

DESCRIPTION

TITLE OF INVENTION: LOAF-LIKE FOOD CONVEYING MACHINE AND FOOD SLICING DEVICE

TECHNICAL FIELD

[0 0 0 1]

5 The present invention relates to loaf-like food conveying machines and food slicing devices and particularly relates to a loaf-like food conveying machine for conveying a loaf-like food such as bread, ham, or cheese toward a slicer that slices the loaf-like food to a predetermined thickness, and a food slicing device including the same.

10 BACKGROUND ART

[0 0 0 2]

Conventionally, food slicing devices have been used, which are capable of slicing a loaf-like food such as a bread loaf having been baked, cheese, ham, sausages, or fish cakes (called *kamaboko*), for example, to an optimal thickness suitable for eating. Such food slicing
15 devices include a slicer for slicing the loaf-like food to a predetermined thickness and a loaf-like food conveying machine for conveying the loaf-like food toward the slicer.

[0 0 0 3]

As loaf-like food conveying machines such as those described above, a number of machines have hitherto been proposed. For example, a machine has been proposed in which a
20 bread loaf being a loaf-like food is sandwiched between a pair of forwarding belts configured with timing belts having a plurality of projections on a surface thereof, so that the pair of forwarding belts sandwich the bread loaf from both sides thereof and convey the bread loaf toward a slicer with a fixed dimension, so that it is possible to slice the bread loaf to a desired thickness (see Patent Literatures 1 and 2, for example).

25

CITATION LIST

PATENT LITERATURE

[0 0 0 4]

PATENT LITERATURE 1: JP-A-2013-000884

30 PATENT LITERATURE 2: JP-A-2013-000849

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0 0 0 5]

5 The conveying machines disclosed in Patent Literatures 1 and 2 are configured, as described above, to sandwich the bread loaf with the pair of forwarding belts, so that the bread loaf is sequentially moved from above the slicer as a result of a rotating operation of the pair of forwarding belts.

[0 0 0 6]

10 Meanwhile, the pair of forwarding belts included in each of the conveying machines disclosed in Patent Literatures 1 and 2 is configured by using caterpillar-like timing belts. Thus, gears (see the reference numeral 23 in FIG. 5 of each of Patent Literatures 1 and 2) are disposed on an upper end side and a lower end side in order to transmit the rotation to the forwarding belts. When the bread loaf being a loaf-like food is conveyed by the pair of forwarding belts described above, the pair of forwarding belts and the bread loaf become separated at the positions of the gears. When the bread loaf is supplied to the slicer while the separation is present, the bread loaf is not held at the separation positions and is brought into an unstable state. Thus, it is feared that, when the slicer abuts against the bread loaf, the bread loaf may be deformed, and defective slicing may occur where the cutting is incomplete or the like.

15 Further, when the separation positions are present, because it is not possible, in particular, to properly slice the portion at a terminal end part (an upper end part) of the bread loaf, another problem also arises where the portion at the terminal end part becomes waste, which lowers yield of the bread slices.

[0 0 0 7]

25 Further, the conveying machines disclosed in Patent Literatures 1 and 2 are each provided with the plurality of projections formed on the surface of the forwarding belts and are thus configured to be able to prevent the bread loaf from falling off, because slipping or the like does not easily occur between the belts and the bread loaf. However, in Patent Literatures 1 and 2, because the separation positions between the pair of forwarding belts and the bread loaf are present as described above, the bread loaf is brought into an unstable holding state at those positions, and there is a possibility that the bread loaf may fall off depending on the length of the bread loaf in the process of being sliced.

[0 0 0 8]

Further, the pair of forwarding belts included in each of the conveying machines disclosed in Patent Literatures 1 and 2 are configured so that the timing belts are stretched around the gears used as fulcrums. Thus, there is also a possibility that at least one of the pair of forwarding belts may become slack between the gears. If the forwarding belts become slack in this manner, there is a possibility that the bread loaf may fall off as described above. In addition, because the bread loaf has an unstable conveyance speed and/or conveyance posture, it is difficult to convey the bread loaf for a desired distance. Thus, there is also a possibility that slicing to a desired thickness may become difficult.

[0 0 0 9]

In view of the problems described above, it is an object of the present invention to provide a loaf-like food conveying machine capable of conveying a loaf-like food for an accurate distance while stably holding the loaf-like food and preventing the occurrence of fall-off of the loaf-like food, defective slicing in the slicer, and the like, and a food slicing device using the same.

SOLUTION TO PROBLEM

[0 0 1 0]

The present inventors repeated intensive studies to solve the problems described above. As a result, the inventors learned that it is possible to convey a loaf-like food such as a bread loaf for an accurate distance while stably holding the loaf-like food, by adopting screw conveyors as conveyors for conveying the loaf-like food, in place of the configuration using belts such as that in the conventional example, so that the loaf-like food is sandwiched and conveyed by the plurality of screw conveyors. The inventors discovered that it is possible to thereby prevent the occurrence of fall-off of the loaf-like food, defective slicing in the slicer, and the like and thus completed the present invention.

[0 0 1 1]

More specifically, the present invention provides a loaf-like food conveying machine that conveys an elongated block-shaped loaf-like food while holding the loaf-like food. The loaf-like food conveying machine includes: a plurality of screw conveyors that are disposed so as to be capable of sandwiching the loaf-like food from directions orthogonal to an elongated direction of the loaf-like food and that convey the loaf-like food for a predetermined distance along the elongated direction; and a drive unit that intermittently rotates the plurality of screw conveyors so as to convey the loaf-like food for the predetermined distance. The plurality of screw conveyors convey the loaf-like food while guiding the loaf-like food along the elongated

direction, by rotating while at least a portion of a screw thread provided for each of the plurality of screw conveyors is in contact with the loaf-like food in a biting manner.

[0 0 1 2]

With the above aspect, the loaf-like food conveying machine of the present invention
5 preferably adopts a configuration in which the plurality of screw conveyors are disposed in at least one pair positioned opposite each other while the loaf-like food is interposed therebetween.

[0 0 1 3]

With the above aspect, the loaf-like food conveying machine of the present invention
may adopt a configuration in which the plurality of screw conveyors are capable of reciprocating
10 between a standby position in which the plurality of screw conveyors are positioned apart from the loaf-like food and a sandwiching position in which the plurality of screw conveyors are in contact with the loaf-like food.

[0 0 1 4]

With the above aspect, the loaf-like food conveying machine of the present invention
15 may adopt a configuration in which the plurality of screw conveyors each rotate in synchronization.

[0 0 1 5]

With the above aspect, the loaf-like food conveying machine of the present invention
preferably adopts a configuration further including a control unit for controlling the rotating of
20 the plurality of screw conveyors so that the loaf-like food is conveyed for the predetermined distance along the elongated direction.

[0 0 1 6]

With the above aspect, the loaf-like food conveying machine of the present invention
may adopt a configuration in which the plurality of screw conveyors are disposed in two pairs
25 each positioned opposite each other while the loaf-like food is interposed therebetween, and the two pairs of screw conveyors are disposed so that each pair is positioned apart in a width direction of the loaf-like food.

[0 0 1 7]

With the above aspect, the loaf-like food conveying machine of the present invention
30 may adopt a configuration further including: a plurality of auxiliary screw conveyors disposed so as to be capable of sandwiching the loaf-like food from the directions orthogonal to the elongated direction of the loaf-like food. The auxiliary screw conveyors are disposed in at least one pair positioned opposite each other while the loaf-like food is interposed therebetween, in

positions between the two pairs of screw conveyors that are disposed so that each pair is positioned apart.

[0 0 1 8]

With the above aspect, the loaf-like food conveying machine of the present invention
 5 may adopt a configuration further including an interval adjustment part for adjusting separation distances for the two pairs of screw conveyors that are disposed so that each pair is positioned apart.

[0 0 1 9]

With the above aspect, the loaf-like food conveying machine of the present invention
 10 may adopt a configuration in which the loaf-like food is a bread loaf, and the plurality of screw conveyors convey the bread loaf while guiding the bread loaf along the elongated direction.

[0 0 2 0]

The present invention provides a food slicing device including: at least, a loaf-like food conveying machine that conveys an elongated block-shaped loaf-like food while holding the
 15 loaf-like food; and a slicer that slices the loaf-like food conveyed and supplied by the loaf-like food conveying machine into a food slice having a predetermined thickness. In the food slicing device, the loaf-like food conveying machine is the loaf-like food conveying machine according to the present invention described above.

[0 0 2 1]

20 With the above aspect, the food slicing device of the present invention may adopt a configuration in which the loaf-like food is a bread loaf, the loaf-like food conveying machine conveys and supplies the bread loaf toward the slicer, and the slicer slices the bread loaf into a bread slice having a predetermined thickness.

25 ADVANTAGEOUS EFFECTS OF INVENTION

[0 0 2 2]

The loaf-like food conveying machine of the present invention adopts, as described above, the configuration including the plurality of screw conveyors for sandwiching and conveying the loaf-like food. Thus, it is possible to convey the loaf-like food for an accurate
 30 distance, while stably holding the loaf-like food. Accordingly, it is possible to prevent the occurrence of fall-off of the loaf-like food such as a bread loaf, defective slicing in the slicer, and the like.

[0 0 2 3]

In addition, the food slicing device of the present invention includes the loaf-like food conveying machine according to the present invention described above. Thus, it is possible to prevent the occurrence of fall-off of the loaf-like food such as a bread loaf, defective slicing in the slicer, and the like, similarly to the above. It is also possible to improve yield of food slices such as the bread slices resulting from the slicing.

[0 0 2 4]

Other purposes, characteristics, and advantages of the present invention will become clear from the following description of embodiments of the present invention, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0 0 2 5]

[FIG. 1] FIG. 1 is a drawing for schematically explaining one embodiment of a loaf-like food conveying machine and a food slicing device according to the present invention and is a schematic drawing of an overall configuration of the food slicing device including the loaf-like food conveying machine, with an example in which a bread loaf is used as a loaf-like food.

[FIG. 2] FIGS. 2(a) and 2(b) are drawings for schematically explaining the one embodiment of the loaf-like food conveying machine and the food slicing device according to the present invention and are schematic drawings showing a configuration of an essential part of the food slicing device including the loaf-like food conveying machine. FIG. 2(a) is a front view, whereas FIG. 2(b) is a bottom view.

[FIG. 3] FIG. 3 is a drawing for schematically explaining the one embodiment of the food slicing device according to the present invention and is a bottom view of an essential part showing an operation of a slicer.

[FIG. 4] FIG. 4(a) and FIG. 4(b) are drawings for schematically explaining the one embodiment of the loaf-like food conveying machine and the food slicing device according to the present invention and are schematic drawings showing an operation using a bread loaf as a loaf-like food and slicing a bread slice from the bread loaf.

[FIG. 5A] FIG. 5A is a drawing for schematically explaining the one embodiment of the loaf-like food conveying machine according to the present invention, is a drawing showing a schematic configuration of the loaf-like food conveying machine including a plurality of screw conveyors, and is an arrow view taken in the direction of the arrow B in FIG. 1.

[FIG. 5B] FIG. 5B is a drawing for schematically explaining the one embodiment of the loaf-like food conveying machine according to the present invention, is a drawing showing a

schematic configuration of the loaf-like food conveying machine including the plurality of screw conveyors, and is a cutaway view taken in the direction of the arrow B in FIG. 1.

[FIG. 5C] FIG. 5C is a drawing for schematically explaining the one embodiment of the loaf-like food conveying machine of the present invention, is a drawing showing a schematic
 5 configuration of the loaf-like food conveying machine including the plurality of screw conveyors, and is a side view of a conveyance unit structuring the loaf-like food conveying machine shown in FIG. 5A and FIG. 5B.

[FIG. 5D] FIG. 5D is a drawing for schematically explaining another embodiment of a loaf-like food conveying machine according to the present invention and is a cutaway view of
 10 the loaf-like food conveying machine as viewed from the top face side, in an example in which separation distances are adjustable for two pairs of screw conveyors.

[FIG. 5E] FIG. 5E is a drawing for schematically explaining the other embodiment of the loaf-like food conveying machine according to the present invention and is a cutaway view of the loaf-like food conveying machine shown in FIG. 5D as viewed from a lateral face side.

15 [FIG. 5F] FIG. 5F is a drawing for schematically explaining the other embodiment of the loaf-like food conveying machine according to the present invention and is a cutaway view of the loaf-like food conveying machine as viewed from a side face side at a cutaway position different from that in FIG. 5E.

[FIG. 6] FIG. 6 is a drawing for schematically explaining one embodiment of a food
 20 slicing device according to the present invention and is a planar view showing a conveyance state of a bread slice being a food slice resulting from slicing.

[FIG. 7] FIG. 7 is a drawing for schematically explaining the one embodiment of the food slicing device according to the present invention, is a drawing showing a conveyance state of the bread slice being the food slice resulting from the slicing, and is a plan view showing the
 25 conveyance state on a more downstream side than the state shown in FIG. 6.

[FIG. 8] FIGS. 8(a) and 8(b) are drawings for schematically explaining the one embodiment of the food slicing device according to the present invention and are drawings showing a schematic configuration of a crust cutter provided for the food slicing device that slices a bread loaf as a loaf-like food. FIG. 8(a) is a front view, whereas FIG. 8(b) is a side
 30 view.

[FIG. 9] FIGS. 9(a) to 9(d) are drawings for schematically explaining the one embodiment of the food slicing device according to the present invention and are each a flowchart showing an operation to perform a crust cut-off process on the bread slice being a food slice.

[FIG. 10] FIG. 10 is a drawing for schematically explaining another embodiment of the food slicing device according to the present invention and is a drawing showing a schematic configuration of a loaf-like food conveying machine further including a plurality of auxiliary screw conveyors, in addition to the plurality of screw conveyors.

5

DESCRIPTION OF EMBODIMENTS

[0 0 2 6]

The following will describe embodiments of a loaf-like food conveying machine according to the present invention and a food slicing device including the loaf-like food
10 conveying machine and will provide detailed explanations thereof with reference to the drawings as appropriate.

The drawings used in the following explanations may show characteristic portions in a slight enlargement for the sake of convenience, in order to facilitate comprehension of characteristics of the loaf-like food conveying machine and the food slicing device of the present
15 invention. The proportion of the dimensions of certain constituent elements or the like may be different from that in actuality. Also, the materials, the dimensions, and the like presented in the following explanations are merely examples. The present invention is not limited by those examples and may be implemented with modifications as appropriate, as long as the gist thereof is not changed.

20 [0 0 2 7]

<Overall configuration of food slicing device including loaf-like food conveying machine>

An overall configuration of a food slicing device including a loaf-like food conveying machine according to an embodiment of the present disclosure will be explained in detail below, with reference to FIGS. 1 to 9.

25 FIG. 1 is a schematic drawing showing an overall configuration of a food slicing device 1 including a loaf-like food conveying machine 2 according to the present embodiment, with an example in which a bread loaf 100 is used as a loaf-like food.

FIGS. 2(a) and 2(b) are schematic drawings showing a configuration of an essential part of the food slicing device 1 including the loaf-like food conveying machine 2. FIG. 2(a) is a
30 front view, whereas FIG. 2(b) is a bottom view.

FIG. 3 is a bottom view of an essential part showing an operation of a rotary slicer (slicer) 3.

FIGS. 4(a) to 4(c) are schematic drawings showing an operation using the bread loaf 100 as a loaf-like food and slicing a bread slice 101 from the bread loaf 100.

FIG. 5A is a drawing showing a schematic configuration of the loaf-like food conveying machine 2 including a plurality of screw conveyors 21 and is an arrow view taken in the direction of the arrow B in FIG. 1. FIG. 5B is a cutaway view. FIG. 5C is a side view of a conveyance unit 2B structuring the loaf-like food conveying machine 2.

5 FIG. 5D is a cutaway view of a loaf-like food conveying machine 200 as viewed from the top face side, in an example in which a separation distance is adjustable for two screw conveyors 21, 21 (21B, 21B).

FIG. 5E is a cutaway view of the loaf-like food conveying machine 200 shown in FIG. 5D as viewed from a lateral face side.

10 FIG. 5F is a cutaway view of the loaf-like food conveying machine 200 as viewed from a side face side at a cutaway position different from that in FIG. 5E.

FIG. 6 is a planar view showing a conveyance state of the bread slice 101 being a food slice resulting from slicing.

15 FIG. 7 is a drawing showing a conveyance state of the bread slice 101 being a food slice resulting from the slicing and is a plan view showing the conveyance state on a more downstream side than the state shown in FIG. 6.

FIGS. 8(a) and 8(b) are drawings showing a schematic configuration of a crust cutter 6 provided for the food slicing device 1 and configured to cut off crusts 102 from the bread slice 101. FIG. 8(a) is a front view, whereas FIG. 8(b) is a side view.

20 FIGS. 9(a) to 9(d) are each a flowchart showing an operation to perform a crust cut-off process on the bread slice 101 being a food slice.

For the sake of convenience in the explanations, in FIG. 1, FIG. 2(a), and FIGS. 4(a) to 4(c) show side views of the conveyance unit 2B in which a portion of the loaf-like food conveying machine 2 is partially cut away.

25 [0 0 2 8]

A loaf-like food to be sliced by a food slicing device according to the present invention is a food that is irregularly solidified or a food in a homogeneously solidified state such as, for example, a bread loaf having been baked, cheese, ham, sausages, or fish cakes (*kamaboko*).

30 The food slicing device according to the present invention is capable of slicing a loaf-like food as listed above to an optimal thickness suitable for eating. Further, the loaf-like food conveying machine according to the present invention is configured to convey a loaf-like food as listed above toward a slicer, for example.

Thus, in the following explanations, to begin with, an overall configuration of the food slicing device 1 including the loaf-like food conveying machine 2 of the present embodiment

will be described in detail. After that, a configuration of the loaf-like food conveying machine 2 will be explained further in detail.

[0 0 2 9]

Further, in the present disclosure, from the viewpoint of providing easy-to-understand
 5 explanations, an example will be explained in which a bread loaf (see the reference numeral 100 shown in FIG. 1 and so on) is an example of the loaf-like food, and a bread slice (see the reference numeral 101 shown in FIG. 1 and so on) being a food slice is obtained as a result of slicing the bread loaf.

[0 0 3 0]

10 In other words, the food slicing device 1 of the present embodiment may be used for slicing the bread loaf 100 which has been baked to have a block shape in an oven or the like (not shown), into a plurality of bread slices 101 each having a slice thickness α suitable for a sandwich, for example. The bread loaf 100 having the block shape generally has an elongated shape like a cuboid, and a slice surface thereof has a quasi-rectangular shape; however, in the
 15 following explanations, the bread loaf 100 may be regarded as having a square prism shape, while a slice surface thereof is regarded as being a square in some situations.

[0 0 3 1]

[Food slicing device]

As shown in FIG. 1 and so on, the food slicing device 1 of the present embodiment is
 20 generally configured so as to include, at least, the loaf-like food conveying machine 2 configured to convey the bread loaf 100 being a loaf-like food having an elongated block shape while holding the bread loaf 100; and a rotary slicer (slicer) 3 configured to slice the bread loaf 100 conveyed and supplied by the loaf-like food conveying machine 2 into the bread slices 101 being food slices each having a predetermined thickness.

25 In addition, the food slicing device 1 in the illustrated example further includes: a slicer reciprocation driver 4 configured to drive the rotary slicer 3 to reciprocate; a transport conveyor 5 configured to sequentially convey the plurality of bread slices 101 sliced by the rotary slicer 3 to the downstream side; a crust cutter 6 configured to cut off the crusts 102 from the bread slices 101; a crusher 7 configured to crush the crusts 102 into breadcrumbs 104; and a wind power
 30 conveying machine 8 configured to carry, with wind power, the breadcrumbs 104 to a predetermined position.

[0 0 3 2]

Among the constituent elements described above, the transport conveyor 5 includes a

first belt conveyor 51 disposed underneath the rotary slicer 3; a second belt conveyor 52 disposed on the downstream side thereof; and a third belt conveyor 53 disposed further on the downstream side, and a fourth belt conveyor 54 provided as being directed toward a sandwich stage (a sandwich making stage). In addition, the second belt conveyor 52 is provided with the

5 crust cutter 6 mentioned above. Furthermore, the crusher 7 and the wind power conveying machine 8 are provided so as to straddle a terminal end part (the end part on the downstream side) of the second belt conveyor 52 (the conveyor on the upstream side) and a starting end part (the end part on the upstream side) of the third belt conveyor 53 (the conveyor on the downstream side). Also, a butter spreader 94 is disposed on the third belt conveyor 53.

10 [0 0 3 3]

In addition, the food slicing device 1 includes: a bread loaf supplier 91 configured to supply the bread loaf 100, one by one, toward the loaf-like food conveying machine 2; an aligner 92 configured, before the crust cut-off process performed by the crust cutter 6, to align the positions of the bread slices 101 on the first belt conveyor 51 into a certain state; and a remover

15 93 configured to remove, off the first belt conveyor 51, end bread slices 105 (see FIG. 6) that are sliced at first and at last from each bread loaf 100.

[0 0 3 4]

As mentioned above, the butter spreader 94 is disposed on the third belt conveyor 53. The butter spreader 94 is configured to temporarily spread butter (e.g., mustard butter) stored in

20 a hopper 94a on a surface of a transfer roller 94b which is rotating and to further transfer and spread the butter from the transfer roller 94b onto the slice surface of a crustless bread slice (food slice) 103 from which the crusts 102 have been cut off. An auxiliary roller 94c is in contact with the lower surface side of the third belt conveyor 53 so as to oppose the transfer roller 94b, for the purpose of keeping downward sagging amounts of the crustless bread slice 103 and the

25 third belt conveyor 53 within a predetermined range, the sagging being associated with pressing of the transfer roller 94b. The transfer roller 94b is driven to rotate by a motor (not shown) or the like. The auxiliary roller 94c may be in a non-driven idle state so as to be rotated while being in contact with the third belt conveyor 53.

[0 0 3 5]

30 The loaf-like food conveying machine 2 is configured to convey the loaf-like food having the elongated block shape while holding the loaf-like food, and in the present embodiment, as shown in FIG. 5A, FIG. 5B, FIG. 5C, and so on, the loaf-like food conveying machine 2 is configured to convey the bread loaf 100 as the loaf-like food so as to be supplied toward the rotary slicer 3 (also see the configuration of the loaf-like food conveying machine 200

illustrated in FIG. 5D to FIG. 5F).

[0 0 3 6]

The loaf-like food conveying machine 2 is generally configured so as to include the plurality of screw conveyors 21 (21A and 21B) that are disposed so as to be capable of sandwiching the bread loaf 100 from the directions orthogonal to the elongated direction of the bread loaf 100 and configured to convey the bread loaf 100 for a predetermined distance along the elongated direction; and a drive unit 24 configured to intermittently rotate the plurality of screw conveyors 21 (21A and 21B) so that the bread loaf 100 is conveyed for the predetermined distance.

10 [0 0 3 7]

Further, the loaf-like food conveying machine 2 of the present embodiment is configured so that the plurality of screw conveyors 21 (21A and 21B) rotate while at least a portion of a screw thread 212 provided for each of the screw conveyors 21 (21A and 21B) is in contact with the bread loaf 100 in a biting manner. As a result of the plurality of screw conveyors 21 (21A and 21B) rotating in this manner, the loaf-like food conveying machine 2 is configured to convey the bread loaf 100 toward the rotary slicer 3 side, while guiding the bread loaf 100 along the elongated direction.

The loaf-like food conveying machine 2 of the present embodiment will be explained further in detail later.

20 [0 0 3 8]

The rotary slicer (slicer) 3 is configured to have a disc shape and is provided to have a posture tilted at a tilt angle θ being an acute angle (e.g., $\theta = 5^\circ$ to 30° approximately), so that a plate surface thereof gradually gets higher toward the slicing process starting side, with respect to a conveyance surface 51a (a horizontal surface) of the first belt conveyor 51.

25 [0 0 3 9]

The slicer reciprocation driver 4 is configured to drive the rotary slicer 3 to reciprocate in acute-angle tilting directions parallel to the tilted posture described above. The slicer reciprocation driver 4 is configured to cause the rotary slicer 3 to perform a slicing operation with an outset stroke in a substantially diagonally downward direction and to perform a retreat operation with a return stroke in a substantially diagonally upward direction. From the top of the page of FIG. 1, the loaf-like food conveying machine 2 is configured to intermittently convey the bread loaf 100 for the distance corresponding to the slice thickness α , in a direction intersecting (in the drawing, the direction orthogonal to) a trajectory of the reciprocation driving

of the rotary slicer 3. In the food slicing device 1 of the present embodiment, because the conveyance direction of the bread loaf 100 is orthogonal to the tilted trajectory of the rotary slicer 3 as described above, the bread loaf 100 is sliced into the bread slices 101 which are right-angle slices. Further, the conveyance direction of the bread loaf 100 by the loaf-like food
 5 conveying machine 2 is tilted at the tilt angle θ , with respect to the direction orthogonal to the conveyance surface 51a of the first belt conveyor 51.

[0 0 4 0]

The bread loaf supplier 91 includes a vertical conveyor 91a that is linked by a plurality of vertical frames 91b and is configured to move in circles while being guided by a guiding
 10 frame 91c of which the position is fixed. The bread loaf supplier 91 is configured so that, as a result of the vertical conveyor 91a circling around while one bread loaf 100 each having a cuboid shape or a square prism shape is inserted between every pair of vertical frames 91b, the posture of a leading bread loaf 100 is changed by the guiding frame 91c so as to be tilted (the tilt angle θ) above the loaf-like food conveying machine 2 before falling. With the operation described
 15 herein, the bread loaf supplier 91 is configured to supply the bread loaf 100, one by one, to the loaf-like food conveying machine 2.

[0 0 4 1]

FIGS. 2(a) and (b) are the front view and the bottom view showing an essential part of the food slicing device 1, which primarily represents schematic configurations of the rotary slicer
 20 3 and the slicer reciprocation driver 4.

As shown in the drawing, the rotary slicer 3 is supported by a reciprocation frame 31 while having a posture (the tilt angle θ) tilted at the acute angle, which gradually gets higher toward the slicing starting side with respect to the first belt conveyor 51 (the conveyance surface 51a) and is driven to rotate by a slicer motor 32 fixed to the reciprocation frame 31 via a slicer
 25 rotary belt 33.

By a fixed frame 41 of which the position is fixed, the reciprocation frame 31 is guided so as to get gradually higher toward the slicing starting side with respect to the first belt conveyor 51 and so as to reciprocate along the acute-angle tilting directions tilted at the acute angle.

30 In the state in which the reciprocation frame 31 and the fixed frame 41 are linked together, the slicer reciprocation driver 4 is configured to cause the rotary slicer 3 and the slicer motor 32 to integrally reciprocate together with the reciprocation frame 31, while being guided by the fixed frame 41 in the acute-angle tilting directions.

[0 0 4 2]

More specifically, the rotation of a reciprocation drive motor 42 fixed to the fixed frame 41 in the slicer reciprocation driver 4 is transmitted, by a belt 43, to a drive shaft 44 rotatably supported by the fixed frame 41 and a rotary arm 45 integrally provided with the drive shaft 44. To the reciprocation frame 31, two arm holding rails 31b are fixed in a front-rear direction (the direction orthogonal to the advancing direction of the first belt conveyor 51). A tip end part 45a of the rotary arm 45 is inserted between the arm holding rails 31b, 31b (i.e., in a groove) so as to be slidable in the front-rear directions. To the reciprocation frame 31, two linear rails 31a are fixed in the left-and-right direction (the advancing direction of the first belt conveyor 51) to be parallel. The linear rails 31a are respectively guided by two linear guides 41a in the left-and-right direction that are fixed to the fixed frame 41 so as to be parallel. In the depicted example, the linear rails 31a on the moving side and the linear guides 41a on the fixed side form linear guiding members; however, the rails may be on the fixed side, and the guides may be on the moving side.

[0 0 4 3]

Accordingly, when the rotary arm 45 rotates by 180° from the position shown in FIG. 2(b) to the position shown in FIG. 3, the tip end part 45a of the rotary arm 45 slides in the front-rear direction between the arm holding rails 31b, 31b. Also, with the sliding guidance by the linear rails 31a and the linear guides 41a, the reciprocation frame 31 linearly moves in the left-and-right direction with respect to the fixed frame 41. In this manner, by the fixed frame 41, the rotary slicer 3 and the slicer motor 32 are integrally guided and reciprocated. Thus, at the time of slicing, because the rotation of the rotary slicer 3 and the reciprocation in the acute-angle tilting directions (on the acute-angle tilted trajectory) are stabilized, slice surfaces of the bread slices 101 will have a clean appearance. In the depicted example, the rotary arm 45 and the arm holding rails 31b, 31b structure a reciprocation slider crank mechanism; however, when the space between the arm holding rails 31b, 31b is regarded as a groove of a cam, the tip end part 45a of the rotary arm 45 may be considered as a cam follower.

[0 0 4 4]

Although being simplified for the sake of convenience in the illustration, FIG. 2(a) also depicts an adjustment mechanism 46 for the tilt angle θ using a long hole and a screw. By using the adjustment mechanism 46, it is possible to adjust the tilt angle θ of the rotary slicer 3 and the slicer reciprocation driver 4 within the range of approximately $\pm 5^\circ$, for example, so as to finely adjust the falling posture of the bread slices 101, in accordance with how the bread loaf 100 is baked, the size (the slice thickness α , in particular) of the bread slices 101, and the like.

[0 0 4 5]

In addition, as shown in FIG. 2(a) and 2(b), a plate-like bread slice guide 34 is fixed to a tip end part (on the loaf-like food conveying machine 2 side) of the reciprocation frame 31, so as to integrally move in synchronization with the reciprocation of the rotary slicer 3. The tip end of the bread slice guide 34 is positioned immediately behind and immediately below a blade edge of the rotary slicer 3 which cuts into the bread loaf 100. The bread slice guide 34 is configured, at the time of slicing, to guide the bread slice 101 so that the bread slice 101 sliced by the rotary slicer 3 falls on the first belt conveyor 51 while having a tilted posture and is also configured to cover the bread slice 101 so that the slicer rotary belt 33, a pulley 33a, a rotary shaft 33b, and the like positioned on the bottom face side of the rotary slicer 3 do not interfere with the bread slice 101. The bread slice guide 34 is disposed so as to intersect the tilted trajectory of the rotary slicer 3 while forming a guidance angle δ (where $\delta = 10^\circ$ to 60° approximately) being an angle of elevation.

[0 0 4 6]

In this situation, the guidance angle δ (e.g., $\delta \approx 30^\circ$) of the bread slice guide 34 is set to be larger than the tilt angle θ (e.g., $\theta \approx 15^\circ$) of the tilted trajectory. With this configuration, it is possible to guide the bread slice 101 sliced by the rotary slicer 3 into having a tilted posture which gradually gets lower (see FIG. 4(a)) toward the slicing starting side (the downstream side regarding the conveyance direction of the first belt conveyor 51). In this manner, as a result of the bread slice guide 34 guiding the bread slice 101 into having the tilted posture, it is possible to determine the side that lands first. Thus, because the falling posture of the bread slice 101 is stabilized, it is possible to minimize derangement of falling positions.

[0 0 4 7]

Further, at the tip end part of the reciprocation frame 31, a plate-like bread loaf stopper 35 is provided so as to extend therefrom. The bread loaf stopper 35 moves integrally with the rotary slicer 3. The bread loaf stopper 35 includes a supporting member 35a for supporting a lower end part of the bread loaf 100 from underneath; and a window hole 35b having a rectangular shape and allowing the bread slices 101 sliced by the rotary slicer 3 to pass. By having the bread loaf 100 supported by the supporting member 35a from underneath, it is possible, for example, to adjust forwarding force of the loaf-like food conveying machine 2 so that the bread slices 101 do not get compressed more than necessary in the thickness direction. It is therefore possible to prevent non-uniformity in the slice thickness α among the bread slices 101. However, when it is possible to ensure that the bread slices 101 have the slice thickness α , with the intermittence conveyance and the holding of the bread loaf 100 by the loaf-like food conveying machine 2, it is also possible to omit the supporting member 35a.

[0 0 4 8]

Further, below the rotary slicer 3, the window hole 35b is positioned opposite the bread slice guide 34. Because the window hole 35b and the bread slice guide 34 are positioned opposite each other, it is possible, with the bread slice guide 34, to easily guide the bread slices
 5 101 sliced by the rotary slicer 3 diagonally downward so as to be directed to the window hole 35b, while providing the protection from interference with the pulley 33a, the rotary shaft 33b, and the like of the rotary slicer 3.

[0 0 4 9]

Further, as shown in FIG. 3, when the slice surface of the bread loaf 100 is considered
 10 to be a square of which the length of each side is LS, a slicer diameter DM required by the cutting can be expressed with Expression (1) presented below:

$$DM > 2^{1/2} \times LS \dots (1)$$

Further, a moving stroke ST (i.e., a revolving diameter of the rotary arm 45) of the rotary slicer 3 required by the cutting can be expressed with Expression (2) presented below:

15 $ST > 2^{1/2} \times LS \dots (2)$

Because the food slicing device 1 of the present embodiment includes the bread slice guide 34 as described above, it is sufficient when the slicer diameter DM is larger than $2^{1/2}$ (≈ 1.41) times the length LS of each side. The moving stroke ST is equal to or larger than the slicer diameter DM.

20 [0 0 5 0]

Next, with reference to FIGS. 4(a) to 4(c), an operation to slice the bread slices 101 from the bread loaf 100 by using the food slicing device 1 of the present embodiment will be explained in detail.

[0 0 5 1]

25 As shown in FIG. 4(a), to begin with, when the loaf-like food conveying machine 2 has conveyed the bread loaf 100 for the distance corresponding to the slice thickness α and come to a halt, the rotary slicer 3 slices the bread loaf 100 from a lower end part thereof to obtain a bread slice 101, with an outset stroke along the acute-angle tilted trajectory. When the rotary slicer 3 performs the slicing operation, the window hole 35b allows the bread slice 101, which has been
 30 sliced by the rotary slicer 3 and guided by the bread slice guide 34, to pass (fall down). In this situation, the supporting member 35a is in a retreated state in a more forward position than the loaf-like food conveying machine 2 in the onset stroke direction, so as not to obstruct the slicing operation of the rotary slicer 3.

[0 0 5 2]

Subsequently, as shown in FIG. 4(b), the rotary slicer 3 retreats from the bread loaf 100 with a return stroke, and the loaf-like food conveying machine 2 conveys the bread loaf 100 for a distance corresponding to the next slice thickness α . When the rotary slicer 3 retreats as

5 described herein, the supporting member 35a is positioned below the loaf-like food conveying machine 2 and, while keeping the slice thickness α of the next slice, holds a lower end part of the bread loaf 100. Also, the window hole 35b and the bread slice guide 34 retreat together with the rotary slicer 3.

[0 0 5 3]

10 After that, as shown in FIG. 4(c), while the loaf-like food conveying machine 2 is at a halt, the rotary slicer 3 again moves with an onset stroke along the acute-angle tilted trajectory and slices the next bread slice 101 from a lower end part of the bread loaf 100. Because the operation by the loaf-like food conveying machine 2 to convey the bread loaf 100 and the slicing operation by the rotary slicer 3 are performed in collaboration in this manner, it is possible to

15 efficiently perform the slicing process. In the present embodiment, after a plurality of bread slices 101 have been sliced from the bread loaf 100, and even when an end bread slice 105 (see FIG. 6) remaining in the end is smaller than the predetermined slice thickness α , it is possible to support the end bread slice 105 with the plurality of screw conveyors 21 included in the loaf-like food conveying machine 2. In that situation, although it is not possible to slice the end bread

20 slice 105 with an onset stroke movement of the rotary slicer 3, the end bread slice 105 passes through the window hole 35b by being guided by the bread slice guide 34 and falls onto the first belt conveyor 51.

[0 0 5 4]

After that, the bread slice 101 sliced by the rotary slicer 3 falls onto the first belt

25 conveyor 51 while having the posture tilted at an acute angle (e.g., a tilted posture at approximately 10° to 30°) with respect to the conveyance surface 51a and is conveyed toward the downstream side while being held parallel. More specifically, as shown in FIG. 4(a), the bread slice 101 sliced by the rotary slicer 3 is guided by the bread slice guide 34 into having the tilted posture which gradually gets lower toward the slicing starting side (the downstream side

30 regarding the conveyance direction of the first belt conveyor 51). As shown in FIG. 4(b), the bread slice 101 falling while having the tilted posture lands on (the conveyance downstream side of) the conveyance surface 51a of the first belt conveyor 51 by a lower-side end part 101a in a diagonal direction. Further, as shown in FIGS. 4(b) and 4(c), as a result of an upper-side end part 101b turning downward by using the landed lower-side end part 101a as a fulcrum and

landing on (the conveyance upstream side of) the conveyance surface 51a, the entire slice surface is smoothly held on the conveyance surface 51a.

[0 0 5 5]

As described above, when the bread slice 101 falls onto the conveyance surface 51a, the
 5 bread slice 101 is guided by the bread slice guide 34 into having the tilted posture. Thus, the bread slice 101 falls while having the stable tilted posture, without the entirety thereof sagging and bending or an end part thereof drooping. In other words, the bread slice 101 lands on the conveyance surface 51a by the end part (the lower-side end part 101a) positioned on the lower side of the tilted posture and, soon after that, the other end part (the upper-side end part 101b)
 10 positioned on the higher side also lands. Thus, the falling posture does not easily get disturbed, and derangement of falling positions is also kept small.

[0 0 5 6]

Next, a conveyance state of the bread slice 101 sliced by the food slicing device 1 of the present embodiment will be explained in detail, with reference to FIG. 6.

15 [0 0 5 7]

As described above, when the bread slice 101 falls onto the conveyance surface 51a of the first belt conveyor 51 while having the tilted posture, the falling posture of the bread slice 101 in a front view, in particular, is stabilized. However, even in that situation, it is anticipated in some cases that the falling position (the falling posture) in a planar view might slightly deviate
 20 from (might not be parallel to) the advancing direction of the first belt conveyor 51. To cope with those cases, the food slicing device 1 of the present embodiment is provided with the aligner 92 for aligning the position of the bread slice 101 on the first belt conveyor 51 to be parallel to the advancing direction of the first belt conveyor 51, before the crust cut-off process.

[0 0 5 8]

25 More specifically, the aligner 92 shown in FIG. 6 includes alignment plates 92a disposed on both sides, on the left and the right, of the bread slice 101 regarding the advancing direction of the first belt conveyor 51 and an air cylinder 92c that causes the alignment plates 92a to advance and retreat. In the aligner 92 shown in FIG. 6, as a result of the alignment plates 92a on the left and the right coming into contact with the left and the right side faces of the bread
 30 slice 101 in synchronization, it is possible to quickly align the bread slice 101 into the state of being straight with respect to the advancing direction.

[0 0 5 9]

On the conveyance direction downstream side of the aligner 92, the remover 93 for the

end bread slices 105 is provided. More specifically, the remover 93 includes a push-out plate 93a for pushing the end bread slices 105 from one lateral side of the advancing direction and an air cylinder 93b for causing the push-out plate 93a to advance and retreat. On the basis of the size (height) of the bread loaf 100 and the slice thickness of the bread slices 101, the occurrence
 5 timing of the end bread slices 105 (the time of arrival at the remover 93) is known in advance, or a sensor (not shown) is able to detect the arrival. Accordingly, by extending the air cylinder 93b with predetermined timing, it is possible to take out the end bread slices 105 into an end bread slice collecting container 93c, by pushing out the end bread slices 105 with the use of the push-out plate 93a.

10 [0 0 6 0]

Next, a conveyance state of the bread slice 101 on a more downstream side than the position shown in FIG. 6 will be explained in detail, with reference to FIG. 7.

[0 0 6 1]

The bread slice 101 of which the posture has been aligned by the aligner 92 shown in
 15 FIG. 6 is transferred from the first belt conveyor 51 (the conveyance surface 51a) to the subsequent second belt conveyor 52 (a conveyance surface 52a). Provided in an intermediate position on the second belt conveyor 52 is the crust cutter 6 for cutting off the crusts of the bread slice 101 positioned on the conveyance surface 52a.

[0 0 6 2]

20 The crust cutter 6 includes a crust cut-off blade 62 disposed on the upper side of the second belt conveyor 52 and an elastic member 67 disposed in a region abutting against the crust cut-off blade 62 on the lower side of the second belt conveyor 52. As shown in FIG. 7, the elastic member 67 has an area larger than the slice surface of the bread slice 101.

[0 0 6 3]

25 The crust cut-off blade 62 is provided in the manner of a rectangular (substantially square in the example shown in FIG. 7) frame in a planar view. More specifically, the crust cut-off blade 62 is provided while four blade members 62a, 62b, 62c, and 62d are combined in the manner of a hash symbol. Among the blade members, two opposing sides (the two blade members 62a and 62c in the example shown in FIG. 7) are formed to be long enough to reach the
 30 outer edges of the bread slice 101 or to extend beyond the outer edges. As a result of simultaneously pressing the blade members 62a, 62b, 62c and 62d structuring the crust cut-off blade 62 against the bread slice 101 in a stationary state while the second belt conveyor 52 is at a halt, the crusts 102 on the four sides in total are simultaneously cut off while being separate from

one another. Further, the elastic member 67 is provided while being fixed to a conveyor guide (not shown) or the like of the second belt conveyor 52 and may be configured by using a rubber plate or a urethan sheet, for example.

[0 0 6 4]

5 Next, configuration of the crust cutter 6 included in the food slicing device 1 of the present embodiment will be explained in detail, with reference to FIGS. 8(a) and 8(b).

[0 0 6 5]

In the crust cutter 6, an up-and-down frame 61 for integrally supporting the crust cut-off blade 62 via an anti-vibration member 61b is guided so as to reciprocate in the up-and-down
10 directions, by a fixed frame 66 of which the position is fixed.

[0 0 6 6]

More specifically, rotation of the crust cut-off motor 63 fixed to the fixed frame 66 is transmitted to a rotary plate 64 having a circular shape and directly linked to the crust cut-off motor 63. The rotary plate 64 and the up-and-down frame 61 are connected by a swinging arm
15 65. One end part (the lower end part) of the swinging arm 65 is swingably linked to the up-and-down frame 61. To the other end part (the upper end part) of the swinging arm 65, the rotary plate 64 is rotatably linked in a position eccentric to the center of the rotary plate 64. To the up-and-down frame 61, two linear rails 61a are fixed in the up-and-down direction to be parallel. The linear rails 61a are respectively guided by two linear guides 66a in the up-and-
20 down direction that are fixed to the fixed frame 66 so as to be parallel. In the depicted example, the linear rails 61a on the moving side and the linear guides 66a on the fixed side form linear guiding members; however, the rails may be on the fixed side, and the guides may be on the moving side.

[0 0 6 7]

25 Accordingly, when the rotary plate 64 makes a half-turn in one of the forward and the backward directions from the state indicated with the solid line in FIG. 8(b), the up-and-down frame 61 linearly moves downward (to the position of the imaginary line) with respect to the fixed frame 66, as a result of sliding guidance by the linear rails 61a and the linear guides 66a. When the rotary plate 64 further makes another half-turn in one of the forward and the backward
30 directions, the up-and-down frame 61 linearly moves upward (to the original position indicated with the solid line) with respect to the fixed frame 66, as a result of sliding guidance by the linear rails 61a and the linear guides 66a.

[0 0 6 8]

Next, an operation of the crust cutter 6 to perform the crust cut-off process on the bread slice 101 will be explained in detail, with reference to FIGS. 9(a) to 9(d) (also see FIG. 1 and FIG. 7, as necessary).

[0 0 6 9]

5 To begin with, as shown in FIG. 9(a), in the state in which the crust cut-off blade 62 is standing by above the second belt conveyor 52, a next bread slice 101 is conveyed by the second belt conveyor 52.

Subsequently, as shown in FIG. 9(b), when the bread slice 101 reaches the region provided with the elastic member 67, the second belt conveyor 52 is brought to a halt, and the
10 crust cut-off blade 62 is lowered by driving the crust cut-off motor 63 (see FIGS. 8(a) and 8(b)).

[0 0 7 0]

Subsequently, as shown in FIG. 9(c), in a lower limit stroke position of the crust cut-off blade 62, the elastic member 67 elastically supports the force of the crust cut-off blade 62 pressing the bread slice 101 while allowing the second belt conveyor 52 to sink. In this
15 manner, the tip end of the crust cut-off blade 62 descends until the tip end slightly touches the conveyance surface 52a of the second belt conveyor 52, so as to cut off only the crusts 102 of the bread slice 101.

[0 0 7 1]

After that, as shown in FIG. 9(d), the crust cut-off blade 62 is raised by driving the crust
20 cut-off motor 63 (the same as above), and also, the conveyance by the second belt conveyor 52 is resumed.

As described above, because the elastic member 67 is provided, it is possible to provide the elastic support so that the crust cut-off blade 62 does not bite into the second belt conveyor 52. Thus, advantageous effects are achieved where safety and hygiene are ensured, without
25 compromising durability of the second belt conveyor 52.

[0 0 7 2]

Returning to the description of FIG. 7, the terminal end part (the end part on the downstream side) of the second belt conveyor 52 and the starting end part (the end part on the upstream side) of the third belt conveyor 53 are connected together via a gap β across which the
30 crustless bread slice 103 can be handed over. Further, the conveyance width (the belt width) of the third belt conveyor 53 is formed to be a width slightly larger than the width of the crustless bread slice 103, i.e., a width approximately equal to the width of the bread slice 101.

[0 0 7 3]

Accordingly, the crustless bread slice 103 is able to hop, with an inertia force, from the second belt conveyor 52 onto the third belt conveyor 53. Meanwhile, the crusts 102 that have already been cut off by the crust cut-off blade 62 are separated from the crustless bread slice 103 and become loose due to the shock that was caused when the crustless bread slice 103 hopped
 5 onto the third belt conveyor 53, and the crusts 102 fall through the gap β or from either of the two side parts of the third belt conveyor 53. The fallen crusts 102 are collected by a crust collecting container 71 of the crusher 7 and are ground into breadcrumbs 104 by the grinder 72, so that the breadcrumbs 104 are conveyed through a conduit 82 with wind power by a blower 81 of the wind power conveying machine 8 so as to be collected by a breadcrumb collecting
 10 container 83 (see FIG. 1). Furthermore, on the third belt conveyor 53, butter is spread on a slice surface of the crustless bread slice 103 by the transfer roller 94b of the butter spreader 94, as necessary, so that the crustless bread slice 103 proceeds to the sandwich stage (see FIG. 1).
 [0 0 7 4]

Because the food slicing device 1 of the present embodiment includes the loaf-like food
 15 conveying machine 2 of which details will be explained later, it is possible, not only when the bread loaf 100 is sliced as a loaf-like food, to prevent the occurrence of fall-off of the loaf-like food, defective slicing in the rotary slicer 3, and the like.
 [0 0 7 5]

[Loaf-like food conveying machine]

20 Next, a configuration of the loaf-like food conveying machine 2 of the present embodiment will be explained further in detail, primarily with reference to FIGS. 5A to 5C (also see the loaf-like food conveying machine 200 illustrated in FIGS. 5D to 5F).
 [0 0 7 6]

The loaf-like food conveying machine 2 of the present embodiment includes, as
 25 mentioned earlier, the plurality of screw conveyors 21 (21A and 21B) capable of sandwiching the bread loaf 100 from the sides thereof; and the drive unit 24 configured to rotate the plurality of screw conveyors 21A and 21B. As a result of the plurality of screw conveyors 21A and 21B rotating while at least a portion of the screw thread 212 provided for each of the screw conveyors 21A and 21B is in contact with the bread loaf 100 in a biting manner, the loaf-like food
 30 conveying machine 2 is configured to convey the bread loaf 100 toward the rotary slicer 3 side while guiding the bread loaf 100 along the elongated direction. In this situation, the bread loaf 100 is conveyed in the elongated direction, as a result of being guided in accordance with the leading angle of the screw thread 212 of each of the screw conveyors 21A and 21B.

[0 0 7 7]

For the sake of convenience in the explanations, the example shown in FIG. 5B and so on depicts a state in which the bread loaf 100 is positioned apart from the screw conveyors 21A and 21B; however, during the conveyance, as a result of each of the screw conveyors 21A and 21B being in contact with the bread loaf 100, an action to hold/convey (guide) the bread loaf 100 as described above is achieved. More specifically, as a result of the screw thread 212 of each of the screw conveyors 21A and 21B being in contact with the bread loaf 100 in a slightly biting (wedging) manner, the abovementioned action is achieved.

[0 0 7 8]

As shown in FIG. 5A and FIG. 5B, the loaf-like food conveying machine 2 includes a pair of conveyance units 2A and 2B. The two conveyance units 2A and 2B are structured substantially integrally, by each being attached onto a unit base 2C. Further, because the pair of conveyance units 2A and 2B are symmetrically disposed on the unit base 2C in positions apart from each other, a lateral wall 22A and a lateral wall 22B respectively included in the conveyance units 2A and 2B are positioned opposite each other. In this manner, as a result of the lateral walls 22A and 22B being positioned opposite each other, a food storage part 22 is structured so as to be capable of storing therein the bread loaf 100 one by one, which is a conveyed item supplied from the bread loaf supplier 91 explained above. The food storage part 22 in the depicted example is further provided with a pair of wall parts 22C that are disposed between the pair of conveyance units 2A and 2B and structure the food storage part 22 together with the abovementioned lateral walls 22A and 22B. The space enclosed by the lateral walls 22A, 22B, and the pair of wall parts 22C corresponds to the food storage part 22. For the sake of convenience in the illustration of the planar view, from the pair of wall parts 22C, FIG. 5A shows only one wall part 22C disposed on one of the sides.

[0 0 7 9]

The unit base 2C is configured to function as a base plate for supporting the entirety of the loaf-like food conveying machine 2 by having the abovementioned pair of conveyance units 2A and 2B disposed on the top face side thereof. For example, the unit base 2C may be configured by using, for example, a high-strength steel plate having a predetermined thickness.

[0 0 8 0]

The unit base 2C is configured to support the abovementioned pair of conveyance units 2A and 2B so as to be able to make a sliding movement for a predetermined distance in the directions moving away from and closer to each other. Although details are omitted from the

drawings, the unit base 2C is provided with slide holes or the like through which bolts or the like for slidably supporting the pair of conveyance units 2A and 2B can be inserted. Similarly, the unit base 2C is provided with a plurality of through holes or threaded holes (not shown) for attaching the loaf-like food conveying machine 2 to the food slicing device 1, by using bolts or the like.

[0 0 8 1]

In addition, the unit base 2C is provided with an exit hole 26 for conveying the bread loaf 100 downward. Furthermore, as described in detail later, the unit base 2C is provided with a plurality of clearance holes 25 capable of accommodating therein distal ends 211b of the plurality of screw conveyors 21A and 21B.

[0 0 8 2]

The loaf-like food conveying machine 2 of the present embodiment is provided with a handle part 23 for performing an operation to adjust the separation distance between the abovementioned pair of conveyance units 2A and 2B. The handle part 23 is used for manually turning an adjustment shaft 233. In the example shown in FIG. 5A, the adjustment shaft 233 is supported by a supporting part 231 provided for the conveyance unit 2A and a supporting part 232 provided for the conveyance unit 2B, so as to be rotatable while being in a state in which movement in a thrust direction is restricted.

[0 0 8 3]

Although details are omitted from the drawings, it is possible to use, as the adjustment shaft 233, an element configured so that, for example, the vicinity of a substantially central part in the longitudinal direction expands and contracts in conjunction with the rotation. As a result of the expansion and the contraction of the adjustment shaft 233, each of the pair of the conveyance units 2A and 2B makes a sliding movement on the unit base 2C, in conjunction with the movements of the supporting part 231 provided for the conveyance unit 2A and the supporting part 232 provided for the conveyance unit 2B getting closer to or away from each other. With this arrangement, it is possible to change the distance between the lateral wall 22A and the lateral wall 22B. Thus, while taking into consideration the size (the perimeter) or the like of the bread loaf 100 being a conveyed item, it is possible to adjust abutment pressure and biting margins of the screw threads 212 of the screw conveyors 21A and 21B with respect to the bread loaf 100. In other words, by optimally adjusting the separation distance between the lateral wall 22A and the lateral wall 22B, it is possible to stably convey the bread loaf 100 without being greatly damaged or falling.

[0 0 8 4]

The conveyance unit 2A and the conveyance unit 2B provided as one pair respectively include two screw conveyors 21A and two screw conveyors 21B and have substantially the same configuration as each other in an aspect that the constituent elements are disposed symmetrically.

- 5 Thus, in the following explanations, detailed configurations of both of the conveyance units 2A and 2B will be described together.

[0 0 8 5]

- The plurality of screw conveyors 21A and 21B are structured with the two screw conveyors 21A included in the conveyance unit 2A and the two screw conveyors 21B included in
10 the conveyance unit 2B, although details are partially omitted from the examples shown in FIGS. 5A to 5C. The loaf-like food conveying machine 2 is configured to intermittently convey the bread loaf 100 toward the rotary slicer 3 side underneath for the distance corresponding to the predetermined thickness, as a result of the abovementioned screw conveyors 21A and 21B intermittently rotating in predetermined directions.

- 15 [0 0 8 6]

- Further, the plurality of screw conveyors 21A and 21B are each disposed so that a portion of the screw thread 212 (explained in detail later) is exposed to the food storage part 22 through the window part 22a provided in the lateral wall 22A or the lateral wall 22B (see the screw conveyors 21A and 21B in FIG. 5A and FIG. 5B and the screw conveyors 21B and the
20 window parts 22a of the conveyance unit 2B shown in FIG. 5C).

[0 0 8 7]

- Because each of the screw conveyors 21A and 21B has the screw thread 212 formed on the surface of a cylinder part 211, a screw shape is formed as shown in the depicted example (see the screw conveyors 21B shown in FIG. 5C). Further, as shown in FIG. 5B, each of the screw
25 conveyors 21A and 21B is configured so that a basal end 211a side thereof is rotatably supported by a suspension part 214 positioned in an upper part inside a corresponding one of the conveyance units 2A and 2B. Further, the distal end 211b of each of the screw conveyors 21A and 21B on the opposite side from the basal end 211a is accommodated in the clearance hole 25 provided in the unit base 2C while keeping clearance therebetween. Furthermore, in a position
30 closer to the basal end 211a, each of the screw conveyors 21A and 21B is provided with a conveyor gear 213 which is structured with a spur gear and to which rotation is transmitted from a motor 24A (explained later) via a transmission 24B.

[0 0 8 8]

Further, each of the screw conveyors 21A and 21B in the depicted example is provided with an interruption part where the screw shape is interrupted, in a position slightly lower than an intermediate part in the lengthwise direction being the vertical direction in FIG. 5B and FIG. 5C. In this part, a cylinder shaft 215 serving as a rotary shaft of a corresponding one of the screw conveyors 21A and 21B is exposed. Further, as a result of this part of the cylinder shaft 215 being inserted into a through hole (not shown) provided for a supporting frame 27, each of the screw conveyors 21A and 21B is configured to be able to rotate while having a stable posture.

[0 0 8 9]

The material of the screw conveyors 21A and 21B is not particularly limited. It is possible to use any metal material or the like having a certain strength, without any restriction; however, when it is taken into consideration that the screw conveyors 21A and 21B come into contact with various types of loaf-like foods such as the bread loaf 100 at a certain temperature or higher after being baked, dairy products like cheese, or processed meat like ham, it is desirable to configure the screw conveyors 21A and 21B with a stainless steel material or the like, from viewpoints of heat resistance and hygiene.

[0 0 9 0]

The motor 24A is a drive source for rotating the plurality of screw conveyors 21A and 21B and may be configured by using, as well as a generic motor, a pulse motor capable of controlling rotation angles, or the like. In the example shown in FIG. 5B (also see FIG. 5D), after the rotation caused by the drive unit 24 is decelerated by the transmission 24B, the rotation is transmitted from a first drive gear 244 attached to a rotary shaft (not shown) included in the transmission 24B, to a second drive gear 245 attached to a transmission shaft 243. The rotation transmitted to the second drive gear 245 is transmitted via the transmission shaft 243 to a first bevel gear 240 and is further transmitted via a second bevel gear 242 engaged with the first bevel gear 240 to a transmission gear 241 configured with a spur gear. Further, as a result of the rotation being transmitted from the transmission gear 241 to the conveyor gear 213 provided for each of the screw conveyors 21A and 21B, the motor 24A being the drive source is able to rotate the plurality of screw conveyors 21A and 21B.

[0 0 9 1]

It is desirable that the plurality of screw conveyors 21A and 21B are disposed in at least one pair positioned opposite each other while the bread loaf 100 is interposed therebetween. Although details are partially omitted from FIG. 5A and FIG. 5B, the two screw conveyors 21A included in the conveyance unit 2A and the two screw conveyors 21B included in the conveyance unit 2B are disposed so that each pair opposes each other so as to be capable of

sandwiching the bread loaf 100 therebetween. In other words, in the depicted example, the plurality of screw conveyors 21A and 21B are disposed in two pairs each positioned opposite each other while the bread loaf (the loaf-like food) 100 is interposed therebetween. Also, the two pairs of screw conveyors 21A and 21B are positioned in the vicinity of corner parts of the bread loaf 100 so that each pair is positioned apart in the width direction of the bread loaf 100.

By disposing the plurality of screw conveyors 21A and 21B in the manner described above, it is possible to stably convey the bread loaf 100 without being damaged or dropped.

[0 0 9 2]

In addition, in association with the adjustment of the separation distance between the pair of conveyance units 2A and 2B implementing the method described above, it is desirable to configure the plurality of screw conveyors 21A and 21B so as to be capable of reciprocating between a standby position in which the screw conveyors 21A and 21B are positioned apart from the bread loaf 100 and a sandwiching position in which the screw conveyors 21A and 21B are in contact with the bread loaf 100. In that situation, although details are omitted from the drawings, it is possible to adopt, for the loaf-like food conveying machine 2 shown in FIG. 5A and FIG. 5B, for example, an automatic separation mechanism configured to cause the conveyance unit 2A and the conveyance unit 2B to move away from and closer to each other. By adopting this mechanism, for example, when the bread loaf 100 vertically supplied from above the loaf-like food conveying machine 2 is received into the food storage part 22, the conveyance unit 2A and the conveyance unit 2B are moved by the automatic separation mechanism in the separating directions so that, because the separation is slightly larger than when the bread loaf 100 is being conveyed, it is possible to receive the bread loaf 100 having a stable posture. Further, after the bread loaf 100 is received in the food storage part 22 by a certain length, the automatic separation mechanism moves the conveyance unit 2A and the conveyance unit 2B in the directions to get closer to each other so that the conveyance posture of the bread loaf 100 conveyed by the plurality of screw conveyors 21A and 21B is stabilized.

Furthermore, when the automatic separation mechanism described above moves the plurality of screw conveyors 21A and 21B in the directions to move greatly away from each other, an advantageous effect is achieved where operability is enhanced at the time of cleaning or performing equipment maintenance on the loaf-like food conveying machine 2 and the entirety of the food slicing device 1.

[0 0 9 3]

In addition, it is desirable that the plurality of screw conveyors 21A and 21B each rotate in synchronization. With this configuration, because the rotation speeds and the conveyance

speeds are made consistent among the screw conveyors 21A and 21B, it is possible to convey the bread loaf 100 stably and uniformly without the occurrence of a partial inconsistency or the like at the time of the conveyance.

[0 0 9 4]

5 Furthermore, it is desirable that the loaf-like food conveying machine 2 (and the food slicing device 1) of the present embodiment further includes a control unit (not shown) for controlling the rotating of the plurality of screw conveyors 21A and 21B, so that the bread loaf 100 is conveyed for the predetermined distance along the elongated direction. By providing such a control unit, for example, it is possible to cause the plurality of screw conveyors 21A and
10 21B to rotate uniformly in synchronization with one another. It is therefore possible to convey the bread loaf 100 more stably and uniformly. Further, by providing the control unit (not shown) and adopting a configuration capable of adjusting the rotation speeds of the screw conveyors 21A and 21B, it is possible to easily and optimally adjust the thickness of the bread slices 101 to be sliced from the bread loaf 100 by the rotary slicer 3.

15 [0 0 9 5]

The intermittent conveyance distance of the bread loaf 100 conveyed by the loaf-like food conveying machine 2 is a distance matching a setting value of the slice thickness α (see FIG. 1) of the bread slices 101. It is possible to optimally set the conveyance distance, by storing, in the control unit in advance, a relationship between rotation speeds of the plurality of
20 screw conveyors 21A and 21B and conveyance distances. Alternatively, it is also possible to adopt a configuration in which an optical sensor or the like is installed in a certain section of the loaf-like food conveying machine 2 so as to have the drive unit 24 controlled by the control unit while detecting the actual conveyance distance of the bread loaf 100, so that the rotation speeds of the plurality of screw conveyors 21A and 21B are controlled. Further, adopting a pulse
25 motor for the drive unit 24 makes the rotation speed control by the control unit easier and more accurate and also makes the intermittent conveyance distance of the bread loaf 100 more accurate.

[0 0 9 6]

Various specifications of the plurality of screw conveyors 21A and 21B included in the
30 loaf-like food conveying machine 2 of the present embodiment are not particularly limited; however, for example, it is desirable to optimally set a pitch and a forward angle of the screw threads 212, from the viewpoint of achieving capability to stably and uniformly convey the bread loaf 100 at an appropriate conveyance speed.

[0 0 9 7]

With the loaf-like food conveying machine 2 of the present embodiment configured as described above, it is possible to convey the bread loaf 100 having a length corresponding to three Japanese commercial loaves, for example, for an accurate distance corresponding to a
 5 desired thickness, so that it is possible to slice the bread loaf 100 to a thickness suitable for making sandwiches or for making toast, for example.

[0 0 9 8]

For instance, when the bread loaf 100 having a length corresponding to three Japanese commercial loaves is to be sliced to a thickness used for making rather thin sandwiches such as
 10 those available in convenience stores or in-store bakeries, the following thickness and slice number may be used. For example, the bread loaf 100 has a size corresponding to three Japanese commercial loaves such as length: 386 mm × width: 134 mm × height: 122 mm and a slicing process will be performed at a stage preceding the crust cut-off process so as to obtain the bread slices 101 used for making sandwiches and having a cut size of 105 mm × 100 mm in a
 15 planar view. In this situation, the slicing is performed so that each bread slice 101 has a thickness of 9 mm, 11 mm, or 13 mm. Alternatively, when the bread slices 101 are to be used for making sandwiches, the bread loaf 100 may be sliced to have a thickness of 15 mm in some situations.

[0 0 9 9]

20 When the bread loaf 100 having a size corresponding to three Japanese commercial loaves as described above is conveyed by a conveying machine having the conventional configuration configured to sandwich and convey the bread loaf with a pair of forwarding belts as disclosed in Patent Literatures 1 or 2, for example, because the separation position between the forwarding belts and the bread loaf is present, it would be difficult to properly slice the
 25 portion of the bread loaf 100 at the terminal end part (the upper end part). For this reason, using the conventional conveying machine is presented with the problem where the portion at the terminal end part (the upper end part) of the bread loaf 100 becomes waste, which lowers yield of the bread slices. According to an experiment performed by the present inventors, in the case where the bread loaf 100 having the abovementioned size was conveyed by a conveying machine
 30 with the conventional configuration having the pair of forwarding belts, 38 slices were yielded when the bread slices 101 had a 9-mm thickness; 32 slices were yielded when the bread slices 101 had a 11-mm thickness; and 27 slices were yielded when the bread slices 101 had a 13-mm thickness.

[0 1 0 0]

In contrast, by using the loaf-like food conveying machine 2 of the present embodiment and conveying the bread loaf 100 while employing the plurality of screw conveyors 21A and 21B in an experiment, 40 slices were yielded when the bread slices 101 had a 9-mm thickness, 5 33 slices were yielded when the bread slices 101 had a 11-mm thickness; and 28 slices were yielded when the bread slices 101 had a 13-mm thickness. In other words, by conveying the bread loaf 100 while using the loaf-like food conveying machine 2, the yielded number of the bread slices 101 was increased by approximately 1 to 2 per every bread loaf having the size corresponding to three Japanese commercial loaves, which improved the yield by approximately 10 3% to 5%. From the experiment results, it was confirmed that, by conveying the bread loaf 100 with the plurality of screw conveyors 21A and 21B, it is possible to slice the bread loaf 100 to a desired thickness even at the position corresponding to the upper end part (the terminal end part). Accordingly, it became apparent that, by conveying the bread loaf 100 while using the loaf-like food conveying machine 2 of the present embodiment, it is possible to increase the yield of the 15 bread slices 101 that can be served as commercial products such as sandwiches and to thus improve the yield thereof.

[0 1 0 1]

In the experiment using the conveying machine having the conventional configuration as described above, if rather large caving occurred to the bread loaf 100, when the bread loaf 100 20 being rather long and having the size corresponding to three Japanese commercial loaves was conveyed and sliced in particular, there was a tendency that the yield of the bread slices 101 further decreased. It is considered that the reason is that, when the conveying machine with the conventional configuration employing a pair of forwarding belts was used, the conveyance posture of the bread loaf 100 experiencing the caving did not easily become stable, and that, in 25 particular, it was difficult to achieve a proper slice thickness at the position corresponding to the upper end part (the terminal end part) of the bread loaf 100.

[0 1 0 2]

<Functions and advantageous effects>

As explained above, the loaf-like food conveying machine 2 of the present embodiment 30 adopts the configuration including, as described above, the plurality of screw conveyors 21 configured to sandwich and convey the loaf-like food (the bread loaf 100). Thus, it is possible to convey the loaf-like food for an accurate distance while stably holding the loaf-like food. With this configuration, it is possible to prevent the occurrence of fall-off of the loaf-like food such as the bread loaf 100, defective slicing in the rotary slicer 3, and the like.

[0 1 0 3]

Furthermore, the food slicing device 1 of the present embodiment includes the loaf-like food conveying machine 2 of the present embodiment described above. Thus, similarly to the above, it is possible to prevent the occurrence of fall-off of the loaf-like food such as the bread loaf 100, defective slicing in the rotary slicer 3, and the like. In addition, the yield of food slices such as the bread slices 101 is also improved.

[0 1 0 4]

<Modification examples of present invention>

Certain embodiments of the present invention have thus been explained in detail; however, the loaf-like food conveying machine and the food slicing device of the present invention are not limited by the embodiments described above. It is possible to carry out the present invention with various alterations and corrections, without departing from the principle of the present invention and the scope set forth in the accompanying claims.

The following will describe modification examples of the present invention in detail.

15 [0 1 0 5]

[Modification example including auxiliary screw conveyors]

In the above embodiment, the example of the loaf-like food conveying machine was explained in which, as indicated in FIG. 5A to FIG. 5C and so on, only the plurality of screw conveyors 21 (21A and 21B) are provided in two pairs so that each pair opposes each other, while the bread loaf 100 being a loaf-like food is interposed therebetween; however, the present invention is not limited to this configuration. For example, it is also possible to adopt a configuration of a loaf-like food conveying machine 20 in an example shown in FIG. 10 further including a plurality of auxiliary screw conveyors 28 disposed so as to be capable of sandwiching the bread loaf 100 (see FIG. 5B) from the directions orthogonal to the elongated direction of the bread loaf 100.

FIG. 10 is a drawing showing a schematic configuration of the loaf-like food conveying machine 20 (a conveyance unit 20B) further including the plurality of auxiliary screw conveyors 28, in addition to the plurality of screw conveyors 21.

In the example shown in FIG. 10, for the sake of convenience in the illustration, only the conveyance unit 20B on one of the sides (corresponding to the conveyance unit 2B of the loaf-like food conveying machine 2 shown in FIG. 5A and FIG. 5B).is depicted from the pair of conveyance units structuring the loaf-like food conveying machine 20.

[0 1 0 6]

As shown in FIG. 10, because each of the auxiliary screw conveyors 28 has the same shapes as each of the screw conveyors 21, i.e., has a screw thread 282 formed on the surface of a cylinder part 281, a screw shape is formed as shown in the depicted example. Further, similarly to the screw conveyors 21, the auxiliary screw conveyors 28 are configured so that the basal end
 5 side thereof (the upper end side thereof in the depicted example) is rotatably supported by the suspension part 214 positioned in an upper part inside the conveyance unit 20B and, although details are omitted from the drawing, so as to be intermittently rotatable by the drive unit 24.

Similarly to the screw conveyors 21, the auxiliary screw conveyors 28 may also be configured so that the rotation thereof is controlled by a control unit (not shown) so as to convey
 10 the bread loaf 100 for a predetermined distance while guiding the bread loaf 100 along the elongated direction, by rotating while at least a portion of the screw thread 282 is in contact with the bread loaf 100 in a biting manner.

Further, although not shown in FIG. 10, similarly to the screw conveyors 21, the auxiliary screw conveyors 28 may be configured to be capable of reciprocating between a
 15 standby position in which the auxiliary screw conveyors 28 are positioned apart from the bread loaf 100 and a sandwiching position in which the auxiliary screw conveyors 28 are in contact with the bread loaf 100.

Furthermore, with the abovementioned rotation control exercised by the control unit, the auxiliary screw conveyors 28 may be configured to be able to rotate in synchronization with the
 20 screw conveyors 21.

[0 1 0 7]

Further, similarly to the screw conveyors 21, the auxiliary screw conveyors 28 are also provided with an interruption part where the screw shape is interrupted, in a position slightly lower than an intermediate part in the lengthwise direction being the vertical direction in FIG. 10
 25 so that, in this part, the cylinder shaft 215 is exposed. Further, similarly to the screw conveyors 21, as a result of the cylinder shaft 215 being inserted in a through hole (not shown) provided for the supporting frame 27, each of the auxiliary screw conveyors 28 is configured to be able to rotate while having a stable posture.

[0 1 0 8]

30 In the loaf-like food conveying machine 20 shown in FIG. 10, the auxiliary screw conveyors 28 are disposed in one pair positioned opposite each other while the bread loaf 100 is interposed therebetween, while being positioned between the two pairs of screw conveyors 21, 21 (FIG. 10 shows only one of the screw conveyors 21) that are disposed so that each pair is positioned apart. In this manner, by further providing at least one pair of auxiliary screw

conveyors 28 in addition to the two pairs of screw conveyors 21, the six screw conveyors in total abut against the bread loaf 100 being a loaf-like food. Thus, even when the bread loaf is sized to have a long length or when the bread loaf is soft (explained in detail later), it is possible to more stably convey the bread loaf without being impacted by these characteristics.

5 [0 1 0 9]

[Modification example including interval adjustment part for between two pairs of screw conveyors]

In the above embodiment, the configuration is explained in which the handle part 23 (see FIG. 5A) or the like is provided to perform the operation of adjusting the separation distance
 10 between the pair of conveyance units 2A and 2B; however, the present invention is not limited to this configuration. For example, the present invention may adopt a configuration provided with an interval adjustment part for adjusting the separation distances for the two pairs of screw conveyors that are disposed so that each pair is positioned apart (see the loaf-like food conveying machine 200 shown in FIG. 5D, FIG. 5E, and FIG. 5F). Also with respect to the loaf-like food
 15 conveying machine 200 in the example shown in FIG. 5D, FIG. 5E, and FIG. 5F, for the sake of convenience in the illustration, only the conveyance unit on one of the sides (corresponding to the conveyance unit 2B of the loaf-like food conveying machine 2 shown in FIG. 5A and so on) is depicted from the pair of conveyance units.

[0 1 1 0]

20 Although details of the interval adjustment part are omitted from FIG. 5D, FIG. 5E, and FIG. 5F, for example, similarly to the structure shown in FIG. 5A, it is possible to adopt a configuration provided with an expansion/contraction mechanism of which the length varies according to a handle operation, so that it is possible to change the separation distances for the two pairs of screw conveyors 21, 21 that are disposed so that each pair is positioned apart. In
 25 that situation, for example, the abovementioned expansion/contraction mechanism may be attached to each of the supporting frames 27, 27 respectively supporting the two pairs of screw conveyors 21, 21, so that it is possible to cause the supporting frames 27, 27 and the two pairs of screw conveyors 21, 21 to make sliding movements.

[0 1 1 1]

30 By providing the interval adjustment part described above, for example, it is possible to reduce the separation distances for the two pairs of screw conveyors 21 21 in a sliding direction S shown in FIG. 5D and FIG. 5F and to enlarge the separation distances for the two pairs of screw conveyors 21, 21 in the opposite direction of the sliding direction S. With this configuration, it is possible to adjust abutment positions of the four screw conveyors 21 in total

against the bread loaf 100 being a loaf-like food, so as to be in optimal positions that make it possible to stably hold/convey the bread loaf 100. It is also possible to finely adjust the abutment pressures and the biting amounts of the screw conveyors 21 with respect to the bread loaf 100. Consequently, similarly to the above, when the bread loaf is sized to have a long
 5 length or when the bread loaf is soft, it is possible to more stably convey the bread loaf without being impacted by these characteristics.

Furthermore, although not shown in FIG. 5D, FIG. 5E, and FIG. 5F, it is desirable that the interval adjustment part is configured to be able to also adjust, simultaneously or individually, the inter-axial distance of the abovementioned pair of auxiliary screw conveyors 28
 10 in addition to the two pairs of screw conveyors 21, 21.

[0 1 1 2]

[Advantageous effects achieved by having auxiliary screw conveyors or interval adjustment part]

The following will explain the capability to more stably convey the loaf-like food (the bread loaf) by providing the loaf-like food conveying machine with the auxiliary screw
 15 conveyors or the interval adjustment part as described above in addition to the plurality (two pairs) of screw conveyors, as well as problems of the conveying machine having the conventional configuration.

[0 1 1 3]

Generally speaking, bread loaves are baked to have a size with a length corresponding
 20 to three Japanese commercial loaves of cubic milk bread (Japanese *shokupan*) available at storefront and the like. Each of the baked bread loaves is cut into Japanese-commercial-loaf-sized loaves, as appropriate, or conveyed by a loaf-like food conveying machine as described above to a slicer and sliced into bread slices. Meanwhile the bread loaves each having the size corresponding to three Japanese commercial loaves have characteristics where the size may
 25 easily vary due to being long and the shape may easily vary due to softness that determines quality of the bread and caving (buckling) or the like. The conveying machine with the conventional configuration employing forwarding belts or the like is presented with the problem where stable conveyance cannot be achieved due to the inability to address these characteristics. In other words, conveying machines using the vertically downward movement of the long bread
 30 loaf caused by its own weight is presented with the problem where, when forwarding belts or the like such as those in the conventional example are employed, the size (the length) variation or the deformation may easily be caused.

[0 1 1 4]

The loaf-like food conveying machine according to the present invention adopts, first,

the configuration in which the loaf-like food (the bread loaf) is conveyed by the screw conveyors. Thus, it is possible to more stably convey the loaf-like food such as the bread loaf without having the bread loaf damaged or dropped, as compared to the conveying machine having the conventional configuration.

5 In addition, in the present invention, when the abovementioned auxiliary screw conveyors or the interval adjustment parts for between the two pairs of screw conveyors are provided, it is possible to effectively inhibit the occurrence of the variation in the size and the shape, without being impacted by the length, the softness, and the like of the bread loaf. Further, providing the auxiliary screw conveyors or the interval adjustment part makes the
10 conveyance posture of the bread loaf 100 stable even when, in particular, the bread loaf 100 has caving in large size. Consequently, because it is possible to slice the bread loaf 100 to a desired thickness even at the position corresponding to the upper end part (the terminal end part) thereof, the yield of the bread slices 101 is stably improved.

[0 1 1 5]

15 [Applications of the loaf-like food conveying machine]

In the above embodiment, the example was explained in which the loaf-like food conveying machine is applied to the food slicing device, so that the bread loaf is conveyed as a loaf-like food and is supplied toward the slicer; however, the present disclosure is not limited to this example and may be applied to any purpose as long as conveying and supplying a loaf-like
20 food is required.

[0 1 1 6]

Further, in the above embodiment, the example was explained in which the bread loaf is used as a loaf-like food; however, the item being conveyed by the loaf-like food conveying machine according to the present invention is not limited to a bread loaf. The loaf-like food
25 conveying machine according to the present invention is able to achieve the same advantageous effects as described above even when the item being conveyed is any of various types of loaf-like foods such as, for example, cheese, ham, sausages, solidified processed meat, and fish cakes (*kamaboko*), as well as seafood such as fresh fish or solidified processed seafood. The same applies to the food slicing device according to the present invention.

30

INDUSTRIAL APPLICABILITY

[0 1 1 7]

The loaf-like food conveying machine of the present embodiment is capable of conveying the loaf-like food for the accurate distance while stably guiding the loaf-like food. It

is therefore possible to prevent the occurrence of fall-off of the loaf-like food such as a bread loaf, defective slicing in the slicer, and the like. Consequently, the loaf-like food conveying machine of the present invention is extremely suitable for conveyance purposes to slice loaf-like foods such as, for example, cheese, ham, sausages, solidified processed meat, or fish cakes
 5 (*kamaboko*), as well as seafood such as fresh fish or solidified processed seafood.

REFERENCE SIGNS LIST

[0 1 1 8]

- 1: food slicing device
- 10 2, 20, 200: loaf-like food conveying machine
- 2A, 2B, 20B: conveyance unit (a pair of conveyance units)
- 2C: unit base
- 25: clearance hole
- 26: exit hole
- 15 21, 21A, 21B: screw conveyor (a plurality of screw conveyors; a pair of screw conveyors; two pairs of screw conveyors)
- 211: cylinder part
- 211a: basal end
- 211b: distal end
- 20 212: screw thread
- 213: conveyor gear
- 214: suspension part
- 215: cylinder shaft
- 22: food storage part
- 25 22A, 22B: lateral wall
- 22a: window part
- 22C: wall part (a pair of wall parts)
- 23: handle part
- 231, 232: supporting part
- 30 233: adjustment shaft
- 28: auxiliary screw conveyor (a plurality of screw conveyors; a pair of auxiliary screw conveyors)
- 281: cylinder part
- 282: screw thread

	24A: motor
	24B: transmission
	240: first bevel gear
	241: transmission gear
5	242: second bevel gear
	243: transmission shaft
	244: first drive gear
	245: second drive gear
	27: supporting frame
10	S: sliding direction
	3: rotary slicer (slicer)
	31: reciprocation frame
	31a: linear rail
	31b: arm holding rail
15	32: slicer motor
	33: slicer rotary belt
	33a: pulley
	33b: rotary shaft
	34: bread slice guide
20	35: bread loaf stopper
	35a: supporting member
	35b: window hole
	4: slicer reciprocation driver
	41: fixed frame
25	41a: linear guide
	42: reciprocation drive motor
	43: belt
	44: drive shaft
	45: rotary arm
30	45a: tip end part
	5: transport conveyor
	51: first belt conveyor
	51a: conveyance surface
	52: second belt conveyor (conveyor on the upstream side)

	52a: conveyance surface
	53: third belt conveyor (conveyor on the downstream side)
	54: fourth belt conveyor
	6: crust cutter
5	61: up-and-down frame
	61a: linear rail
	61b: anti-vibration member
	62: crust cut-off blade
	62a, 62b, 62c, 62d: blade members
10	63: crust cut-off motor
	64: rotary plate
	65: swinging arm
	66: fixed frame
	66a: linear guide
15	67: elastic member
	7: crusher
	71: crust collecting container
	72: grinder
	8: wind power conveying machine
20	81: blower
	82: conduit
	83: breadcrumb collecting container
	91: bread loaf supplier
	92: aligner
25	92a: alignment plate
	92c: air cylinder
	93: remover
	93a: push-out plate
	93b: air cylinder
30	93c: end bread slice collecting container
	94: butter spreader
	94a: hopper
	94b: transfer roller
	94c: auxiliary roller

100: bread loaf (loaf-like food)

101: bread slice (food slice)

102: crust

103: crustless bread slice

5

104: breadcrumbs

CLAIMS

CLAIM 1

A loaf-like food conveying machine that conveys an elongated block-shaped loaf-like food while holding the loaf-like food, comprising:

a plurality of screw conveyors that are disposed so as to be capable of sandwiching the loaf-like food from directions orthogonal to an elongated direction of the loaf-like food and that convey the loaf-like food for a predetermined distance along the elongated direction; and

a drive unit that intermittently rotates the plurality of screw conveyors so as to convey the loaf-like food for the predetermined distance, wherein

the plurality of screw conveyors convey the loaf-like food while guiding the loaf-like food along the elongated direction, by rotating while at least a portion of a screw thread provided for each of the plurality of screw conveyors is in contact with the loaf-like food in a biting manner.

CLAIM 2

The loaf-like food conveying machine according to CLAIM 1, wherein the plurality of screw conveyors are disposed in at least one pair positioned opposite each other while the loaf-like food is interposed therebetween.

CLAIM 3

The loaf-like food conveying machine according to CLAIM 1 or 2, wherein the plurality of screw conveyors are capable of reciprocating between a standby position in which the plurality of screw conveyors are positioned apart from the loaf-like food and a sandwiching position in which the plurality of screw conveyors are in contact with the loaf-like food.

CLAIM 4

The loaf-like food conveying machine according to CLAIM 1 or 2, wherein the plurality of screw conveyors each rotate in synchronization.

CLAIM 5

The loaf-like food conveying machine according to CLAIM 1 or 2, further comprising:

a control unit for controlling the rotating of the plurality of screw conveyors so that the loaf-like food is conveyed for the predetermined distance along the elongated direction.

CLAIM 6

The loaf-like food conveying machine according to CLAIM 2, wherein
the plurality of screw conveyors are disposed in two pairs each positioned
opposite each other while the loaf-like food is interposed therebetween, and
the two pairs of screw conveyors are disposed so that each pair is positioned apart
in a width direction of the loaf-like food.

CLAIM 7

The loaf-like food conveying machine according to CLAIM 6, further
comprising:
a plurality of auxiliary screw conveyors disposed so as to be capable of
sandwiching the loaf-like food from the directions orthogonal to the elongated direction of the
loaf-like food, wherein
the auxiliary screw conveyors are disposed in at least one pair positioned opposite
each other while the loaf-like food is interposed therebetween, in positions between the two pairs
of screw conveyors that are disposed so that each pair is positioned apart.

CLAIM 8

The loaf-like food conveying machine according to CLAIM 6, further
comprising:
an interval adjustment part for adjusting separation distances for the two pairs of
screw conveyors that are disposed so that each pair is positioned apart.

CLAIM 9

The loaf-like food conveying machine according to CLAIM 1 or 2, wherein
the loaf-like food is a bread loaf, and
the plurality of screw conveyors convey the bread loaf while guiding the bread
loaf along the elongated direction.

CLAIM 10

A food slicing device comprising:
at least, a loaf-like food conveying machine that conveys an elongated block-
shaped loaf-like food while holding the loaf-like food; and
a slicer that slices the loaf-like food conveyed and supplied by the loaf-like food
conveying machine into a food slice having a predetermined thickness, wherein
the loaf-like food conveying machine is the loaf-like food conveying machine
according to CLAIM 1 or 2.

CLAIM 11

The food slicing device according to CLAIM 10, wherein
the loaf-like food is a bread loaf,
the loaf-like food conveying machine conveys and supplies the bread loaf toward
the slicer, and
the slicer slices the bread loaf into a bread slice having a predetermined thickness.