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### Meat separator and device for stripping meat part from bone-in meat

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#### Abstract

A meat separator separates meat part attached to bone part by coming into contact with outer peripheral surface of the bone part of bone-in meat that moves relatively with respect to the meat separator. The meat separator includes a plurality of clamp blocks. The clamp blocks each include scraping contact portion that comes into contact with the outer peripheral surface of the bone part, and the scraping contact portions cooperate with each other so as to clamp the outer peripheral surface of the bone part. At least one of the clamp blocks is configured so that at least a part of the scraping contact portion of the clamp block is displaceable in a plurality of directions along outer surface shape of the bone part, and the at least one of the clamp blocks includes biasing function portion that elastically pushes back the displacement in direction moving away from bone part.

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## Background/Summary

### TECHNICAL FIELD

- (1) The present invention relates to a meat separator and a device for stripping meat part from bone-in meat which strips a meat part off a bone part of the bone-in meat such as chicken leg meat.
- (2) Priority is claimed on Japanese Patent Application No. 2021-200254, filed Dec. 9, 2021, the content of which is incorporated herein by reference.

### BACKGROUND ART

- (3) In recent years, a meat part separating apparatus that mechanically separates a meat part off a bone part of bone-in meat such as chicken leg meat has been developed.
- (4) This type of meat part separating apparatus separates the meat part off the bone part using a meat separator while raising a clammer that holds an end portion of the bone part in a state in which an incision is made at an appropriate location in the meat part of the bone-in meat in advance by an incision device. The meat separator has a scraping claw that is inserted into the incision of the meat part such that the scraping claw comes into contact with the outer peripheral surface of the bone part of the bone-in meat. The meat part separating apparatus can separate the meat part off the bone part by raising the bone part with the scraping claw of the meat separator being pressed against the outer peripheral surface of the bone part of the bone-in meat (for example, see Patent Document 1).
- (5) The meat separator described in Patent Document 1 includes a fixed clamp (a fixed separator) that is fixed to the factory equipment and a movable clamp (a movable separator) that approaches and moves away from the fixed clamp. Scraping claws are provided at mutually opposing tip end portions of the fixed clamp and the movable clamp. Each scraping claw has a bone part receiving portion formed in a concave shape capable of receiving the outer peripheral surface of the bone part of the bone-in meat. The side edge portion of the bone part receiving portion of the fixed clamp and the side edge portion of the bone part receiving portion of the movable clamp face each other and overlap each other when the movable clamp is displaced in a direction approaching the fixed clamp. As a result, the two bone part receiving portions surround the outer periphery of the bone part of the bone-in meat, and when the bone part is raised in this state, the meat part is scraped off the bone part.
- (6) Further, the movable clamp is biased in a direction approaching the fixed clamp by a biasing part such as a spring member or an air cylinder. Due to this configuration, the meat separator can track a change of the outer surface shape of the bone part and scrape the meat part even if there is a part where an outer diameter changes in the middle of the bone part in a longitudinal direction or a bulge such as a knee joint.

### CITATION LIST

Patent Document

Patent Document 1

- (7) Japanese Patent No. 4190705

### SUMMARY OF INVENTION

#### Technical Problem

- (8) However, in the meat separator described in Patent Document 1, when the bone part of the bone-in meat is clamped, a clamping load by the two bone part receiving portions acts on the bone part in only one direction (a movable direction of the movable clamp). For this reason, there is a concern that it may be difficult to press the bone part receiving portion accurately along the outer surface shape of the bone part of the bone-in meat, and thus depending on the shape of the bone part, a large portion of the meat part may remain on the bone part, or conversely, a portion of the

bone part may be scraped together with the meat part and remain as residual bone in the meat part.

(9) Aspects of the present invention provide a meat separator and a meat part separating apparatus for bone-in meat that can efficiently and stably separate a meat part off a bone part of the bone-in meat.

#### Solution to Problem

(10) A meat separator and a meat part separating apparatus for bone-in meat according to the present invention employ the following configurations.

(11) According to the present invention, there is provided a meat separator that separates a meat part attached to a bone part by coming into contact with an outer peripheral surface of the bone part of bone-in meat that moves relatively with respect to the meat separator, the meat separator including a plurality of clamp blocks in which each of the plurality of clamp blocks include a scraping contact portion that comes into contact with the outer peripheral surface of the bone part and in which each of the scraping contact portions cooperate with each other so as to clamp the outer peripheral surface of the bone part, wherein at least one of the clamp blocks is configured so that at least a part of the scraping contact portion of the clamp block is displaceable in a plurality of directions along an outer surface shape of the bone part, and the at least one of the clamp blocks includes a biasing function portion that is configured to elastically push back the displacement in a direction moving away the bone part.

(12) With the above configuration, in a case where the meat part is separated from the bone part of the bone-in meat, the scraping contact portion of the plurality of clamp blocks come into contact with the outer peripheral surface of the bone part of the bone-in meat, and in this state, the bone part moves relative to the meat separator. At this time, the at least one of the clamp blocks is displaced in the plurality of directions along the outer surface shape of the bone part while at least a part of the scraping contact portion is receiving a biasing force from the biasing function portion. Accordingly, the scraping contact portions of the plurality of clamp blocks are elastically pressed against the outer surface of the bone part from the plurality of directions. As a result, the meat part attached to the periphery of the bone part is separated from the bone part from a position close to the bone part in a state where residual meat is small and the separation of the bone part is small.

(13) The meat separator may further include an approaching device that is configured to relatively displace the at least one of the clamp blocks closer to other clamp blocks, wherein the at least one of the clamp blocks may include a pair of clamp claws that are configured to be displaceable in a direction intersecting with an approaching displacement direction in which the at least one of the clamp blocks is relatively displaced closer to the other clamp blocks, and a spring member that is configured to bias the pair of clamp claws in a direction in which the pair of clamp claws approach each other, wherein the pair of clamp claws may be provided with contact blades that form a concave bone part receiving portion that receives the outer peripheral surface of the bone part between the pair of clamp claws, wherein the spring member may constitute the biasing function portion, and wherein the contact blade of each of the clamp claws may constitute the scraping contact portion.

(14) In this case, the at least one of the clamp blocks and the other of the clamp blocks are relatively displaced in the direction approaching each other by the approaching device, and the scraping contact portions of the clamp blocks come into contact with the outer peripheral surface of the bone part. At this time, in the at least one of the clamp blocks, the contact blades of the pair of clamp claws constituting the scraping contact portion come into contact with the outer peripheral surface of the bone part, and the outer peripheral surface of the bone part is received in the concave bone part receiving portion formed between the two contact blades. The two contact blades receive the biasing force from the spring member that biases the pair of clamp claws in the direction in which the pair of clamp claws approach each other and are pressed against the outer peripheral surface of the bone part in the direction intersecting with the approaching displacement direction. As a result, the scraping contact portions of the plurality of clamp blocks come into contact with

the outer peripheral surface of the bone part in the plurality of directions.

(15) The meat separator may further include an approaching device that is configured to relatively displace the at least one of the clamp blocks closer to other clamp blocks, wherein the scraping contact portion of the at least one of the clamp blocks may be constituted by an elastic member that elastically deforms so as to follow a shape of the outer peripheral surface of the bone part by coming into contact with the outer peripheral surface of the bone part, and wherein the biasing function portion may also be constituted by the elastic member.

(16) In this case, when the at least one of the clamp blocks and the other of the clamp blocks are relatively displaced in the direction in which the at least one of the clamp blocks and the other clamp blocks approaches each other by the approaching device, the elastic member provided in the at least one of the clamp blocks elastically deforms so as to follow the shape of the outer peripheral surface of the bone part by coming into contact with the outer peripheral surface of the bone part. At this time, the elastic member is pressed against the outer peripheral surface of the bone part from the plurality of directions due to its own elasticity. As a result, the scraping contact portions (including the elastic member) of the plurality of clamp blocks come into contact with the outer peripheral surface of the bone part in the plurality of directions.

(17) The approaching device may include a biasing part that biases the at least one of the clamp blocks and the other clamp blocks in a direction in which the at least one of the clamp blocks and the other clamp blocks approach each other.

(18) In this case, the at least one of the clamp blocks and the other of the clamp blocks are biased in the direction in which the at least one of the clamp blocks and the other clamp blocks approach each other by the biasing part. For this reason, entire of the clamp blocks are displaced so as to flexibly follow the outer surface shape of the bone part while the scraping contact portions of the clamp block are pressed against the outer peripheral surface of the bone part in multiple directions. As a result, the scraping contact portions are not pressed against the bone part with an excessive force, and thus it possible to prevent damage or nicks to the bone part in advance.

(19) According to the present invention, there is provided a meat part separating apparatus for bone-in meat including: a bone part holding device that is configured to hold a bone part of the bone-in meat; any one of the meat separators described above; and a moving device that is configured to relatively move the bone part holding device and the meat separator approximately in a longitudinal direction of the bone part held by the bone part holding device.

#### Advantageous Effects of Invention

(20) In the meat separator and the meat part separating apparatus for bone-in meat according to the present invention, at least a part of the scraping contact portion of the clamp block is displaceable in the plurality of directions along the outer surface shape of the bone part, and the displacement in a direction of separating from the bone part is elastically pushed back by the biasing function portion. For this reason, when the meat part is separated off the bone part of the bone-in meat, the scraping contact portions of the plurality of clamp blocks are pressed against the outer peripheral surface of the bone part from the plurality of directions. Therefore, in a case where the meat separator and the meat part separating apparatus for bone-in meat according to the present invention are adopted, the scraping contact portions come into closer contact with the outer peripheral surface of the bone part, and the meat part can be efficiently and stably separated off the bone part of the bone-in meat.

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## Description

### BRIEF DESCRIPTION OF DRAWINGS

(1) FIG. 1 is a side view of a meat part separating apparatus according to a first embodiment.

(2) FIG. 2 is an oblique view of a meat separator of the first embodiment.

- (3) FIG. 3 is a view of a movable clamp block of the first embodiment viewed in a direction of arrow III in FIG. 2.
- (4) FIG. 4 is a side view showing the behavior of the meat separator of the first embodiment.
- (5) FIG. 5 is a plan view showing the same behavior of the meat separator of the first embodiment as shown in FIG. 4.
- (6) FIG. 6 is a side view showing another behavior of the meat separator of the first embodiment.
- (7) FIG. 7 is a plan view showing the same behavior of the meat separator of the first embodiment as shown in FIG. 6.
- (8) FIG. 8 is a plan view of a meat separator of a second embodiment.
- (9) FIG. 9 is a plan view of a meat separator of a third embodiment.
- (10) FIG. 10 is a plan view of a meat separator of a fourth embodiment.

#### DESCRIPTION OF EMBODIMENTS

(11) Hereinafter, embodiments of the present invention will be described with reference to the drawings. The materials, shapes, relative arrangements, and the like of the components described in the following embodiments are not intended to limit the scope of the present invention unless otherwise specified.

(12) Further, in each of the embodiments which will be described below, common reference signs will be given to the same parts, and some duplicate explanations will be omitted.

#### First Embodiment

(13) FIG. 1 is a side view of a meat part separating apparatus for bone-in meat **1** (hereinafter referred to as a “meat part separating apparatus **1**”) of the present embodiment.

(14) The meat part separating apparatus **1** is an apparatus for separating a meat part **m** off a bone part **b** of bone-in meat **2** such as chicken leg meat. Hereinafter, chicken leg meat will be described as an example of the bone-in meat **2**. In the chicken leg meat (the bone-in meat **2**), a femur **b1** and a tibia **b2** are connected to each other by a knee joint **b3**, and an ankle **b4** is connected to the end portion of the tibia **b2**.

(15) The meat part separating apparatus **1** shown in FIG. 1 includes a clasper **10** (a bone part holding device) that holds the ankle **b4** (the bone part **b**) with the bone-in meat **2** facing downward, a lifting device **11** (a moving device) that raises and lowers the clasper **10**, and a meat separator **12** that separates the meat part **m** off the bone part **b** of bone-in meat **2** in cooperation with the rising movement of the clasper **10**.

(16) FIG. 1 shows the meat part separating apparatus **1** disposed at a processing station where the meat part **m** of the bone-in meat **2** is separated in the vicinity of the knee joint **b3**. In practice, as a step before performing the above processing with the meat part separating apparatus **1** shown in FIG. 1, incision processing with respect to the meat part **m** around the end portion on a side of the ankle **b4** of the tibia **b2**, tendon cutting processing of the meat part **m** in a longitudinal direction of the bone part **b**, separating processing of the meat part **m** around the tibia **b2**, or the like is performed at a different processing station. Between the processing stations, the common clasper **10** moves while holding the ankle **b4** of the bone-in meat **2**.

(17) The clasper **10** has a structure capable of holding and releasing the ankle **b4** of the bone-in meat **2**.

(18) The lifting device **11** moves the bone part **b** of the bone-in meat **2** relative to the meat separator **12** in a vertical direction by raising the clasper **10** that holds the bone **b** (the ankle **b4**) of the bone-in meat **2** at a predetermined speed. In the present embodiment, the lifting device **11** raises the bone part **b** of the bone-in meat **2** upward with respect to the meat separator **12** whose position in the vertical direction is fixed, and thus it is possible for the meat separator **12** to separate the meat part **m**.

(19) However, it is also possible to fix the bone part **b** of the bone-in meat **2** with the clasper **10** and to move the meat separator **12** downward. Further, it is also possible to arrange the bone-in meat **2** laterally such that the longitudinal direction of the bone part **b** is substantially horizontal

and to relatively move the bone part b of the bone-in meat **2** and the meat separator **12** in a substantially horizontal direction.

(20) The meat separator **12** includes a fixed clamp block **15A** that is fixed to the factory equipment, and a movable clamp block **15B** that is displaceable in a direction of approaching the fixed clamp block **15A** and a direction of separating from the fixed clamp block **15A**. Hereinafter, for convenience of explanation, in a left-right direction in FIG. **1**, a side on which the fixed clamp block **15A** is disposed is referred to as an “equipment inside i”, and a side on which the movable clamp block **15B** is disposed is referred to as an “equipment outside o”.

(21) The fixed clamp block **15A** and the movable clamp block **15B** are provided with scraping contact portions **15At** and **15Bt** that come into contact with the outer peripheral surface of the bone part b of the bone-in meat **2** at their mutually opposing tip end portions. The scraping contact portions **15At** and **15t** of both crank blocks **15A** and **15B** are pressed against the outer peripheral surface of the bone part b of the bone-in meat **2** so as to clamp the outer peripheral surface of the bone part b therebetween through their mutual cooperation.

(22) The movable clamp block **15B** is supported by a substantially L-shaped rotation arm **16**. The movable clamp block **15B** swings around a rotation shaft **16a** at the base end of the rotation arm **16** so as to approach and move away from the fixed clamp block **15A**. In the case of the present embodiment, the rotation shaft **16a** of the rotation arm **16** is disposed at a lower position than the fixed clamp block **15A** and is rotated by an air cylinder **17** having a biasing part such as a spring member. The rotation arm **16** swings around the rotation shaft **16a** by the operation of the air cylinder **17**, and thus displaces the movable clamp block **15B** at the tip end side in a direction which approaches the fixed clamp block **15A** (a direction toward the equipment inside i) or in a direction which separates from the fixed clamp block **15A** (in a direction toward the equipment outside o).

(23) In a state where the movable clamp block **15B** has approached the fixed clamp block **15A**, when the scraping contact portion **15Bt** comes into contact with the outer peripheral surface of the bone part b of the bone-in meat **2** and receives a reaction force from the bone part b, the movable clamp block **15B** is pushed back in the direction of separating (the direction toward the equipment outside o) against a biasing force of the biasing part of the air cylinder **17**. At this time, the movable clamp block **15B** is displaced in the direction toward the equipment outside o along the outer surface shape of the bone part b, while the scraping contact portion **15Bt** is pressed against the outer surface of the bone part b by an appropriate biasing force.

(24) In the present embodiment, the air cylinder **17** and the rotation arm **16** constitute an approaching device that displaces the movable clamp block **15B** relatively close to the fixed clamp block **15A**. However, the approaching device is not limited to this configuration, and may have any other configuration as long as it can displace the movable clamp block **15B** relatively close to the fixed clamp block **15A**. For example, the approaching device may be a device that horizontally moves the movable clamp block **15B** in a direction of the equipment inside i and in a direction of the equipment outside o.

(25) FIG. **2** is an oblique view of the meat separator **12**, and FIG. **3** is a view of the movable clamp block **15B** viewed in a direction of arrow III in FIG. **2**. FIG. **4** is a side view showing the behavior of the meat separator **12**, and FIG. **5** is a plan view showing the same behavior of the meat separator **12** as shown in FIG. **4**. In the following explanation of the fixed clamp block **15A** and the movable clamp block **15B**, a direction in which the fixed clamp block **15A** and the movable clamp block **15B** face each other is referred to as a “direction of approach and separation of the block,” and a direction orthogonal to the vertical direction and the direction of approach and separation of the block are referred to as a “width direction.”

(26) The fixed clamp block **15A** includes a plate-shaped fixed clamp claw **20** extending substantially horizontally from a fixed wall of the factory equipment toward the equipment outside o. The fixed clamp claw **20** has a concave bone part receiving portion **21** that opens toward the

equipment outside o at its tip end portion (an extending end portion). As shown in FIG. 5, the bone part receiving portion **21** is formed, for example, in a substantially U-shaped planar shape that opens gently outward in the width direction. The outer peripheral surface of the bone part b of the bone-in meat **2** suspended and supported by the clasper **10** is received in the bone part receiving portion **21**. The scraping contact portion **15**At on the side of the fixed clamp block **15A** is constituted by a bone part receiving portion **21**.

(27) The movable clamp block **15B** has a thick support plate **22** connected to the tip end portion of the rotation arm **16**, a pair of clamp claws **23a** and **23b** rotatably supported by the support plate **22**, and a pair of spring members **24** biasing the pair of clamp claws **23a** and **23b** in a direction in which they approach each other.

(28) The support plate **22** includes a rectangular plate base **22a** and side cover walls **22b** that extend in a substantially L shape from both end portions of the plate base **22a** in the width direction.

(29) The support plate **22** is in an erect posture such that the plate base **22a** is along the tip end portion of the rotation arm **16** in a state in which the tip end portion of the rotation arm **16** is erected vertically upward. Hereinafter, the side of the plate base **22a** facing the fixed clamp block **15A** is referred to as a “front surface,” and the side opposite thereto is referred to as a “back surface.”

(30) A pair of pivot shafts **25** that rotatably support the clamp claws **23a** and **23b**, and a pair of regulation shafts **26** that regulate each rotational displacement of the clamp claws **23a** and **23b** are projected from the front surface of the plate base **22a**. The pivot shaft **25** and the regulation shaft **26** protrude in a direction orthogonal with respect to the front surface of the plate base **22a**. Further, as shown in FIGS. 2, 4, 6, and the like, a connection block **27** to which the tip end portion of the rotation arm **16** is connected is attached at the center position in the width direction of the back surface of the plate base **22a**.

(31) Each of the clamp claws **23a** and **23b** includes a thin strip-shaped claw main body **28** extending in the direction of approach and separation of the block in a state the tip end portion of the rotation arm **16** is erected and a thick strip-shaped support piece **29** to which one end portion in a longitudinal direction of the claw main body **28** is connected. Regarding the claw main body **28**, the side connected to the support piece **29** is referred to as a “base end portion,” and the side opposite thereto is referred to as a “tip end portion.” A connection portion **28a** bent into substantially an L shape is integrally formed at the base end portion of the claw main body **28**. The connection portion **28a** is bolted to one end portion of the support piece **29** in the longitudinal direction. In this state, each of the clamp claws **23a** and **23b** is an integral block having substantially an L shape when viewed from the side.

(32) The pair of clamp claws **23a** and **23b** are rotatably connected to the corresponding pivot shaft **25** of the support plate **22** at the other end side (the lower end side in FIG. 3) of each support piece **29** in the longitudinal direction. The pair of pivot shafts **25** on the side of the support plate **22** are disposed side by side in the width direction at two positions spaced apart in the width direction on the front surface of the plate base **22a**. The two support pieces **29** supported by the pivot shafts **25** are disposed side by side in the width direction on the front side of the plate base **22a** of the support plate **22**. The pair of clamp claws **23a** and **23b** are displaceable between an approaching position at which the claw main bodies **28** approaching each other in the width direction and a separating position at which the claw main bodies **28** separate from each other in the width direction by rotating around the pivot shafts **25**.

(33) Each of the claw main bodies **28** of the clamp claws **23a** and **23b** has a cutout portion **30** that extends from near the base end portion toward the tip end portion side in a side edge portion adjacent to another claw main body **28** (hereinafter referred to as an “inner side edge”). The separation width between the cutout portions **30** of the two adjacent claw main bodies **28** in the width direction is a constant separation width from the base end portion to a predetermined position



near the tip end portion and gradually increases toward the tip end portion on the tip end portion side beyond the predetermined position. A region of the two adjacent claw main bodies **28** where the separation width between the cutout portions **30** gradually increases toward the tip end portion is a concave bone part receiving portion **31** that receives the outer peripheral surface of the bone part b of the bone-in meat **2** between the two adjacent claw main bodies **28**. The side edge portion of each of the two adjacent claw main bodies **28** that forms the bone part receiving portion **31** has a thickness that gradually decreases toward an end portion that forms an edge of the cutout portion **30**. This portion of the claw main body **28** is a contact blade **32** that comes into contact with the outer peripheral surface of the bone-in meat **2**. The bone part receiving portion **31** is formed by the contact blades **32** of the two clamp claws **23a** and **23b**.

(34) In the present embodiment, the contact blades **32** of the two clamp claws **23a** and **23b** form the scraping contact portion **15Bt** in the movable clamp block **15B**.

(35) Moreover, a regulation piece **33** extending in the width direction is attached to one clamp claw **23a** so as to straddle the cutout portion **30** between the two clamp claws **23a** and **23b**. The regulation piece **33** regulates the bone part b and the meat part m from being caught in a deep position on the base side of the cutout portion **30** between the two clamp claws **23a** and **23b** during the separating operation of the meat part m of the bone-in meat **2** by the meat separator **12**.

(36) As shown in FIGS. **2** and **3**, an insertion hole **34** that penetrates the support piece **29** in a thickness direction and that has a circular shape in a front view is formed in the support piece **29** of each clamp claw **23a**. Each regulation shaft **26** that is projected from the plate base **22a** of the support plate **22** is inserted into the insertion hole **34** of each support piece **29**. The outer surface of the corresponding regulation shaft **26** comes into contact with the inner wall of the insertion hole **34** when the pair of clamp claws **23a** and **23b** are displaced to the most separating position and are displaced to the most approaching position. As a result, the displacement of the pair of clamp claws **23a** and **23b** in the direction of separating and the displacement in the direction of approaching are regulated.

(37) The outer surface of the corresponding regulation shaft **26** may come into contact with the inner wall of the insertion hole **34** only when the pair of clamp claws **23a** and **23b** are displaced to the most separating position.

(38) Further, as shown in FIG. **3**, spring locking projections **35a** and **35b** are projected from the support pieces **29** of the clamp claws **23a** and **23b**, respectively. The spring locking projection **35a** of one clamp claw **23a** protrudes toward the back surface side of the clamp claw **23a**, and the spring locking projection **35b** of the other clamp claw **23b** protrudes toward the front side of the clamp claw **23b**. Furthermore, a pair of spring locking projections **36a** and **36b** are projected from the front surface of the plate base **22a** of the support plate **22**. One spring locking projection **36a** is disposed at a position spaced apart from the support piece **29** of one clamp claw **23a** outside in the width direction (at the side separating from the support piece **29** of the other clamp claw **23b**). The other spring locking projection **36b** is disposed at a position spaced apart from the support piece **29** of the other clamp claw **23b** outside in the width direction (at the side away from the support piece **29** of the one clamp claw **23a**).

(39) The end portions of the spring member **24** such as a compression coil spring are locked to the spring locking projection **35a** of one clamp claw **23a** and the spring locking projection **36b** of the plate base **22a**. The end portions of a similar spring member **24** such as a compression coil spring is locked to the spring locking projection **35b** of the other clamp claw **23b** and the spring locking projection **36a** of the plate base **22a**. The two spring members **24** bias the clamp claws **23a** and **23b** in a direction in which the two clamp claws **23a** and **23b** approach each other. Specifically, since the two clamp claws **23a** and **23b** are rotatably supported by the pivot shafts **25** on the support plate **22**, the two spring members **24** bias the two clamp claws **23a** and **23b** so as to narrow the opening angle of the two clamp claws **23a** and **23b**.

(40) In the present embodiment, the two clamp claws **23a** and **23b** are biased in the direction of

approaching by the two spring members **24** whose one ends are supported by the support plate **22**, but both end portions of one spring member **24** may be connected to each of the two clamp claws **23a** and **23b**.

(41) FIGS. **4** and **5** are diagrams showing the behavior of the meat separator **12** when separating the meat part **m** around the tibia **b2** of the bone-in meat **2**, and FIGS. **6** and **7** are diagrams showing the behavior of the meat separator **12** when separating the meat part and the membrane around the knee joint **b3** of the bone-in meat **2**. FIG. **6** is a side view of the meat separator **12** similar to FIG. **4**, and FIG. **7** is a plan view of the meat separator **12** similar to FIG. **5**.

(42) Hereinafter, with appropriate reference to FIGS. **4** to **7** and FIG. **1**, the processing of the bone-in meat **2** by the meat part separating apparatus **1** will be described.

(43) First, the movable clamp block **15B** is separated from the fixed clamp block **15A** by operating the air cylinder **17**.

(44) In this state, the bone-in meat **2** that has undergone the incision processing around the ankle **b4** and the incision processing along the bone part **b** is held by the clasper **10** and descends toward the meat separator **12**. In this way, when the incision portion of the meat part **m** of the bone-in meat **2** descends to the height position of the fixed clamp block **15A** of the meat separator **12**, the movable clamp block **15B** is displaced close to the fixed clamp block **15A** by the operation of the air cylinder **17**. As a result, through the incision portion of the bone-in meat **2**, the bone part receiving portion **21** (the scraping contact portions **15At**) of the fixed clamp block **15A** and the bone part receiving portion **31** (the scraping contact portion **15Bt**) of the movable clamp block **15B** come into contact with the outer surface of the bone part **b** so as to surround the outer peripheral surface of the bone part **b** (the tibia **b2**) of the bone-in meat **2**.

(45) At this time, the operation of the air cylinder **17** is stopped, and the biasing force of the biasing part of the air cylinder **17** causes the bone part receiving portion **31** (the scraping contact portion **15Bt**) of the movable clamp block **15B** to be pressed against the outer peripheral surface of the bone part **b**.

(46) Moreover, the bone part receiving portion **31** (the scraping contact portion **15Bt**) of the movable clamp block **15B** is formed by the contact blades **32** of the clamp claws **23a** and **23b**, and thus, at this time, the pair of clamp claws **23a** and **23b** receive a reaction force in a separating direction from the bone part **b** while receiving the biasing force of the spring member **24**. For this reason, the contact blades **32** of the pair of clamp claws **23a** and **23b** which constitute the bone part receiving portion **31** are elastically pressed against the outer surface of the bone part **b** in the direction of approach and separation of the block and the width direction.

(47) In this state, the bone-in meat **2** held by the clasper **10** is raised by the operation of the lifting device **11**. At this time, as shown in FIGS. **4** and **5**, in a state where the bone part receiving portions **21** and **31** of the fixed clamp block **15A** and the movable clamp block **15B** are pressed against the outer surface of the tibia **b2**, only the bone part **b** is pulled upward. For this reason, the meat part **m** attached to the periphery of the tibia **b2** is scraped off the periphery of the tibia **b2** by the meat separator **12**. Moreover, at this time, the clamp claws **23a** and **23b** of the movable clamp block **15B** are elastically pressed against the outer surface of the bone part **b** in the direction of approach and separation of the block and in the width direction, and thus the clamp claws **23a** and **23b** reliably come into close contact with the outer surface of the tibia **b2** even if the outer diameter or shape of the tibia **b2** changes slightly in the longitudinal direction.

(48) In this way, the meat part **m** scraped off the tibia **b2** overlaps the outer surface of the meat part **m** on the femur **b1** side in a state in which its front and back reversed.

(49) Thereafter, when the bone-in meat **2** held by the clasper **10** is further raised by the operation of the lifting device **11**, the bone part receiving portion **21** and **31** of the fixed clamp block **15A** and the movable clamp block **15B** reach a large bulged portion of the knee joint **b3** of the bone-in meat **2**. At this time, as shown in FIGS. **6** and **7**, the pair of clamp claws **23a** and **23b** of the movable clamp block **15B** receive a contact reaction force from the bulged portion of the knee joint **b3**, are

displaced to move backward in the direction of approach and separation of the block against the force of the biasing part of the air cylinder **17**, and are displaced to be separated from each other in the width direction against the biasing force of the spring member **24**.

(50) Thereafter, when the bone-in meat **2** held by the clasper **10** is further raised by the operation of the lifting device **11**, the bone part receiving portion **21** and **31** of the fixed clamp block **15A** and the movable clamp block **15B** are pressed against the outer surface of the femur **b1** of the bone-in meat **2**, and the meat part **m** is separated from the periphery of the femur **b1**.

(51) As described above, the meat separator **12** of the present embodiment is configured such that the scraping contact portion **15Bt** (the contact blades **32** of the clamp claws **23a** and **23b**) of the movable clamp block **15B** is displaceable in a plurality of directions along the outer surface shape of the bone part **b** of the bone-in meat **2** and the displacement in the direction moving away from the bone part **b** is elastically pushed back by the spring member **24** which is a biasing function portion. For this reason, when the meat part **m** is separated from the bone part **b** of the bone-in meat **2**, the scraping contact portions **15At** and **15Bt** of the fixed clamp block **15A** and the movable clamp block **15B** are pressed against the outer peripheral surface of the bone part **b** from the plurality of directions. Therefore, in a case where the meat separator **12** of the present embodiment is adopted, the scraping contact portions **15At** and **15Bt** come into closer contact with the outer peripheral surface of the bone part **b**, and the meat part **m** can be efficiently and stably separated from the bone part **b** of the bone-in meat **2**. As a result, it is possible to minimize the occurrence of a phenomenon in which the meat part **m** remains largely attached to the bone part **b**, or a phenomenon in which some of the separated bone part **b** remains as residual bone in the meat part **m**.

(52) Further, the meat separator **12** of the present embodiment includes the approaching device (the air cylinder **17** and the rotation arm **16**) that displaces the movable clamp block **15B** close to the fixed clamp block **15A**, and the movable clamp block **15B** includes the pair of clamp claws **23a** and **23b** that are relatively displaceable in the width direction and the spring member **24** (the biasing function portion) that biases the pair of the clamp claws **23a** and **23b** in the direction in which the pair of the clamp claws **23a** and **23b** approach each other. The pair of clamp claws **23a** and **23b** are provided with the contact blades **32** that form the concave bone part receiving portion **31** that receives the outer peripheral surface of the bone part **b** between the contact blades **32**. For this reason, when the contact blades **32** of the clamp claws **23a** and **23b** are pressed against the outer peripheral surface of the bone part **b** in the direction in which the blocks approach and separate by the approaching device, the two contact blades **32** come into contact with the outer peripheral surface of the bone part **b** in the width direction while receiving the biasing force of the spring member **24**.

(53) Therefore, in a case where the meat separator **12** of the present embodiment is adopted, it is possible to make the scraping contact portion **15At** of the fixed clamp block **15A** and the scraping contact portion **15Bt** of the movable clamp block **15B** follow the outer surface shape of the bone part **b** and reliably come into contact therewith in the plurality of directions.

(54) Furthermore, in the meat separator **12** of the present embodiment, by appropriately changing the spring member **24** to one having a different spring constant, the pressing force of the contact blades **32** against the outer peripheral surface of the bone part **b** can be easily changed.

(55) Furthermore, in the meat separator **12** of the present embodiment, the air cylinder **17** that constitutes the approaching device incorporates the biasing part for biasing the movable clamp block **15B** in the direction toward the fixed clamp block **15A**. For this reason, the scraping contact portion **15Bt** (the contact blades **32**) flexibly follows the outer surface shape of the bone part **b** to be displaced in the direction in which the blocks approach and separate and in the width direction while the scraping contact portion **15Bt** (the contact blades **32**) of the movable clamp block **15B** is pressed against the outer surface of the bone part **b**. As a result, the scraping contact portions **15At** and **15Bt** are not pressed against the bone part **b** with an excessive force, and thus it possible to

prevent damage or nicks to the bone part b in advance.

## Second Embodiment

(56) FIG. 8 is a plan view of a meat separator **112** of a second embodiment.

(57) In the meat separator **12** of the first embodiment described above, the movable clamp block **15B** is configured to include the pair of clamp claws **23a** and **23b** that are relatively displaceable in the width direction, and the fixed clamp block **15A** is constituted by one fixed clamp claw **20**. On the other hand, in the meat separator **112** of the present embodiment, a fixed clamp block **115A** is also configured to include a pair of clamp claws **20a** and **20b** that are relatively displaceable in the width direction. The pair of clamp claws **20a** and **20b** are biased in a direction in which they approach each other by the spring member **24**, similarly to the movable clamp block **15B**.

(58) The clamp claws **20a** and **20b** of the fixed clamp block **115A** have the same shape as the clamp claws **23a** and **23b** of the movable clamp block **15B**. That is, the tip end portions of the clamp claws **20a** and **20b** are provided with the contact blades **32** that form a concave bone part receiving portion **121** therebetween.

(59) In the case of the meat separator **112** of the present embodiment, when the scraping contact portion **15Bt** of the movable clamp block **15B** and the scraping contact portion **115At** of the fixed clamp block **115A** are pressed against the outer surface of the bone part b by the operation of the approaching device, the pairs of clamp claws **20a**, **20b**, **23a**, and **23b** of both clamp blocks **115A** and **15B** are displaced in the width direction against the biasing force of the spring member **24**. As a result, the scraping contact portions **115At** and **15Bt** (the clamp claws **20a**, **20b**, **23a**, and **23b**) of both clamp blocks **115A** and **15B** are elastically pressed against the outer peripheral surface of the bone part b in more multiple directions.

(60) Therefore, in a case where the meat separator **112** of the present embodiment is adopted, the scraping contact portions **115At** and **15Bt** of both clamp blocks **115A** and **15B** come into close contact with the outer peripheral surface of the bone part b in the more multiple directions, and the meat part m can be more efficiently and stably separated from the bone part b of the bone-in meat **2**.

## Third Embodiment

(61) FIG. 9 is a plan view of a meat separator **212** of a third embodiment.

(62) In the meat separator **212** of the present embodiment, two movable clamp blocks **15B** and **15C** are disposed approximately 120 degrees shifted around the center of the bone part b so as to face the tip end portion of one fixed clamp block. The two movable clamp blocks **15B** and **15C** have the same structure as the movable clamp block **15B** of the first embodiment. The two movable clamp blocks **15B** and **15C** are moved in a direction approaching the fixed clamp block **15A** by an approaching device (not shown). As a result, the scraping contact portions **15Bt** and **15Ct** of the movable clamp blocks **15B** and **15C** clamp the outer peripheral surface of the bone part b together with the scraping contact portion **15At** of the fixed clamp block **15A**. At this time, the pair of clamp claws **23a** and **23b** of the each movable clamp block **15B** and **15C** follow the outer surface shape of the bone part b to be displaced in the width direction while the pair of clamp claws **23a** and **23b** are pressed against the outer peripheral surface of the bone part b by the biasing force of the spring member **24**.

(63) The meat separator **212** of the present embodiment has the same configuration as the first embodiment except that the two movable clamp blocks **15B** and **15C** are disposed approximately 120 degrees shifted around the center of the bone part b. For this reason, the meat separator **212** of the present embodiment can obtain the same basic effect as the first embodiment, but it is possible to clamp the outer peripheral surface of the bone part b in three directions by one fixed clamp block **15A** and two movable clamp blocks **15B** and **15C**.

(64) In the meat separator **212** of the present embodiment, the pair of clamp claws **23a** and **23b** of the movable clamp blocks **15B** and **15C** flexibly follows the outer peripheral surface of the bone part b while receiving the biasing force of the spring member **24**, and thus the multiple scraping

contact portions **15At**, **15Bt**, and **15Ct** can be brought into close contact with the outer peripheral surface of the bone part **b** in more multiple directions. For this reason, the meat part **m** can be further efficiently and stably separated from the bone part **b** of the bone-in meat **2**.

#### Fourth Embodiment

(65) FIG. **10** is a plan view of a meat separator **312** of a fourth embodiment.

(66) The meat separator **312** of the present embodiment includes a fixed clamp block **15A** that is fixed to the factory equipment, and a movable clamp block **315B** that is displaceable in a direction of approaching the fixed clamp block **15A** and a direction of separating from the fixed clamp block **15A**. The movable clamp block **315B** is operated in the approaching direction by an approaching device similarly to the first embodiment described above.

(67) The fixed clamp block **15A** has the same structure as that of the first embodiment.

(68) The movable clamp block **315B** has a pair of holding arms **50a** extending in a connecting plate **50** held by the approaching device so as to form a substantially U-shape in a plan view. Both end portions of a metal wire **55**, which is a linear elastic member, are fixed to the pair of holding arms **50a**. The metal wire **55** is held under tension by the pair of holding arms **50a**.

(69) In the present embodiment, the metal wire **55**, which is a linear elastic member, constitutes a scraping contact portion of the movable clamp block **315B**. When the metal wire **55** held by the holding arms **50a** is pressed against the outer peripheral surface of the bone part **b** of the bone-in meat, the metal wire **55** is elastically deformed along the shape of the outer peripheral surface of the bone part **b** and comes into close contact with the outer peripheral surface of the bone part **b**. When the bone part **b** moves relative to the meat separator **312** in the longitudinal direction in this state, the meat part can be scraped off the bone part **b** by the metal wire **55**. In the present embodiment, the metal wire **55** also constitutes a biasing function portion that elastically pushes back the displacement of the scraping contact portion in a direction of separating from the bone part **b**.

(70) The approaching device (not shown) that displaces the movable clamp block **315B** in the direction toward the fixed clamp block **15A** includes a biasing part such as a spring member that biases the movable clamp block **315B** in a direction of approaching the fixed clamp block **15A**, as in the first embodiment.

(71) As described above, the meat separator **312** of the present embodiment is configured such that the metal wire **55** that is the scraping contact portion of the movable clamp block **315B** is displaceable in a plurality of directions along the outer surface shape of the bone part **b** of the bone-in meat **2** and the displacement in the direction separating from the bone part **b** is elastically pushed back by the elasticity of the metal wire **55** itself. For this reason, when the meat part is separated from the bone part **b** of the bone-in meat **2**, the scraping contact portion **15At** of the fixed clamp block **15A** and the metal wire **55** (the scraping contact portion) of the movable clamp block **315B** are pressed against the outer peripheral surface of the bone part **b** from a plurality of directions.

(72) Therefore, in a case where the meat separator **312** of the present embodiment is adopted, the scraping contact portion **15At** of the fixed clamp block **15A** and the metal wire **55** of the movable clamp block **315B** come into closer contact with the outer peripheral surface of the bone part **b**, and the meat part can be efficiently and stably separated from the bone part **b** of the bone-in meat.

(73) In the embodiment shown in FIG. **10**, the metal wire **55** (the elastic member) is adopted as the scraping contact portion only in the movable clamp block **315B**, but the same metal wire **55** may also be adopted in the scraping contact portion of the fixed clamp block **15A**. In this case, the scraping contact portions of the fixed clamp block **15A** and the movable clamp block **315B** come into closer contact with the outer peripheral surface of the bone part, and the meat part can be more efficiently and stably separated from the bone part **b** of the bone-in meat.

(74) Further, the meat separator **312** of the present embodiment includes the approaching device that displaces the movable clamp block **315B** close to the fixed clamp block **15A**, the scraping contact portion of the movable clamp block **315B** is constituted by the elastic member (the metal

wire 55), and, at the same time, the elastic member (the metal wire 55) also constitutes the biasing function portion that elastically pushes back the displacement in the direction of separating from the bone part b. For this reason, the structure has a small number of parts and can be made smaller and lighter, and it is also possible to bring the scraping contact portion into closer contact with the outer peripheral surface of the bone part b of the bone-in meat and to more efficiently and stably peel the meat part off the bone part b.

(75) Furthermore, the meat separator **312** of the present embodiment adopts the metal wire **55** as the elastic member used in the scraping contact portion. For this reason, it is possible to easily obtain a high load-bearing capacity when the meat part is separated from the bone part b, and it is possible to more reliably separate the meat part from the bone part b.

(76) Further, in the meat separator **312** of the present embodiment, the approaching device that displaces the movable clamp block **315B** includes a biasing part such as a spring member that biases the movable clamp block **315B** in a direction toward the fixed clamp block **15A**. For this reason, the entire metal wire **55** is displaced to flexibly follow the outer surface shape of the bone part b while the metal wire **55** of the movable clamp block **315B** is reliably pressed against the outer surface of the bone part b. As a result, the scraping contact portion **15At** and the metal wire **55** are no longer pressed against the bone part b with an excessive force, and thus it possible to prevent damage or injury to the bone part b in advance.

(77) The present invention is not limited to the above embodiments, and various design changes can be made without departing from the scope thereof.

(78) For example, in the first to third embodiments described above, the concave scraping contact portion is formed by the contact blades of the pair of displaceable clamp claws, but the scraping contact portion is not limited to this configuration. For example, the scraping contact portion may be constituted by the contact blades of three or more displaceable clamp claws, and the three or more clamp claws may be biased by a spring member in a direction of approaching each other.

(79) Further, in the fourth embodiment shown in FIG. **10**, the metal wire **55** is adopted as the elastic member used in the scraping contact portion, but the elastic member is not limited to this. The elastic member may be made of a wire material other than a metal, such as a resin. For example, the elastic member can be made of a material such as an elastomer that is not harmful even if it comes into contact with food and has excellent cleanability. Further, the shape of the elastic member is not limited to a wire shape. The elastic member may have a band-like shape, for example.

(80) Furthermore, in the fourth embodiment shown in FIG. **10**, one movable clamp block **315B** is disposed to face the fixed clamp block **15A**, but as in the third embodiment shown in FIG. **9**, the three or more clamp blocks may be disposed in an annular shape around the bone part.

(81) Furthermore, in each of the above embodiments, the scraping contact portion (the clamp claws **23a** and **23b** or the metal wire **55**) of the clamp block is displaceable only in a radial direction centered on the bone part, but the direction of displacement of the scraping contact portion may be a direction that intersects with the radial direction centered on the bone part.

(82) Furthermore, in each of the above embodiments, the fixed clamp block that is fixed to the factory equipment is combined with the several movable clamp blocks that approach and separate from the fixed clamp block, but all of the clamp blocks may also be constituted by the movable clamp blocks that approach and separate from the bone part.

#### REFERENCE SIGNS LIST

(83) **1** Meat part separating apparatus **2** Bone-in meat **10** Clamper **11** Lifting device (moving device) **12**, **112**, **212**, **312** Meat separator **15A**, **115A** Fixed clamp block (clamp block) **15B**, **15C**, **315B** Movable clamp block (clamp block) **15At**, **15Bt**, **115At** Scraping contact portion **16** Rotation arm **17** Air cylinder (approaching device) **20a**, **20b** Clamp claw **23a**, **23b** Clamp claw **24** Spring member (biasing function portion) **31** Bone part receiving portion **32** Contact blade **55** Metal wire (elastic member, scraping contact portion, biasing function portion) m Meat part b Bone part

## Claims

1. A meat separator that separates a meat part attached to a bone part by coming into contact with an outer peripheral surface of the bone part of bone-in meat that moves relatively with respect to the meat separator, the meat separator comprising: a plurality of clamp blocks in which each of the plurality of clamp blocks include a scraping contact portion that comes into contact with the outer peripheral surface of the bone part and in which each of the scraping contact portions cooperate with each other so as to clamp the outer peripheral surface of the bone part, wherein at least one of the clamp blocks is configured so that at least a part of the scraping contact portion of the clamp block is displaceable in a plurality of directions along an outer surface shape of the bone part, and the at least one of the clamp blocks includes a biasing function portion that is configured to elastically push back the displacement in a direction moving away from the bone part.
  2. The meat separator according to claim 1, further comprising: an approaching device that is configured to relatively displace the at least one of the clamp blocks closer to other clamp blocks, wherein the at least one of the clamp blocks includes: a pair of clamp claws that are configured to be displaceable in a direction intersecting with an approaching displacement direction in which the at least one of the clamp blocks is relatively displaced closer to the other clamp blocks, and a spring member that is configured to bias the pair of clamp claws in a direction in which the pair of clamp claws approach each other, wherein the pair of clamp claws are provided with contact blades that form a concave bone part receiving portion that receives the outer peripheral surface of the bone part between the contact blades, wherein the spring member constitutes the biasing function portion, and wherein the contact blade of each of the clamp claws constitutes the scraping contact portion.
  3. The meat separator according to claim 1, further comprising: an approaching device that is configured to relatively displace the at least one of the clamp blocks close to other clamp blocks, wherein the scraping contact portion of the at least one of the clamp blocks is constituted by an elastic member that elastically deforms so as to follow a shape of the outer peripheral surface of the bone part by coming into contact with the outer peripheral surface of the bone part, and wherein the biasing function portion is also constituted by the elastic member.
  4. The meat separator according to claim 2, wherein the approaching device includes a biasing part that biases the at least one of the clamp blocks and the other clamp blocks in a direction in which the at least one of the clamp blocks and the other clamp blocks approach each other.
  5. A meat part separating apparatus for bone-in meat comprising: a bone part holding device that is configured to hold a bone part of the bone-in meat; a meat separator that separates a meat part attached to the bone part by coming into contact with an outer peripheral surface of the bone part of bone-in meat that moves relatively with respect to the meat separator, the meat separator comprising: a plurality of clamp blocks in which each of the plurality of clamp blocks include a scraping contact portion that comes into contact with the outer peripheral surface of the bone part and in which each of the scraping contact portions cooperate with each other so as to clamp the outer peripheral surface of the bone part, wherein at least one of the clamp blocks is configured so that at least a part of the scraping contact portion of the clamp block is displaceable in a plurality of directions along an outer surface shape of the bone part, and the at least one of the clamp blocks includes a biasing function portion that is configured to elastically push back the displacement in a direction moving away from the bone part; and a moving device that is configured to relatively move the bone part holding device and the meat separator approximately in a longitudinal direction of the bone part held by the bone part holding device.
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