertical movement. The apparatus may further include a tiltable tray for receiving the spherical product from the cutting means. The tiltable tray is also driven by means of the same motor in a cooperative relation with the cam mechanisms so as to tilt the tray and have the received spherical product slide off the tray.

In another embodiment of the invention at least one of the first and second cylinders is a split-type cylinder. That is, the first cylinder or the second cylinder comprises an outer cylinder and an inner cylinder to be inserted into the outer cylinder, wherein the inner cylinder is composed of two half-cylinders adapted to fit each other so that one half cylinder can be filled with a food material that differs from that to be filled in the other half cylinder.

When the apparatus employs such a split cylinder as the second cylinder, a method is provided for feeding and extruding a multi-colored, cylindrical and enveloped food product in which an outer material envelopes an inner material. The method comprises the steps of: a) feeding an outer material having a first color in the one half-cylinder; b) feeding an outer material having a second color that differs from the first color in the other half-cylinder; c) fitting the half-cylinders to each other to form a single cylinder as said inner cylinder and inserting said inner cylinder into the outer cylinder being assembled as one cylinder; and d) mounting the assembled cylinder in said apparatus as the second cylinder, thereby said second cylinder extruding a two-colored outer material that includes said first and second colors during its operation.

If the apparatus also employs an additional split cylinder as the first cylinder for the inner food material, the first cylinder also extrudes a two-colored material such that a product produced by the apparatus has four colors.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the present invention will be further understood from the following detailed description of the preferred embodiments and practices thereof and from the accompanying drawings in which:

Fig. 1 is a side elevational view, partly in cross section, and partly schematic, of an encrusting apparatus embodying the present invention.

Fig. 2 is a front view, partly in cross section, of the apparatus shown in Fig. 1.

Fig. 3 is a diagrammatic plane view, partly in cross section, of the apparatus shown in Fig. 2.

Fig. 4 is a sectional view taken along the plane IV-IV of Fig. 1.

Fig. 5 is the opposite side of an elevational view, partly in cross section, and partly schematic, of the apparatus shown in Fig. 1, to show the arrangement of the sliding shaft.

Fig. 6 is a diagrammatic front view of the apparatus shown in Fig. 1, after the double nozzle is removed from the apparatus.

Figs. 7A-7C are diagrammatic perspective views of an alternative cylinder that can be used in the apparatus shown in Fig. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings, wherein the same or like components are designated by like numerals, Figs. 1, 2, and 3 show one preferred embodiment of an encrusting apparatus 1 for continuously producing the double-layered products of this invention.

Before a cutting process starts, this double-layered product is a substantially elongated or bar-shaped product that may have a cross-sectional area either substantially a square or substantially a circle. This product consists of two layers: an outer food material (referred to as a "casing") and an inner food material (referred to as a "filling") enveloped by the casing. The final product produced by the encrusting apparatus 1 is made from the elongated

product by means of the cutting process. The product is substantially spherical and double-layered, but can take various forms, such as dumplings, or other rice-based products. In the present invention the casing is a food material, such as rice dough, wheat dough, or the like, while the filling is a food material, such as bean paste or the like.

It should be understood that in the specification the term "final product" does not always mean an end product ready for consumer use, but may merely mean an encrusted food product that has a substantially spherical, hemispheric, or like form. Those skilled in the art will understand that any cooking process, for example, heating, steaming, and other processes, can be applied to the product produced by the encrusting apparatus 1.

The encrusting apparatus 1 includes a frame 3, whose upper portion is provided with a first feeding section 5, for continuously feeding the filling, and a second feeding section 7, for continuously feeding the casing. The frame 3 encloses a double nozzle 9 located adjacent the sections 5, 7 for downwardly extruding the fed casing from the first feeding section and the fed filling from the second feeding section 7 in the form of an elongated and cylindrical product, in which the casing envelopes the filling in a substantially coaxial relation. In the frame 3, a vertically movable cutting apparatus 11 is provided below the double nozzle 9 to receive and cut the elongated and cylindrical product that is extruded from the double nozzle 9 so as to produce rounded, encrusted products. In the frame 3, a tiltable tray or chute 13 is located below the cutting apparatus 11 to receive the rounded, encrusted products to be fed.

The upper portion of the frame 3 is integrally provided with a ceiling that forms a main mount 15 for detachably mounting a first horizontal cylinder 17A for the first feeding section 5 and a second horizontal cylinder 17B.

The upper surface of the main mount 15 is provided with a left wall 15A, a right wall 15B, and a center wall 15C (the left and right walls 15A, 15B are shown in Fig. 3) so that first and second receiving recesses 16A, 16B are formed between the three walls 15A, 15B, and 15C. The first receiving recess 16A and the second receiving recess 16B receive the corresponding cylinders 17A, 17B, respectively.

Preferably the left and right walls 15A, 15B may be formed with drain passages 15G that extend to the bottoms of the receiving recesses 16A, 16B. When the cylinders 17A, 17B are removed from the receiving recesses 16A, 16B, these empty recesses 16A, 16B may be readily cleaned with an appropriate liquid, e.g., water, since the drain passages 15G can be readily drained of the liquid.

When the cylinder 17A (or 17B) is received in the corresponding receiving recess 16A (or 16B), an appropriate gap 18 (Fig. 1) exists between the lowest portion of the cylinder 17A (or 17B) and the bottom of the receiving recess 16A (or 16B).

At the front side (the left side in Figs. 1 and 3) of the upper surface of the main mount 15, the center (about the middle portion in Fig. 3), right, and left portions are provided with a center projection 19, which stretches the center wall 15C, a right projection 21R, and a left projection 21L, respectively. The front faces (the left end in Figs. 1 and 3) of these projections 19, 21R, and 21L

lie in the same plane so as to act as a surface for detachably mounting the double nozzle 9.

The double nozzle 9 is provided with a flange 23, which has a surface to be fitted to the surface for mounting. The flange 23 has U-shaped engaging slots 25A, 25B, and 25C at their upper center, right, and left portions, respectively (see Fig. 2). A center clamping member 27A for clamping the flange 23 is pivotally mounted on the center projection 19 via a pivot pin 29A such that it swings up and down with the pivot pin 29A. Similarly, right and left clamping members 27B, 27C, for clamping the flange 23, are pivotally mounted on the right projection 21R and the left projection 21L via pivot pins 29B, 29C, respectively. The right and left clamping members 27B, 27C swing laterally with the corresponding pivot pins 29B, 29C. The clamping members 29A, 29B, and 29C can be engaged to and disengaged from the corresponding engaging slots 25A, 25B, and 25C, respectively. Therefore, the double nozzle 9 can be mounted on the front of the main mount 15 by engaging the engaging slots 25A, 25B, and 25C of the flange 23 with the clamping members 27A, 27B, and 27C such that they are clamped to the flange 23. Conversely, the double nozzle 9 can be detached from the main mount 15 by disengaging the clamping members 27A, 27B, and 27C from the engaging slots 25A, 25B, and 25C.

The rear face of the flange 23 of the double nozzle 9 is formed with receptacle apertures 31A and 32B to receive the front ends of the first and second cylinders 17A, 17B, respectively. The front ends of the first and second cylinders 17A, 17B fit relatively tightly within the receptacle apertures 31A, 32B via an O ring (not shown), so that the double nozzle 9 and the first and

second cylinders 17A, 17B can be removed together from the main mount 15, when the double nozzle 9 is detached from it.

The double nozzle 9 is constructed with two casings, and thus it includes an outer, hollow, cylindrical nozzle 33 and an inner, cylindrical nozzle 35 that is provided within the outer nozzle 33 in a coaxial relation. At a lower portion of the double nozzle 9, it also includes a rotator 39 with a gear 37. The inner nozzle 35 fluidly communicates with the aperture 31A through a passage 41A. A ring passage 43, which is formed between the inner surface of the outer nozzle 33 and the peripheral surface of the inner nozzle 35, fluidly communicates with the aperture 31B through a passage 41B.

To reduce undesirable kneading or stirring in the feeders (the cylinders 17A, 17B), the present apparatus 1 employs a piston mechanism, instead of the prior-art screw or spiral mechanism, for transporting the food materials.

As is obvious from Fig. 3, a first horizontally-acting, piston 45A, working in the first cylinder 17A, and a second, horizontally-acting piston 45B, working in the second cylinder 17B, are each formed with a tapered piston head, which has a tapered surface 45T. Each passage 41A, 41B has a recessed profile corresponding to the tapered surface 45T. With this configuration, when the pistons 45A, 45B force out the food materials within the cylinders 17A, 17B, the tapered surface 45T engages the corresponding recesses of the passages 41A, 41B to minimize the waste of the remaining food material within each of the cylinders 17A, 17B.

Projecting from the rear portion of the upper surface of the main mount 15 is a rear projection 47, for supporting the rear ends of the first and second

cylinders 17A, 17B. It is opposite the receptacle apertures 31A, 32B. The rear projection 47 includes first and second fitting apertures 49A, 49b to closely fit and support the corresponding rear ends of the first and second cylinders 17A, 17B.

The rear projection 47 also includes a driving mechanism for moving the pistons 45A, 45B to force out the food materials from within the cylinders 17A, 17B. This driving mechanism includes a pair of nuts 51A, 51B, which are horizontally and rotatably attached to the rear surface of the rear projection 47, and a pair of cross-feed, threaded, levers 53A, 53B to act as pressurized propeller members. They are threaded into the corresponding nuts 51A, 51B and movable back and forth, and extend through the rear projection 47 for contacting and pressing the corresponding pistons 45A, 45B so that the pistons are forced forwardly.

The cross-feed levers 53A, 53B are secured by longitudinal elongated key-engaging grooves 55A, 55B, which are formed on the levers in correspondence with their length, so that they cannot be turned. The key-engaging grooves 55A, 55B are engaged to and disengaged from the lower ends of stoppers 57A, 57B, which are vertically and movably supported by the rear projection 47.

To rotate the nuts 51A, 51B, toothed wheels 59A, 59B are formed on the peripheries of them. Further, the toothed wheels 59A, 59B engage with corresponding endless belts (e.g., chains or timing belts) 61A, 61B, which in turn engage with corresponding driving gears 65A, 65B of motors 63A, 63B (see FIG. 4) mounted within the frame 3. With this arrangement, when the motors 63A, 63B rotate either inversely or reversely and thus the nuts 51A, 51b rotate

either inversely or reversely the cross-feed levers or the pressurized propeller members 53A, 53B move back and forth. When the strokes of the cross-feed levers 53A, 53B move forward their front ends contact the corresponding pistons 45A, 45B within the corresponding cylinders 17A, 17B such that each piston acts as a forward stroke. When the strokes of the cross-feed levers 53A, 53B move back, their front ends release from the corresponding pistons 45A, 45B and thus only the feed levers 53A, 53B retract.

As noted above, when the cross-feed levers 53A, 53B act as the forward strokes and thus the pistons 45A, 45B reach the ends of their strokes, the food materials within the cylinders 17A, 17B are forced out therefrom through the double nozzle 9, without any waste food materials remaining within the cylinders 17A, 17B. This procedure may be readily performed when both cylinders 17A, 17B reach the ends of their strokes at substantially the same time. However, because the food materials of the two cylinders 17A, 17B are consumed at different rates, it may occur that when one cylinder still contains food material the other one is already emptied and thus needs to be resupplied with the food material. Because of this resupply with the food material, a pair of sensors SA, SB, such as photo sensors, limit switches, or proximity detectors are provided near the corresponding nuts 51A, 51B. When each piston 45A, 45B reaches the end of its stroke, the corresponding rear end of each lever 53A, 53B passes forward thorough a sensing position (near the corresponding nuts 51A, 51B) of the corresponding sensors SA, SB and signals them. When at least one of the sensors detects the corresponding rear end of the lever 53A or

53B, it signals both the motors 63A and 63B to stop, and thus the empty cylinder can be filled with the food material.

Alternatively, one or two detectors may be provided for detecting the load of the motors 63A and 63B instead of providing the sensors SA, SB to detect the movement of the levers 53A, 53B. When each of the pistons 45A, 45B reaches the end of its stroke and engages the corresponding passages 41A, 41B, the load of the corresponding motors 63A, 63B rapidly increases. Therefore, the rapidly increased load of the motor 63A or 63B indicates that the corresponding piston 45A or 45B has reached the end of its stroke, and can be detected by the detector.

By reference now to Fig. 1, a driving mechanism for rotating the rotator 39 in the double nozzle 9 will be explained. An additional mount 67, which supports a motor 69, is attached to the underside of the main mount base 15 via a bracket. Drivingly connected to the drive shaft of the motor 69 is a driven gear 71 that meshes with a first intermediate gear 73 that is rotatably supported by the additional mount 67. The first intermediate gear 73 is drivingly connected to a second intermediate gear 75 rotatably supported by the frame 3. The second intermediate gear 75 is arranged to mesh and un-mesh with the gear 37 of the double nozzle 9, by means of a gear train 77 having a plurality of gears that are meshed. Therefore, when the motor 69 is operating, the rotator 39 in the double nozzle 9 is rotatably driven through the gear 37 by means of the gear train 77 and the first intermediate gear 73, which is driven by the drive shaft of the motor 69.

In reference to Fig. 4, as described above, the vertically-movable cutting apparatus 11 cuts the elongated product that is extruded from the double nozzle 9 while the casing 79B envelopes the filling 79A. The cutting apparatus 11 can be moved vertically as described as follows. The cutting apparatus 11 is mounted on the upper ends of a pair of vertically movable rods 83 that are vertically guided by vertically-movable guides 81 (see Fig. 6), which are provided on the front of the frame 3. As shown in Fig. 6, the lower ends of the movable rods 83 are connected to each other by a yoke 85. On the center portion of the yoke 85, the front end of a connecting plate 87 is pivotally connected by a pivotally-movable shaft 89. Rotatably fitted to the lower end of the connecting plate 87 is an eccentric disk 93, which is mounted on a rotary shaft 91 so as to act as a camming action for elevating the cutting apparatus 11. The frame 3 horizontally and rotatably supports this rotary shaft 91. Attached to the base end of the rotary shaft 91 is a first bevel gear 95. It meshes with a second bevel gear 101 that is attached to one end of an output shaft of a final driven mechanism 99, which is driven by a motor 97. Therefore, when the motor 97 is operating, the cutting apparatus 11 is driven vertically by means of the eccentric disk 93 from the connecting plate 87, which is driven by the rotary shaft 91.

The cutting apparatus 11 also includes a shuttering or sliding mechanism. The sliding mechanism includes a housing 103, which receives polygonal, e.g., hexagonal, circumferentially-arranged cutting members 105, to form a central opening surrounded by them. Each cutting member 105 has at least two cutting surfaces, which include upper and lower cutting surfaces

(only the upper cutting surfaces are illustrated in Fig. 5). The cutting members 105 are assembled in sliding contact with each other. Thus, the central opening is opened and closed to cut the elongated product that is extruded from the double nozzle 9 and that passes through the central opening, to produce the rounded, encrusted products, in each of which the filling is encrusted with the casing. Those skilled in the art will recognize that the rounded encrusted product is not intended to be only a product in which the casing fully covers the inner filling. For example, the casing may be extended part-way around the inner filling so as to form an opening in the casing such that the filling may be partly exposed from the opening.

A connecting pin 107, which can move through the housing 103, is fixed to one of the cutting members 105 that is located in its set position. The head of the connecting pin 107 is integrally fixed to a first sliding shaft 109, which is aligned orthogonally to the connecting pin 107. As shown in Fig. 4, the first sliding shaft 109 is slidably supported so as to slide back and forth by means of a first guide 111, which is attached to the front of the housing 103 and extends backward and forward. As shown in Fig. 5, a second sliding shaft 115 is slidably supported so as to be slid back and forth by means of a second guide 117, which is attached to the frame 3 at substantially the same height as that of the first guide 111.

A mechanical coupling between the rear end of the first sliding shaft 109 and the front end of the second slide shaft 115 is a U-shaped or ring-shaped coupling 117, whose front face has an elongated and vertical slit 117S. The rear end of the first sliding shaft 109 is engaged with the slit 117S of the

coupling 117 in a manner such that the engaged shaft 109 can be moved vertically relative to the coupling 109, while it can be moved back and forth in unison with the coupling 109. The front end of the second sliding shaft 115 is attached to the coupling 117.

Although the coupling 117 is coupled to both sliding shafts 109 and 115, it may be coupled to just either one.

As described above, one end of the output shaft of the final driven mechanism 99 is attached to the second bevel gear 101. Attached to other end of the output shaft of the final driven mechanism 99 is a horizontal, rotary cam 119 (Fig. 4) for driving the sliding mechanism. The rotary cam 119 has a cam groove 119G that engages with a cam follower 125 on a center portion of a swing lever 123. The swing lever 123 swings back and forth with its base end acting as a pivot that is pivoted on the frame 3 via a hinge pin 121. The swing lever 123 is also pivotally connected at its front end to one end of a linkage 129 via a pin 127. The other end of the linkage 129 is pivotally connected to the rear end of the second sliding shaft 115 via a pivot pin 131.

When the motor 97 is operating, the rotary cam 119 rotates to swing the lever 123 back and forth, and thus the second sliding shaft 115 slides back and forth. Then the coupling 117 transmits the movement of the second sliding shaft 115 to the first sliding shaft 109 to make it slide back and forth, so that the cutting members 105 move in sliding contact with each other to cut the elongated product.

Those skilled in the art can recognize that the operation of sliding the cutting members 105 is arranged in a cooperative relation with the elevation of

the cutting apparatus 11. When the cutting members 105 are being slid, both the first and second sliding shafts 109 and 115 are moved in the same direction at substantially the same height, so that a displacement vertically of the cutting apparatus 11 is permitted. Therefore, the transmission of the driving power between the first and second sliding shafts 109 and 115 can be performed under a lower moment than otherwise.

As a result, the timing to slide the cutting members 105 is well matched with the timing to elevate the cutting apparatus 11, to avoid a time lag of the sliding movements of the cutting members 105. Thus, the elongated product can be smoothly cut.

The rounded, encrusted products, which are fed from the cutting apparatus 11, then rest on the tilted tray 13, which is located below the cutting apparatus 11.

In reference again to Figs. 1 and 2, the tiltable tray 13 can be tilted back and forth (corresponding to the left and right sides in Fig. 1). Two vertical guide members 133 are provided on the right and left sides of the lower portion of the front frame 3 in a paired relationship. A vertical slider 135, which has a bracket 137 on its front face, is slidably mounted between the pair of the vertical guide members 133, to slide vertically. A swinging member 141 is pivoted on the upper portion of the bracket 137 by a pivot pin 139 so as to swing vertically on the pivot pin 139. The swinging member 141 is forced clockwise (as in Fig. 1) by a torsion spring (not shown) such that its rear end side abuts the upper surface of the vertical slider 135 and thus is supported in a substantially horizontal position. The swinging member 141 includes a

vertical flange 141F at one of its sides. The tray 13 has a vertical flange 143, with a vertical slit 145 formed thereon which is opposed to the vertical flange 141F of the swinging member 141. A fastener 147, which may include a bolt and nut, is fastened to both the opposed flanges 141F, 143. Although one end of the fastener 147 is securely fastened to the flange 141F of the swinging member 141, the other end is slidably and adjustably fastened to the vertical flange 143 of the tray 13 through the vertical slit 145. Therefore, the height of the tray 13 can be varied by adjusting the position in which the fastener 147 is fastened in the vertical slit 145.

The rotary shaft 91 that drives the eccentric disk 93 for the sliding mechanism also drives the vertical slider 135. For this purpose, the front end of the rotary shaft 91 is connected to a lever 151, whose front end has a cam follower 153. The cam follower 153 is engaged with an appropriately-shaped cam groove 149, which is formed on the vertical slider 135.

In reference to Fig. 2, when the rotary shaft 91 rotates counterclockwise, the cam follower 153 also rotates counterclockwise from the upper dead-center position. During the initial rotation of the cam follower 153, it can rotate along the cam groove 149 of the vertical slider 135. Therefore, the cam follower 153 supports the upper surface of the cam groove 149, and thus the vertical slider 135 is maintained in its highest position.

Then the rotary shaft 91 rotates counterclockwise by about 90 degrees, and the cam follower 153 abuts the lower end of the cam groove 149. Thus the vertical slider 135 is gradually lowered.

The rear end side of the swinging member 141 then abuts the upper portions of the pair of vertical guides 133. This is caused by the downward movement of the vertical slider 135. The vertical slider 135 is then further lowered, and the swinging member 141 rotates counterclockwise around the pin 139 against the force of the torsion spring, to tilt toward the front and thus the tray 13 tilts toward the front. Therefore, those cut products (not shown) that have already dropped from the cutting apparatus 11 onto the tray 13 then slide and drop into the front.

Then, as the cam follower 153 passes through a lower dead center point and gradually goes upward, it gradually moves from the side of the lower end to the side of the upper end of the cam groove 149. Thus it gradually lifts the vertical slider 135. Therefore, the swinging member 141 is gradually urged to its initial position by the force exerted by the torsion spring. When the cam follower 153 returns to the upper dead center point, the swinging member 141 also returns to the initial position (shown in Figs. 1 and 2).

As described above, both the lever 151 for tilting the tray 13 and the eccentric disk 93 for elevating the cutting apparatus 11 are attached to the same rotary shaft 91. Therefore, the elevation of the cutting apparatus 11 can be carried out in a cooperative relation with the tilting of the tray 13. With this cooperation, the tray 13 may receive and release the cut products that are dropped from the cutting apparatus 11 onto it at appropriate times.

Because of the characteristics of the food materials, it is considered that the product dropped from the cutting apparatus 11 may stick or adhere to the tray 13. To avoid this problem, as indicated by the dotted line AT in Fig. 1, an optional tray, which

contains appropriate particles to prevent undesirable sticking or adhesion, may be attached to the tray 13.

In the encrusting apparatus 1 of the invention, when the double nozzle 9 is removed from the apparatus 1, the cylinders 17A, 17B, containing the pistons 45A, 45B, are, together with the double nozzle 9, removed from the receiving recesses 16A, 16B of the apparatus 1. Therefore the food materials may be prevented from leaking from between the double nozzle 9 and the cylinders 17A, 17B and thus the resulting contamination that would otherwise occur may be prevented. For the same reason, the removed double nozzle 9, the removed cylinders 17A, 17B, and the removed pistons 45A, 45B can be readily maintained and cleaned outside of the apparatus 1. After maintenance or cleaning outside of the apparatus 1 the removed cylinders 17A, 17B can receive the pistons 45A, 45B within them and then be filled with the food materials.

Alternatively, after the double nozzle 9 and the cylinders 17A, 17B are removed from the apparatus 1, other types of cylinders, each of which already contains a piston and a food material that differs from the material in the removed cylinder 17A or 17B, as well as another type of double nozzle, may be mounted on the apparatus 1. This procedure is suitable for quickly making various kinds of casings and fillings for the apparatus 1. In particular, this procedure may be an efficient one for making multiple types, but in a low-volume production.

Figs. 7A-7C show an alternative cylinder 170, which can be employed with the apparatus 1 instead of or with the cylinder 17A or 17B. The pistons are not illustrated, for sake of simplicity.

As shown in Fig. 7A, the cylinder 170 includes an outer cylinder 172 and an inner cylinder 174. As shown in Fig. 7B, the inner cylinder 174

consists of a pair of half-cylinders 176, 178. Each half-cylinder 176 or 178 forms a semi- or half-cylindrical form. They are adapted to fit with other one. In a condition where the pair of half-cylinders 176, 178 are separated, one half of the cylinder 176 is manually filled with one kind of food material 180, while the other half of the cylinder 178 is manually filled with another kind of food material 182, which differs from the material 180 shown in Fig. 7C. Then the half-cylinders 176, 178 are fit to each other to form the single inner cylinder 174, as shown in Fig. 7A. The fitted cylinder 174 is then inserted in the outer cylinder 172, which has an inner diameter to fit the outer diameter of the cylinder 174. Thus the cylinder 170 is completed and can be mounted on the apparatus 1 instead the cylinder 17A or 17B. If each food material 180 or 182 has a different color, the cylinder 170 produces a two-colored material. Further, when both the cylinder 17A for the filling and the cylinder 17B for the casing in the apparatus 1 are changed to two of the cylinders 170, the final product can be, e.g., a four-colored product.

While the preferred embodiments of the invention have been described and illustrated herein, it will be apparent for those skilled in the art that various modifications and variations may be made to the present invention without departing from its spirit.

For example, according to the invention of claim 1, those skilled in the art could design a feeding apparatus that employs the two detachable cylinders 17A, 17B in order to produce an elongated and enveloped food product with neither the undesirable kneading associated with the prior-art rotatable screw, nor the complicated maintenance problems due to the prior-art hoppers fixed

on the turret. To achieve these objects, those skilled in the art will recognize that such a feeding apparatus is not limited to using the cutting apparatus 11 shown and illustrated herein. In fact, those skilled in the art could use any other cutting apparatus in order to produce spherical products as the final products from the elongated and enveloped food product.

Thus, it is intended that the scope of the present invention cover modifications and variations thereof, provided that they come within the spirit of the appended claims.



What is claimed is:

1. An apparatus (1) for producing an elongated and enveloped food product in which an outer material envelopes an inner material, and wherein the materials are food materials, said apparatus (1) comprising:

a first cylinder (17A) to be filled with the inner material;

a first piston (45A) slidably inserted in said first cylinder (17A) for extruding the inner material within said first cylinder;

a second cylinder (17B) to be filled with the outer material;

a second piston (45B) slidably inserted in said second cylinder (17B) for extruding the outer material within said second cylinder;

adhering means (9) for causing the extruded outer material from said first cylinder (17A) and the extruded inner material from said second cylinder (17B) to adhere to each other so as to form an elongated and enveloped product in which the outer material envelopes the inner material in a substantially coaxial relation, and for extruding the cylindrically-enveloped product from said adhering means; and



mounting means (16A, 16B) for detachably mounting said cylinders (17A, 17B) to said apparatus (1).

2. The apparatus of claim 1, further comprising further mounting means for mounting said adhering means (9) on said apparatus (1) and detaching said adhering means (9) from said apparatus (1).

3. The apparatus of claim 2, further comprising means for connecting said adhering means, said first cylinder, and said second cylinder together such that when said adhering means is detached from said apparatus, said first cylinder that contains said first piston and said second cylinder that contains said second piston are detached from said apparatus together with said adhering means.

4. The apparatus of any of the preceding claims, further comprising detector means for detecting when each said cylinder reaches the end of its stroke.

5. The apparatus of any of the preceding claims, wherein each piston has a tapered convex head, and said adhering means is profiled with two concave surfaces, each of which closely receives the corresponding tapered convex head of the corresponding cylinder.

6. The apparatus of any of the preceding claims, further comprising cutting means for cutting the cylindrically-enveloped product that is extruded from said adhering means so as to form a plurality of substantially spherical products wherein in each product the outer material encrusts the inner material.



7. The apparatus of claim 6, wherein said cutting means includes polygonal, circumferentially arranged cutting members to form a central opening surrounded by them, wherein said cutting members are assembled in sliding contact with each other so that they shut said central opening to cut the cylindrically-enveloped product that passes through therein from said adhesion means.

8. The apparatus as in claim 7, wherein said cutting means is vertically movable by means of a cam mechanism.

9. The apparatus as in claim 8, wherein said cutting members of said cutting means are driven by an additional cam mechanism.

10. The apparatus as in claim 9, wherein said cam mechanism and said additional cam mechanism are coupled to each other by a coupling and are driven together by the same motor in a cooperative relation.

11. The apparatus as in claim 10, wherein said coupling vertically and slidably supports said cam mechanism for said vertical movement of said cutting means so as to permit this vertical movement.

12. The apparatus as in claim 11, said apparatus further including a tiltable tray for receiving said spherical product from said cutting means, and wherein said tiltable tray is also driven by means of said motor in a cooperative relation so as to tilt to have the received spherical product slide out.

13. The apparatus as in claim 1, wherein at least one of said cylinders comprises an outer cylinder and an inner cylinder to be inserted into said outer cylinder, and wherein said inner cylinder is comprised of



two half-cylinders adapted to fit each other so that one half-cylinder can be filled with a food material that differs from that to be filled in the other half cylinder.

14. A method using the apparatus of claim 13 for feeding and extruding a cylindrical, multiple-colored enveloped food product in which an outer material envelopes an inner material, said method comprising the steps of:

a) feeding an outer material having a first color in said one half-cylinder;

b) feeding an outer material having a second color that differs from said first color in said other half cylinder;

c) fitting said half-cylinders to each other to form said inner cylinder and inserting said inner cylinder into said outer cylinder being assembled as one cylinder; and

d) mounting said assembled cylinder on said apparatus as said second cylinder, thereby in said second cylinder extruding a two-colored outer material that includes said first and second color during its operation.

15. The method as in claim 14, further comprising:

feeding an inner material having a third color in an additional half-cylinder;

feeding an inner material having a fourth color that differs from said third color in an additional half-cylinder;



fitting said additional half-cylinders to each other and inserting said fitted cylinders into an additional outer cylinder being assembled as said first cylinder; and

mounting said first cylinder in said apparatus together with said second cylinder of said step d), thereby said first cylinder also extruding a two-colored material such that a final product from said apparatus has four colors.