

An Apparatus for Dividing Bread Dough or the Like

This invention relates to an apparatus for dividing bread dough. It especially relates to an apparatus for dividing bread dough in which the pieces of cut bread dough are regulated to have a thickness corresponding to a preset distance from the dough outlet of the apparatus. Thereby pieces of bread dough that each have a plate-like form of a uniform thickness are obtained. It relates more especially to an apparatus in which by a simple operation the thickness of bread dough to be cut can be adjusted. It especially relates to an apparatus for dividing bread dough into pieces of bread dough having a plate-like form, without regard to the remaining amount of dough in a dough hopper when the amount of the dough mass is decreasing. This results in an efficient dough production, which leads to a greatly standardized bread-dough product. Thus the automated production of bread dough and the like having a high quality can be promoted.

European Patent Application No. 93302999.3 discloses an apparatus for dividing bread dough or the like. It comprises a dough-cutting member comprising a saw blade means, two dough-supporting members, and a drive means for reciprocating the saw blade means. By this apparatus a plastic material such as bread dough or confectionery dough is smoothly severed, whereby pieces of divided bread dough, each having a plate-like form in which no stress has occurred, are obtained. However, because, at the initial stage of the cutting of bread dough, due to its static friction resistance to an outer force, the dough-cutting member advancing into the

bread dough causes the stress in the bread dough to be increased. Therefore, after a piece of bread dough has been discharged from the dough outlet, the leading end of the piece of bread dough is deformed to somewhat expand, 5 by the reaction of the stress occurring in the hopper, against the outer force. Accordingly, these pieces of divided bread dough did not necessarily have an exactly uniform thickness.

Further, in the above apparatus the positional 10 relationship between the first and second dough-supporting members is stationary, namely, they are in a fixed relationship. Therefore to adjust or change a thickness of the bread dough to be cut, the mounting position of the second dough-supporting member to the 15 frame had to be changed. This leads to complications and inefficiency.

Moreover, the decrease in the amount of the bread dough in the hopper causes the weight of the dough mass in the hopper to be decreased, so that the pressure in 20 the dough decreases. Therefore, the bottom of the bread dough mass against which the dough-cutting member advances cannot be held down by the weight of the bread dough against the dough-supporting member. Thus, the bread dough mass cannot resist the advancing cutting 25 member, so that the dough-cutting member merely pushes a part of the dough mass in any direction with the bread dough mass not being cut. Therefore, not all of the bread dough charged in the hopper would be available to be cut. This leads to an uneconomical use of the bread 30 dough.

This invention comprises in one broad aspect discharge means for regulating the thicknesses of pieces of cut bread dough so as to have a uniform 35 thickness, thereby providing an apparatus for dividing a

bread dough mass by which it can be smoothly sliced into pieces of bread dough having a uniform thickness.

This invention comprises, in another broad aspect, an adjusting means for adjusting the size of the dough outlet, thereby providing an apparatus for dividing a bread dough mass by which the positional relationship of the first and second dough-supporting members can be easily adjusted, so that the thickness of the bread dough to be cut is easily changed.

This invention comprises, in another broad aspect, a pressing means for pressing the bread dough in the hopper, so that the pressure in the bread dough in the hopper is maintained at a uniform value. Therefore, almost all of a dough mass in the hopper can be cut and divided into pieces having a uniform shape and quantity.

By one aspect of this invention an apparatus for dividing bread dough is provided, which comprises

a hopper for dough, the bottom of which is constituted by a first dough-supporting member, a second dough-supporting member, a dough-cutting member, and a dough outlet,

said first dough-supporting member being movable back and forth, and comprising a flat upper surface, a bottom surface, a horizontal forward edge, and a rearward edge, said forward edge extending perpendicular to the direction of movement of said member,

said dough-cutting member comprising a saw blade means, and positioned at said forward edge of said first dough-supporting member,

a drive means for reciprocating said saw blade means in its longitudinal direction while said first dough-supporting member is moved in its advancing direction,

said second dough-supporting member being movable in the same direction and in synchronization with said first

dough-supporting member, being provided with a flat upper surface positioned at a level below the upper surface of said first dough-supporting member, thereby forming said dough outlet, having a preset distance, between said
5 second dough-supporting member and said cutting member, and a drive means for moving said first and second dough-supporting members back and forth, characterized by a discharge means, arranged adjacent and below said dough-cutting member, for regulating the thickness of a
10 piece of dough cut so as to have a thickness corresponding to said preset distance.

By another aspect of this invention an apparatus for dividing bread dough is provided, which comprises a hopper for dough, the bottom of which is constituted
15 by a first dough-supporting member, a second dough-supporting member, a dough-cutting member, and a dough outlet,

said first dough-supporting member being movable back and forth, and comprising a flat upper surface, a bottom
20 surface, a horizontal forward edge, and a rearward edge, said forward edge extending perpendicular to the direction of movement of said member,

said dough-cutting member comprising a saw blade means, and positioned at said forward edge of said first
25 dough-supporting member,

a drive means for reciprocating said saw blade means in its longitudinal direction while said first dough-supporting member is moved in its advancing direction,

30 said second dough-supporting member being movable in the same direction and in synchronization with said first dough-supporting member, being provided with a flat upper surface positioned at a level below the upper surface of said first dough-supporting member, thereby forming said
35 dough outlet between said second dough-supporting member and said cutting member, and

a drive means for moving said first and second dough-supporting members back and forth, characterized by

an adjusting means for moving said second dough-supporting member parallel with and relative to said first dough-supporting member, thereby to adjust the size of said dough outlet.

5 By still another aspect of this invention, an apparatus for dividing bread dough or the like is provided, which comprises

a hopper for dough, the bottom of which is constituted by a first dough-supporting member, a second
10 dough-supporting member, a dough-cutting member, and a dough outlet,

said first dough-supporting member being movable back and forth, and comprising a flat upper surface, a bottom surface, a horizontal forward edge, and a rearward edge,
15 said forward edge extending perpendicularly to the direction of movement of said member,

said dough-cutting member comprising a saw blade means, and positioned at said forward edge of said first dough-supporting member,

20 a drive means for reciprocating said saw blade means in its longitudinal direction while said first dough-supporting member is moved in its advancing direction,

said second dough-supporting member being movable in
25 the same direction and in synchronization with said first dough-supporting member, being provided with a flat upper surface positioned at a level below the upper surface of said first dough-supporting member, thereby forming said dough outlet between said second dough-supporting member
30 and said cutting member, and

a drive means for moving said first and second dough-supporting members back and forth, characterized by

a pressing means, provided in said hopper for dough, for pressing dough in said hopper for dough, said
35 pressing means having a pressing board.

The discharging means is provided below and adjacent the dough outlet of the apparatus. Therefore, before a piece of cut bread dough is placed on a supply conveyor that receives the piece of bread dough, 5 the discharge means regulates the thickness of the piece of cut bread dough so that the piece has a thickness that exactly corresponds to the gap of a preset distance from the dough outlet. This leads to pieces of cut bread dough having a uniform thickness. Also, this results in 10 the effective joining of pieces of dough to make a uniform strip of bread dough.

The adjusting means for adjusting the size of the dough outlet is adapted to move the second dough-supporting member parallel with and relative 15 to its base position, independent of the first dough-supporting member. Therefore, in response to the desired thickness values of the bread dough to be cut, the operator can easily adjust the size of the dough outlet. Thereby the bread dough can be cut into pieces 20 having a desired thickness.

The pressing means is provided in the hopper of the dividing apparatus. Therefore, the pressing means can press the bread dough in the hopper. Thus, during the cutting operation of the bread dough, 25 the pressure in the bread dough can be maintained at a uniform value to resist the cutting member advancing into the bread dough, and to hold the bread dough so as not to be pulled by the cutting member, while being effectively cut. Therefore, even when the bread dough in the hopper 30 is decreased due to the progress of the cutting operation, the cutting member can cut the bread dough while it is held by the pressure from the pressing means. This enables almost all the bread dough charged in the hopper to be economically cut into divided bread dough 35 pieces.

Certain preferred embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view of a first embodiment of this invention, partially broken away.

Figs. 2 and 3 are sectional and side elevational views of the first embodiment of this invention.

Fig. 4 is a perspective view of a second embodiment of this invention, partially broken away.

10 Fig. 5 is a sectional and side elevational view of the second embodiment of this invention.

Figs. 6 to 10 are sectional and side elevational views showing the movements of the second dough-supporting member of the second embodiment of this invention.

15 Fig. 11 is a perspective view of a third embodiment of this invention, partially broken away.

The first embodiment of this invention will now be explained by reference to the attached drawings.

In Fig. 1, a hopper 15 for accomodating a bread dough mass 14 (see Fig. 2) is mounted on a beam 16, which is fixed on a base 17. Slide rails 23 are mounted on the base 17, and slide bearings 21 are mounted on a frame 19.

The slide rails 23 and the slide bearings 21 are slidably combined. The frame 19 is adapted to be moved horizontally, and to move backward and forward relative to the base 17, by any conventional drive means.

A first plate 25, which is flat and square, is mounted horizontally on the frame 19. Adjacent the rear edge of

the first plate 25, a first roller 27 is rotatably mounted on the frame 19. A first belt 29 is entrained on the first plate 25 and first roller 27. The first plate 25, first roller 27, and first belt 29, constitute the main elements of a first dough-supporting member 30 (see Figs. 2 and 3). The first dough-supporting member 30 has a flat upper surface 34 (see Fig. 3), a horizontal forward edge, a lower surface, and a rearward edge. The horizontal forward edge extends perpendicularly to the direction of movement of the first dough-supporting member 30. The two ends of the first belt 29 are securely mounted on a first bracket 33 extending from one of the sides of the hopper 15 (see Fig. 2). Therefore, the horizontal movement of the frame 19 causes the first plate 25 and the first roller 27 to be moved horizontally. Although the frame 19 is moved horizontally so as to change its position relative to the hopper 15, the positional relationship of the part of the first belt 29 to the bottom 36 (see Fig. 2) of the bread dough mass 14 in the hopper 15 is not changed. Namely, upon the horizontal movement of the frame 19, the first plate 25 and the first roller 27 are moved horizontally in the same direction as the frame 19. However, since the first belt 29 is fixed at the first bracket 33, it does not rotate around the first plate 25, but instead, the area of the belt 29 is changed due to the movement of the first dough-supporting member 30.

The first belt 29 may be endless, or it may be removed. In such a case the advantage of the above-mentioned embodiment of the belt will not be obtained, but in such a case the embodiment may still be workable depending on various parameters and by adding other means to loosen the friction between it and the dough above it.

A dough-cutting member 38, namely, a saw blade means, comprising upper and lower saw blades 40 and 42, is positioned in front of the forward edge of the first belt 29, and installed on the frame 19. The edges of each of the blades are aligned with each other. The distance between the adjacent tips of the blades 40 and 42 is 5mm, and the depth of the trough of each of the blades 40 and 42 is 4.3mm. The edge of the upper saw blade 40 is flush with the flat upper surface 34 (see Fig. 3) of the first dough-supporting member 30. The two ends of the upper saw blade 40 are securely mounted on the frame 19, and one of the two ends of the lower saw blade 42 is connected to a slide rod 43. The other end of the lower saw blade 42 is adapted to be slidably received in a hole 20 formed on the frame 19. The upper saw blade 40 and lower saw blade 42 are in a positional relationship wherein the edges of these blades are aligned with each other. The slide rod 43 extends through the frame 19, and is connected by means of a universal joint 45 to a crank device 47. The crank device 47 is installed on a small plate 49 fixed to the frame 19. Therefore, when the crank device 47 is rotated by a motor (not shown), the lower saw blade 42 is reciprocated at a stroke of 20mm in the longitudinal direction, while the blades 40, 42 are advanced, at a speed of 4mm/min, together with the first dough-supporting member 30. This lower saw blade 42 may be mounted on the frame 19, and the upper saw blade 40 may be mounted on the slide rod 43. In this case, the upper saw blade 40 is reciprocated. Also, the lower and upper saw blades 40, 42 may be arranged so that both saw blades are reciprocated in the direction perpendicular to the movement of the first dough-supporting member 30, while they slide in relation to each other.

In Fig. 2 a second plate 51 is mounted on the frame 19

in a position below the dough-cutting member 38. A second roller 53 and a guide roller 48 are rotatably mounted on the frame 19. A second belt 55 is entrained on the second plate 51, the second roller 53, and the guide roller 48. The second plate 51, rollers 48 and 53, and the second belt 55, constitute the main elements of a second dough-supporting member 56. It has a flat upper surface 61, a forward edge, a lower surface, and a side 46, namely, a vertical surface provided by a part of the second belt 55, tensioned between the rear edge of the second plate 51 and the guide roller 48. The second dough-supporting member 56 is adapted to be moved horizontally back and forth since it is mounted on the frame 19. The flat upper surface 61 is positioned below the flat upper surface 34 of the first dough-supporting member 30. The two ends of the second belt 55 are securely mounted on a second bracket 59 extending from the side of the hopper 15 opposite from the side from which the first bracket 33 extends.

Since the second dough-supporting member 56 is mounted on the frame 19 like the first dough-supporting member 30, it is evident that the second dough-supporting member 56 is adapted to be moved in the same direction as, and in synchronization with, the first dough-supporting member 30. Since the rear edge of the second dough-supporting member 56 is positioned to be lower than and spaced apart from the saw blades 40 and 42, a dough outlet 35 is provided between the second dough-supporting member 56 and the dough-cutting member 38. The gap of the dough outlet 35 is set to have a preset distance, in response to a desired thickness of bread dough to be cut. This presetting procedure is attained by changing the position where the second dough-supporting member 56 is mounted on the frame 19. The first and/or second dough-supporting members, the dough-cutting member 38, and the dough outlet 35, constitute the bottom of the

hopper 15.

A driven roller 52 adapted to be rotated by a drive means not shown, and guide rollers 50 and 54, are rotatably mounted on the frame 19. A belt 41 is entrained on the rollers 50, 52, and 54. The belt 41 and the rollers 50, 52, and 54 constitute a discharge conveyor 39. A part of the belt 41 tensioned between the rollers 50 and 54 provides a vertical surface, namely, a side 44. It faces the side 46 of the belt 55 of the second dough-supporting member 56. Thus, adjacent and below the dough-cutting member 38, a discharge means, namely, a discharge path 57, is provided. The belt 41 is adapted to be moved in a direction indicated by an arrow C in Fig. 2 at the same speed as that of the belt 55 of the second dough-supporting member 56. Therefore, the discharge path 57 can convey a piece of bread dough cut downward while compressing it, thereby regulating the thickness of the dough piece to a preset thickness.

The gap of the discharge path 57 is designed to equal the preset gap of the dough outlet 35. Simultaneously with the advancing of the frame 19, the side 44 of the belt 41 and the side 46 of the belt 55 are adapted to cooperatively compress a piece of divided bread dough and convey it downward, thereby discharging it to a supply conveyor 50. In this embodiment a part of the second belt 55 of the second dough-supporting member 56 and a part of the belt 41 of the discharge conveyor 39 constitute the discharge means, namely, the discharge path 57. However, it may be constituted by a part of the belt 41 and a part of the belt of another belt conveyor arranged separately from the second dough-supporting member 56. In this case a part of the belt 41 faces a part of another belt conveyor to provide the discharge path 57.

The increase and decrease of the area of the part of the flat upper surface 61 of the second dough-supporting member 56 positioned in the hopper 15 are in an inverse relationship to the increase and decrease of the area of the part of the flat upper surface 34 of the first dough-supporting member 30 in the hopper 15. Two guards 65 (see Fig. 1), to prevent the dough from overflowing from the flat upper surface 61, are mounted on the second plate 51, adjacent both sides of the second belt 55.

The operation of the first embodiment of the apparatus for dividing the bread dough will be explained below.

At the beginning of the cutting operation the bottom 36 of the dough mass 14, kneaded by a conventional technique and supplied to the hopper 15, is supported only by the flat upper surface 61 of the second dough-supporting member 56, as shown in Fig. 2. The dough-cutting member 38, positioned at the forward end of the first dough-supporting member 30, is outside of the hopper 15. A drive gear (not shown) causes the frame 19 to move right as viewed in Fig. 3, whereby the cutting operation starts. The speed that the frame 19 advances, namely, the speed that the dough-cutting member 38 advances, is 4.5m/min. When the frame 19 begins to move, a motor (not shown) causes the crank device 47 (Fig. 1) to begin to rotate. This rotation causes, through the universal joint 45, the slide rod 43 to be reciprocated. Therefore, the saw blade 42 is reciprocated, so that the cutting movement begins. The stroke of the reciprocating movement of the saw blade 42 is 23mm. Thus the edges of the cutting member 38 advance into the dough mass 14, and smoothly sever it.

The reciprocating movements of the saw blade 42 are effective in cutting bread dough that has a strong elasticity and a high cutting resistance. When the saw

blades 40 and 42 enter the dough mass 14, they do not impart any forcible or pulling action to the dough mass 14. Therefore, no stress occurs in the dough. The dough mass 14 is severed and divided into dough pieces, while a
5 finely cut surface is formed. The advance of the frame 19 causes the first plate 25 to be advanced together with the saw blades 40 and 42. Therefore, by the guiding of the forward end of the first plate 25, the part of the belt 29 positioned on the lower surface of the first
10 dough-supporting member 30 is also advanced in a direction indicated by an arrow A, and moves past the forward edge of the first plate 25 and becomes a part of the flat upper surface 34. By the rightward movement of the first dough-supporting member 30, the area of the
15 flat upper surface 34 positioned in the hopper 15 increases.

Simultaneously with the beginning of the cutting operation of the bread dough, the second belt 55 is retracted in a direction indicated by an arrow B shown in
20 Fig. 3, so that the area of the flat upper surface 61 is decreased. Since the two ends of the second belt 55 are securely mounted on the second bracket 59, the flat upper surface 61 of the second belt 55 does not move relative to the lowest part 36 of the bread dough 14. Thus no
25 tensile force due to any possible friction between the flat upper surface 61 of the belt 55 and the dough is imparted to it. Accordingly, not only can the dough mass be smoothly cut by the saw blades 40 and 42, but also, no stress in the dough mass that remains in the hopper 15
30 occurs.

Fig. 3 shows that a part of the dough mass 14 has been nearly severed by the saw blades 40 and 42, that the leading end of a dough part that has almost become a separate piece of dough is located on a supply conveyor
35 50, and that a dough part to be the end of a piece of

dough is still connected to the dough mass in the hopper 15, and that a part near it is held and compressed between the sides 44 and 46. During the cutting operation, since the two ends of the first belt 29 are
5 securely mounted on the first bracket 33, the first belt 29 cannot be freely rotated, and it is maintained stationary relative to the dough mass 14 inside the hopper. Namely, the flat upper surface 34 can stably contact and support the bottom 36 of the dough mass 14.

10 The saw blades 40 and 42 are advanced until they cross the dough mass, and then a piece of dough is completely divided from the dough mass 14. When the saw blades 40 and 42 are advanced to their preset location, the belt 41 of the discharge conveyor 39 and the belt 55 of the
15 second dough-supporting member 56 convey the end of a piece of divided dough between the sides 44 and 46 of the belts and discharge it to the supply conveyor 50. The thickness of the piece of divided bread dough is regulated between the side 44 of the belt 41 and the side
20 46 of the second dough-supporting member 56, so that the piece of divided bread dough has a thickness corresponding to a preset distance from the dough outlet 35. Thus, the pieces of the divided bread dough have a uniform thickness. During each of the cutting movements,
25 the conveyor 50 may be arranged to be stationary, or to be actuated to convey a piece of divided bread dough left at a speed to avoid the bend in the piece of bread dough that would arise if the bread dough to be transferred to the supply conveyor 50 is thin.

When the cutting of the bread dough mass 14 by the saw blades 40 and 42 is finished, the reciprocating movements of the saw blade 40 are stopped. Simultaneously, the frame 19 begins to move in a direction opposite to that in the cutting operation, to return to the beginning position. At the same time, the area of the flat upper surface 34 begins to decrease. During the retraction of the first dough-supporting member 30 no pulling action is applied to the bread dough mass 14. Also, the area of the flat upper surface 61 is increased. In this case also, no pulling action is applied to the bread dough mass 14. Finally, the frame 19 returns to the beginning position, so that one cycle of the cutting operation is completed.

A second embodiment of this invention will now be explained by referring to the attached drawings.

In Fig. 4 a hopper 15 is mounted on beams 16 fixed to a base 17. A rail 70 is mounted on the base 17 at each side of the hopper 15. Two wheels 72 are mounted on an outer frame 74 at each side of the hopper 15. The wheels 72 can run on the rails 70. The outer frame 74 is adapted to be moved horizontally back and forth relative to the base 17. The horizontal backward and forward movement of the outer frame 74 is attained by a motor 76. A pinion 78 is connected to the motor 76, and is adapted to be rotated by the motor 76 to move a rack 80 back and forth.

A first plate 25 is mounted on the outer frame 74. A first belt 29, having two ends, is entrained on the first plate 25 to provide a flat upper surface 114 (see Fig. 5) for supporting the bread dough in the hopper 15. The first plate 25 and the first belt 29 constitute the main element of a first dough-supporting member 71 (see Fig. 5).

In Fig. 5 the first dough-supporting member 71 has a flat upper surface 73, a horizontal forward edge, a lower surface, and a rearward edge. The horizontal forward edge extends perpendicularly to the direction of movement 5 of the first dough-supporting member 71. The two ends of the first belt 29 are securely mounted on a first bracket 33 extending from one of the sides of the hopper 15. Although the outer frame 74 is moved horizontally so as to change the position of the first plate 25 relative to 10 the hopper 15, the positional relationship of the flat upper surface 73 to the bottom 36 of the bread dough mass 14 in the hopper 15 is not changed. Namely, only the area of the flat upper surface 73, which constitutes the bottom of the hopper 15, is changed.

15 Adjacent the hopper 15 the dough-cutting member 38 is arranged near and below the top of the first plate 25. The member 38 is mounted on the outer frame 74 such that only the edges of the dough-cutting member 38 protrude from the top of the first plate 25. The reason that the 20 dough-cutting member 38 is arranged below the first plate 25 is to decrease its overhang beyond the forward end of the first plate 25. Thus any distortion of the dough-cutting member 38 due to the weight of the dough mass 14 is decreased. This results in the edges of the 25 dough-cutting member 38 not being damaged. The dough-cutting member 38 comprises a saw blade means, namely, upper and lower saw blades 40 and 42. The upper saw blade 40 is mounted on the outer frame 74, and the lower saw blade 42 is adapted to be reciprocated in its 30 longitudinal direction. The upper saw blade 40 and lower saw blade 42 are in a positional relationship wherein the edges of these blades are aligned.

In Fig. 4 a rail 86 is mounted on the outer frame 74 at each side of the hopper 15, at a position nearer the 35 hopper 15 than the position where the first plate 25 is

mounted on the outer frame 74, and at the side of the outer frame 74 opposite the side at which the wheels 72 are rotatably mounted. Wheels 82 are rotatably mounted on an intermediate frame 84, and they can run on rails 5 86. The intermediate frame 84 is adapted to be moved horizontally back and forth relative to the outer frame 74. This horizontal backward and forward movement is attained by an air cylinder 88. The cylinder body 90 of the air cylinder 88 is mounted on the outer frame 74.

10 A pair of swing elements 94 is swingably mounted on the intermediate frame 84 on each side of the hopper 15. Each swing element 94 has a first shaft 96 swingably connected to it and extending from the inner side of an intermediate frame 84, opposite the side on which the 15 wheels 82 are mounted. The swing element 94 consists of an arm extending, in two directions, from a point where the first shaft 96 is mounted, to form an obtuse angle. Near the lower end of the two arms of the swing element 94, a second shaft 98 is provided so as to swingably 20 support an inner frame 100. The top part of the swing element 94 is swingably mounted on a connecting plate 102. The connecting plate 10 connects the two swing elements 94 on each side of the hopper 15. A set of two forward and rearward swing elements 94 constitute a link 25 mechanism.

One of the two ends of the rod 104 of an air cylinder 106 is swingably mounted on one of the two swing elements 94 on each side of the hopper 15, thereby providing a drive source for the link mechanism. The air cylinder 30 106 is mounted on each of the intermediate frames 84. Therefore, the inner frame 100 is adapted to be moved parallel to the intermediate frame 84. An adjusting nut 108 and a lock nut 110 are mounted on the other end of the rod 104 opposite the end on which the link mechanism 35 is mounted. Thereby the operator can adjust the distance

the rod 104 protrudes or retracts. Thus, the link mechanism and the drive source are arranged at each side of the hopper 15, to support the inner frame 100 such that it can be moved parallel to its resting position.

5 In Fig. 5 a second belt 55, having two ends, is entrained on the inner frame 100. The second belt 55 and the inner frame 100 constitute the main elements of a second dough-supporting member 112. It has a flat upper surface 114, a forward vertical surface, a lower surface,
10 and a rearward vertical surface 116 near the dough-cutting member 38. The two ends of the second belt 55 are securely mounted on a second bracket 101 extending from the side of the hopper 15.

The horizontal movements of the outer frame 74 and the
15 intermediate frame 84 change the positional relationship of the inner frame 100 to the hopper 15. However, the positional relationship of the flat upper surface 114 to the bottom 36 of the dough mass 14 is not changed. The area of the flat upper surface 114, which constitutes the
20 bottom of the hopper 15, is merely increased or decreased, without the second belt 55 being able to rotate around the inner frame 100.

The increase and decrease of the area of the flat upper surface 114 are in an inverse relationship to the
25 increase and decrease of the area of the flat upper surface 73 in the hopper 15.

The intermediate frames 84 are connected by a small plate 120, on which small rollers 122 and 124 are rotatably mounted. Driven rollers 130 and 132 are mounted on a bracket 136 that extends from the base 17.

5 The periphery of each of the driven rollers 130 and 132 is arranged so as to frictionally engage the inner surface of the endless belt 126. Assist rollers 138 and 140 are also mounted on the bracket 136. An endless belt 126 is entrained on the small plate 120, the rollers 122

10 and 124, the driven rollers 130 and 132, the assist rollers 138 and 140, and a takeup roller 142 mounted on the rear end of the intermediate frame 84, to form a conveyor 146. A part of the belt 126 stretched around and between the small plate 120 and the roller 122

15 provides a vertical surface 128 that faces the rearward vertical surface 116. The vertical surface 128 extends to a position adjacent the dough-cutting member 38. The assist rollers 138 and 140 help the endless belt 126 to be wound around the driven rollers 130 and 132. The

20 rearward vertical surface 116 formed by the second belt 55 and the vertical surface 128 formed by the belt 126 of the conveyor 146 provide a discharge path 148.

The rollers 130 and 132 are adapted to be forcibly rotated, through the frictional engagement between them

25 and the belt 126, by the movement of the belt 126 entrained on them. However, by using a one-way clutch (not shown), the rollers 130 and 132 can be rotated only in the directions indicated by respective arrows E and F.

In other words, if the belt 126 transmits a tangential

30 force to the periphery of either roller 130 or 132, it cannot be rotated counterclockwise.

On the one hand, the intermediate frame 84, the small plate 120 connected thereto, and the takeup roller 142, can move in unison to the right. On the other hand, the

35 bracket 136 on which the driven rollers 130 and 132 and the assist rollers 138 and 140 are mounted is stationary,

because the bracket 136 is fixed to the base 17.

Therefore, when the intermediate frame 84 begins to move right, the small plate 120 is caused to move away from the set of the four rollers (the driven rollers and
5 assist rollers) mounted on the stationary bracket 136.

Thus, tension is generated in the part of the belt 126 stretched between the set of the four rollers and the small plate 120. This tension causes the belt 126 to transmit a tangential force to the periphery of the

10 driven roller 132 that would rotate it counterclockwise if unchecked. However, it cannot do so, because of the braking action of the one-way clutch. Also, the

positional relationship between the belt 126 and the roller 132 remains stationary. In contrast, when that

15 tension causes the belt 126 to transmit a tangential force to the periphery of the driven roller 130 so as to rotate it clockwise, it can be rotated in a direction indicated by an arrow E, or clockwise, because its

rotatable direction is the same as the moving direction

20 of the belt 126. Therefore, while the intermediate frame 84 advances, the part of the belt 126 positioned at the left side of the driven roller 130 is advanced in a direction indicated by an arrow G shown in Figs. 7 and 8.

That part of the belt 126 passes the rollers 130, 138,
25 and 124.

After the cutting operation is finished and the intermediate frame 84 returns to its starting position, tension is generated in the part of the belt 126

stretched between the set of the four rollers and the

30 takeup roller 142. This tension causes the belt 126 to transmit a tangential force to the periphery of the

driven roller 132 so as to rotate it clockwise, namely,

in a direction indicated by an arrow F in Fig. 10. Since the driven roller 132 is adapted to be rotated in the

35 direction F, it can do so. In contrast, the belt 126

transmits a tangential force to the periphery of the

driven roller 130 in a counterclockwise direction, but it

cannot be rotated in such a direction, because the driven roller 130 can rotate only clockwise. Therefore, the positional relationship between the belt 126 and the roller 130 remains the same.

5 The operation of the second embodiment of the apparatus for dividing bread dough will be explained below.

As shown in Fig. 6, at the beginning of the cutting operation the bottom 36 of the dough mass 14, kneaded by
10 a conventional technique and supplied to the hopper 15, is supported only by the flat upper surface 114 of the second dough-supporting member 112. The dough-cutting member 38 and the flat upper surface 73 are positioned apart from and below the hopper 15. The inner frame 100
15 is located at its starting position. The starting position of the inner frame 100 is such that the top of the edges of the dough-cutting member 38 is almost flush with the upper flat surface 114, and a small gap is provided between the vertical surface 128 and the rear
20 vertical surface 116.

As shown in Fig. 7, the air cylinder 106 is actuated to have the rod 104 extend from its starting position, thereby causing the swing elements 94 to incline by a preset angle. Therefore, by the action of the link
25 mechanisms, the inner frame 100 is moved parallel to the hopper 15, from its starting position, away from the vertical surface 128. Then, the intermediate frame 84 is stopped at a position calculated to provide a preset dough thickness, and this position remains unchanged.
30 The height difference between the edges of the dough-cutting member 38 and the flat upper surface 114 is 8mm.

The motor 76 is then actuated to have the pinion 78 rotated. This causes the rack 80 to be moved, thereby causing the outer frame 74, to which the rack 80 is fixed, to be moved in a direction in which the edges of
5 the dough-cutting member 38 are directed, so that the cutting operation starts.

With the beginning of the movement of the outer frame 74, another drive gear (not shown) causes the lower saw blade 42 to reciprocate while it slides on the upper saw
10 blade 40, so that the cutting movement begins. Thus the edges of the dough-cutting member 38 are advanced into the dough mass 14.

The edges of the upper saw blade 40 and the lower saw blade 42 provide fine cutting movements. These are
15 effective in cutting dough bread that has a strong elasticity and a high cutting resistance. The dough mass 14 is cut into divided plate-like dough pieces, while a finely cut surface is formed.

The advance of the outer frame 74 causes the first
20 plate 25 to be advanced together with the dough-cutting member 38. This causes the first belt 29 to conform to the advance of the first plate 25 and a part of the belt initially positioned under the first plate 25 is caused to take a position above said plate 25, so that the area
25 of the flat upper surface 73 positioned in the hopper 15 is increased.

The two ends of the first belt 29 are securely mounted to the first bracket 33, so that the first belt 29 cannot be freely rotated. Therefore, there is no relative
30 movement of the belt 29 on the flat upper surface 73 relative to the bottom 36 of the dough mass 14.

Simultaneously with the beginning of the cutting of

the dough, the inner frame 100 is retracted, so that the area of the flat upper surface 114 is decreased. The two ends of the second belt 55 entrained on the inner frame 100 are securely mounted on the second bracket 59.

5 Therefore, the flat upper surface 114 of the belt 55 does not move relative to the bottom 36 of the bread dough mass 14. Thus no tensile force due to any possible friction between the flat upper surface 114 of the second belt 55 and the dough mass is imparted to the dough mass
10 14.

The advance of the outer frame 74, namely, the advance of the intermediate frame 84, causes the endless belt 126 to have the driven roller 130, which as stated before is rotatable only in the direction indicated by the arrow E,
15 rotate clockwise, thereby allowing the passage of the belt 126 along the roller 130, while engaging it. Then, the belt 126 passes along the small plate 120 and downward. The belt 126 travels the same distance that the inner frame 100 is moved. The belt 55 also travels
20 the same distance that the inner frame 100 is moved. Therefore, the vertical surfaces 116 and 128, providing a discharge path 148, are moved in the same downward direction and at the same speed to discharge a piece of divided bread dough. This avoids bending the divided
25 dough pieces. The pieces of bread dough are then placed on a supply conveyor 150.

As shown in Fig. 8, when the cutting operation of the dough mass 14 is finished, the sliding movements of the dough-cutting member 38 are stopped. The front of the
30 piece of divided bread dough 152 is placed on the supply conveyor 150, but its end still remains in the discharge path 148. Then the air cylinder 88 is actuated to extend the rod 92. Therefore, as shown in Fig. 9, the intermediate frame 84 is advanced horizontally relative to the outer frame 74, thereby discharging the piece of

divided dough 152 to the supply conveyor 150. Then, as shown in Fig. 10, the air cylinder 106 is actuated to retract the rod 104, so that the inner frame 100 returns to a position whose height is the same as that of its starting position. Then, the rod 92 of the air cylinder 88 is retracted to cause the inner frame 100 to return to its starting position. Finally, the outer frame 74 begins to move in a direction opposite to that in the cutting operation, to return to the starting position. At the same time, the flat upper surface 73 begins to retract, so that its area in the hopper begins to decrease. During the retraction no pulling action is applied to the bread dough 14.

Also, the area of the flat upper surface 114 in the hopper is increased, while no pulling action is applied to the bread dough 14. Finally, the outer frame 74 returns to the starting position for cutting, whereby one cycle of the cutting operation is completed.

If, by the link mechanisms, the inner frame 100 is moved in a forward and downward direction at an oblique angle of almost 45 degrees relative to the intermediate frame 84, while the parallel relationship of the inner frame 100 with the intermediate frame 84 is maintained, any height difference between the upper surface of the cutting member 38 and the flat upper surface 114, and the gap of the discharge path 148 formed by the vertical surfaces 116 and 128, can be simultaneously and evenly adjusted. Therefore, not only is the dough thickness preset by the adjusting nut 108, but also, it is reset with an accuracy needed for practical purposes.

To adjust and monitor the dough thickness, a dough-thickness setting displaying device (not shown) that interlocks with the swing element 94 is used.

A third embodiment of this invention will now be explained by referring to the attached drawings.

In this embodiment a pressing device and its related elements are combined with the dividing apparatus used in
5 the first embodiment of this invention.

In Fig. 11, rails 162, each being U-shaped in cross section, are mounted on the upper end of the hopper 15. A pressing device 160 comprises a beam member 164, a pressing board 166, and an air cylinder 168. The
10 pressing board 166 has dimensions somewhat smaller than the inner dimensions of the hopper 15. The air cylinder 168 is mounted vertically on the beam member 164. The rod 170 of the air cylinder 168 extends downward, and on the lower end of the rod 170 the pressing board 166 is
15 mounted. The beam member 164 is supported by two riders 172, each extending inwardly from the respective end of the beam member 164. Each rider 172 is received in, and slides in, a respective channel in the rails 162. Therefore, the pressing device 160 can be slidably moved
20 on the hopper 15. The device 160 is normally arranged at a position apart from the hopper 15. A pressure sensor 174 is arranged at the lower part of the hopper 15.

The operation of the third embodiment of the apparatus, other than the operation of the pressing
25 device, for dividing the bread dough, is almost the same as that in the first embodiment. Since the pressing device applies force to the outside of the bread dough mass so as to maintain the pressure in the bread dough at a uniform value, almost all of the bread dough in the
30 hopper 15 can be cut and divided into pieces of bread dough, without regard to the amount of bread dough remaining in the hopper.

If no pressing device 160 is provided, the decreased

dough in the hopper 15 causes the weight of the dough mass 14 in the hopper 15 to be decreased, so that the pressure in the dough decreases. Therefore, the dough mass cannot resist the advancing cutting member 38, so
5 that the cutting member 38 cannot cut the bread dough mass. Thus the cutting member 38 merely pushes the dough in any direction. Therefore, not all the bread dough in the hopper can be properly cut.

In the apparatus of this invention, when the dough in
10 the hopper 15 decreases below a preset amount, the pressing device 160 that is normally arranged at a position apart from the hopper 15 is caused to be moved onto the hopper 15. Then the pressing board 166 pushes the dough mass, thereby increasing the pressure in the
15 dough. Therefore, the bread dough is held by the housing device 160, and the cutting operation can be smoothly continued.

Regarding the third embodiment of this invention, the remaining amount of the dough mass 14 in the hopper 15 is
20 monitored and calculated after the dough mass is charged in the hopper 15, and thereafter the pressing device 160 pushes the dough mass 14 forward. However, processes using the apparatus of this invention are not limited to such a procedure. Namely, another procedure may be used,
25 in which, for example, the pressing device is actuated just after the dough has been charged in the hopper. Then, based on the information from the pressure sensor 174, pressure is continuously applied to the dough mass 14. In this case the pressure is gradually increased in
30 response to the decreased dough mass 14 in the hopper 15.

In conclusion, since the discharge means is arranged below and adjacent the dough-cutting member 38, the deformation of the front of a piece of dough, due to the reaction of the stress in the dough
35 against the outer force, can be corrected, by compressing

the front of the piece of dough by the discharge means. Also, since the discharge means pulls a piece of cut dough downward, the dough-cutting member can smoothly cut the bread dough mass. Further, if, after cutting, a part
5 of the bread dough adheres to the underside of the dough-cutting member, it can be peeled off by the downward movement of the discharge means.

Further, by the adjusting means, in response to the desired thickness of the bread dough to
10 be cut, the size of the dough outlet, which defines the thickness of the bread dough, of the apparatus, can be easily changed. Therefore, quickly changing the thickness of a piece of bread dough can be easily attained. This results in saving production time,
15 leading to high productivity.

Moreover, since the pressing means applies a force to the outside of the bread dough mass in the hopper so as to maintain uniform pressure in the dough, almost all of the bread dough in the hopper can be
20 cut and divided into pieces of bread dough. Namely, without regard to the remaining amount of bread dough in the hopper, a bread dough mass charged in the hopper is almost completely used. Therefore, bread dough can be economically cut, thereby obtaining pieces of bread dough
25 having certain preset specifications. This results in lowering the production costs, which leads to saving energy and resources.



Claims:

1. An apparatus for dividing bread dough or the like comprising:

a hopper for dough, the bottom of which is constituted
5 by a first dough-supporting member, a second
dough-supporting member, a dough-cutting member, and a
dough outlet,

said first dough-supporting member being movable back
and forth, and comprising a flat upper surface, a bottom
10 surface, a horizontal forward edge, and a rearward edge,
said forward edge extending perpendicular to the
direction of movement of said member,

said dough-cutting member comprising a saw blade
means, and positioned at said forward edge of said first
15 dough-supporting member,

a drive means for reciprocating said saw blade means
in its longitudinal direction while said first
dough-supporting member is moved in its advancing
direction,

20 said second dough-supporting member being movable in
the same direction and in synchronization with said first
dough-supporting member, being provided with a flat upper
surface positioned at a level below the upper surface of
said first dough-supporting member, thereby forming said
25 dough outlet, having a preset distance, between said
second dough-supporting member and said cutting member,

a drive means for moving said first and second
dough-supporting members back and forth, and

a discharge means, arranged adjacent and below said
30 dough-cutting member, for regulating the thickness of a



piece of dough cut so as to have a thickness corresponding to said preset distance.

2. The apparatus of claim 1, in which said discharge means comprises a pair of belt conveyors arranged such that their belts constitute a discharge path having a gap corresponding to said preset distance.

3. An apparatus for dividing bread dough or the like comprising:

a hopper for dough, the bottom of which is constituted by a first dough-supporting member, a second dough-supporting member, a dough-cutting member, and a dough outlet,

said first dough-supporting member being movable back and forth, and comprising a flat upper surface, a bottom surface, a horizontal forward edge, and a rearward edge, said forward edge extending perpendicular to the direction of movement of said member,

said dough-cutting member comprising a saw blade means, and positioned at said forward edge of said first dough-supporting member,

a drive means for reciprocating said saw blade means in its longitudinal direction while said first dough-supporting member is moved in its advancing direction,

said second dough-supporting member being movable in the same direction and in synchronization with said first dough-supporting member, being provided with a flat upper surface positioned at a level below the upper surface of said first dough-supporting member, thereby forming said dough outlet between said second dough-supporting member and said cutting member,

a drive means for moving said first and second dough-supporting members back and forth, and

an adjusting means for moving said second dough-supporting member in parallel with and relative to said first dough-supporting member, thereby to adjust the



size of said dough outlet.

4. The apparatus of claim 3, in which said adjusting means is a link mechanism.

5. An apparatus for dividing bread dough or the like comprising:

a hopper for dough, the bottom of which is constituted by a first dough-supporting member, a second dough-supporting member, a dough-cutting member, and a dough outlet,

said first dough-supporting member being movable back and forth, and comprising a flat upper surface, a bottom surface, a horizontal forward edge, and a rearward edge, said forward edge extending perpendicular to the direction of movement of said member,

said dough-cutting member comprising a saw blade means, and positioned at said forward edge of said first dough-supporting member,

a drive means for reciprocating said saw blade means in its longitudinal direction while said first

dough-supporting member is moved in its advancing direction,

said second dough-supporting member being movable in the same direction and in synchronization with said first dough-supporting member, being provided with a flat upper surface positioned at a level below the upper surface of said first dough-supporting member, thereby forming said dough outlet between said second dough-supporting member and said cutting member,

a drive means for moving said first and second dough-supporting members back and forth, and

a pressing means, provided in said hopper for dough, for pressing dough in said hopper for dough, said pressing means having a pressing board.

6. The apparatus of claim 5, in which a pressure sensor is provided in said hopper for dough.