Poultry leg boning apparatus
Vorrichtung zum Ausbeinen von Geflügelbeinen
Dispositif à désosser des pattes de volailles

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Proprietors:
• GORDEX CORPORATION
  Isehara-shi, Kanagawa-ken (JP)
• FOODCRAFT EQUIPMENT COMPANY, INC.
  Lancaster Pennsylvania 17601 (US)

Inventor: Sekiguchi, Mitsuaki
Isehara-shi, Kanagawa-ken (JP)

Representative: Grünecker, Kinkeldey,
Stockmair & Schwahnhäusser
Anwaltsozietät
Maximilianstrasse 58
80538 München (DE)

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Description

The present invention relates to a poultry leg boning apparatus for removing meat from the poultry legs.

When the meat is manually removed from the poultry leg, the boning work is carried out with a knife by means of the following steps:

1. cutting the meat of the leg along the upper and lower leg bones;
2. cutting the knee joint so as to separate the upper leg bone from the lower leg bone;
3. pulling up the upper leg bone at the lower end thereof or the knee joint and plucking off the upper leg bone from the leg meat;
4. peeling the meat off the leg along the lower leg bone toward the knee joint so as to make the meat connected only to the knee joint by meat-to-bone connecting tendon tissues; and
5. cutting the meat-to-bone connecting tendon tissues so as to remove the lower leg bone from the leg meat.

The above steps of the manual boning require skill and physical stamina so that it has been desirable to automate them. Especially in the step (1), there has been the problem that, if a force biasing the knife against the bones is too large, the knife chips the bones and the chips of the bones are left on the meat, which decreases the economic value of the meat. Or, if the force biasing the knife against the bones is too small, the knife comes to be detached from the bones and a certain amount of meat is left on the bones, which decreases the yield of the meat removed from the leg. In the step (5), there has been the problem that, it is hard to bias the knife against the knee joint stably because the knee joint is round and the meat-to-bone connecting tendon tissues are hard, this results in a hazard to the operator or may decrease the commercial value of the meat because of the rough cut surface.

Various types of machines and methods for removing the meat from the poultry leg have been proposed. For example, U.S. Pat. No. 2,897,536 to Bergstrom et al, dated Aug. 4, 1959 discloses a machine wherein the leg is passed through a space between a pair of rotating rollers so that the meat is removed from the leg. U.S. Pat. No. 3,261,054 to Kaplan et al, dated July 19, 1966 discloses a machine wherein the leg is passed through a space between a pair of stripper bars so that the meat is removed from the leg. U.S. Pat. No. 3,965,535 to Kaplan et al, dated June 29, 1976 discloses a machine wherein the leg is passed through a space between a pair of discs rotating with their closely spaced peripheral stripping edges in opposition so that the meat is removed from the leg. U.S. Pat. No. 3,348,261 to Segur dated Oct. 24, 1967 discloses a method wherein the meat of the leg is sliced along at least one side of the leg bone, and thereafter the meat is plowed in opposite directions along the upper leg bone and the lower leg bone toward the knee joint.

By means of the above machines and methods, the meat of the leg is forced along the leg bone thereby being removed therefrom. Thus, because of excessive deformation during the boning process, the meat, especially the meat of the upper leg portion, is liable to be damaged more seriously compared with the manually processed meat. Japanese Patent Publication No. 60-23810 dated June 10, 1985 discloses a boning machine having a rotating annular cutter belt. By the machine, the meat between the going run of the cutter belt and the returning run of the cutter belt is left on the leg bone, so that the yield rate of the meat removed from the leg is lower than that by the manual separation.

SUMMARY OF THE INVENTION

The present invention is a part of a machine for automatically carrying out all of the steps of manual boning work.

An object of the present invention is to provide a poultry leg boning apparatus and method according to claims 1, 6 and 11. Preferred embodiments are defined by the dependant claims.

Further objects, features and advantages of the present invention will become apparent from the Detailed Description of the Preferred Embodiments when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Figure 1 is a perspective view showing a general arrangement of a poultry leg boning apparatus in accordance with the preferred embodiment of the present invention;
Figure 2 is a perspective view showing a first, cutting machine for cutting open a poultry leg along the upper leg bone and the lower leg bone, which defines a part of the poultry leg boning apparatus in Figure 1;
Figure 3 is an enlarged detail of a clamp assembly for clamping a poultry leg, which defines a part of the cutting machine of Figure 2;
Figure 4 is an enlarged detail of cutting blades of the cutter assembly of the cutting machine of Figure 2;
Figure 5 is a perspective view showing a biased roll assembly of the cutting machine of Figure 2;
Figures 6A–6D are plan views showing the operation of the cutting machine of Figure 2;
Figure 7 is an enlarged detail of another embodiment of the clamp assembly of Figure 3;
Figure 8 is a perspective view of another embodiment of the cutting machine;
Figure 9 is a perspective view showing a second, tendon cutting machine for removing the lower leg bone of the poultry leg, which defines a part of the poultry leg boning apparatus of Figure 1;
Figure 10 is a cross-sectional view showing the construction of a cutter assembly of the second, tendon cutting machine of Figure 9; and
Figures 11A - 11C are perspective views showing the operation of the tendon cutting machine of Figure 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, a poultry leg boning apparatus in accordance with the preferred embodiment of the present invention comprises a first, cutting machine A for cutting open the poultry leg along the upper leg bone and the lower leg bone, a second, tendon cutting machine B for removing the lower leg bone of the poultry leg, and a working table C disposed between the cutting machine A and the tendon cutting machine B. In the poultry leg boning apparatus, the step (1) in the manual boning process is carried out automatically by the cutting machine A, and the step (5) in the manual boning process is carried out automatically by the tendon cutting machine B. The steps (2) - (4) in the manual boning process are carried out manually on the working table C.

The cutting machine A, the tendon cutting machine B, and the working table C will be described in detail as follows.

First, Cutting Machine A

The first, cutting machine A will be described with reference to Figures 2 to 8. The cutting machine A described in the following is so constructed as to cut open right poultry legs. In the following descriptions, the directions indicated by arrows I, II, III, IV, V and VI in Figure 2 are referred to as forward direction, rearward direction, leftward direction, rightward direction, upward direction and downward direction, respectively. Moreover, in the following descriptions, the direction parallel to the arrows I, II is referred to as the longitudinal direction, the direction parallel to the arrows III, IV is referred to as the transverse direction, and the direction parallel to the arrows V, VI is referred to as the vertical direction, respectively.

In Figure 2, 1a, 1b are sprockets supported by the frame of cutting machine A. Sprockets 1a, 1b are rotatably supported around horizontal axes x1, x2, respectively. The horizontal axes x1, x2 extend in parallel with one another and in the transverse direction. The frame of the cutting machine A is not illustrated for simplicity. An endless chain 2 engages the sprockets 1a and 1b. A motor 1c drives the sprocket 1b, and thereby drives the upper run 2a of the endless chain 2 forward.

As shown in Figure 2, the endless chain 2 has a plurality of clamp assemblies 3 for clamping poultry legs. These assemblies 3 are fixed to the chain 2 at a predetermined distance with each other. The construction of the clamp assembly 3 will be described with reference to Figure 3. The clamp assembly 3 includes a body 3a, the horizontal cross section of which is hook-shaped. A leg 3a1 of the body 3a extends in the longitudinal direction, and the other leg 3a2 of the body 3a extends rightward from the fore end of the leg 3a1. The leg 3a1 is fixed to the endless chain 2 by a bracket 3b which extends leftward from the leg 3a1. A shaft 3c extends in the longitudinal direction through the leg 3a2. The shaft 3c is carried by the leg 3a2 so that it rotates around its longitudinal axis and is fixed in the longitudinal direction. A first clamping member 3d is fixed to the rear end of the shaft 3c. The first clamping member 3d comprises a channel bar having an U-shaped groove extending in the longitudinal direction and closed at its fore end. An arm 3e extends at a right angles to the shaft 3c, and is fixed to the fore end of the shaft 3c at one end. The other end of the arm 3e is provided with a guide-rod 3f, which is rotatable around the arm 3e. A stopper 3g is fixed to the upper surface of the fore end of the leg 3a1. A spring 3h connects the stopper 3g with the arm 3e. The arm 3e is biased toward the stopper 3g around the longitudinal axis of the shaft 3c by the spring 3h, and is abutted against the stopper 3g, so that the arm 3e is held upright when no rightward force acts on the guide-rod 3f.

When the arm 3e is held upright, the open end of the U-shaped groove of the first clamping member 3d is directed upward. Hereinafter, the condition wherein the arm 3e is abutted against the stopper 3g so as to be held upright, and the open end of the U-shaped groove of the first clamping member 3d is directed upward, is referred to as the initial condition of the clamp assembly 3. A second clamping member 3j is fixed to the right side surface of the leg 3a1. The second clamping member 3j is bent rightward at a rear end portion 3j1. A clearance is provided between the rear end portion 3j1 of the second clamping member 3j and the rear end of the first clamping member 3d. The rear end portion 3j1 is provided with a U-shaped cutout 3j2 having an open upper end. The U-shaped cutout 3j2 is aligned with the U-shaped groove of the first clamping member 3d in the initial condition of the clamp assembly 3. The width L of the U-shaped cutout 3j2 of the second clamping member 3j is a little smaller than the width L of the U-shaped groove of the first clamping member 3d. The bracket 3b is provided with a protrusion 3k on its upper surface.

As shown in Figure 2, a line cam 4 made of a curved rod is disposed to the right of the upper run 2a of the endless chain 2. The line cam 4 extends in the longitudinal direction. The line cam 4 is disposed to the left of and above the clamp assembly 3 in the vicinity of the rear end of the upper run 2a of the endless chain 2. At the midway point of the upper run 2a, the line cam 4 is bent to the right of the clamp assembly 3 and is also bent downward to a height a little higher than the shaft 3c of the clamp assembly 3. In the vicinity of the fore end of the upper run 2a of the endless chain 2, the line cam 4 is disposed at a height a little higher than the shaft 3c of the clamp assembly 3, to the right of the clamp assembly.
3, and extends in the longitudinal direction. The line cam 4 is fixed to the frame (not shown) of the cutting machine A.

As shown in Figure 2, a rectangular table 5 is disposed to the right of the endless chain 2. The rectangular table 5 is disposed a little below the clamp assembly 3 fixed to the upper run 2a of the endless chain 2, and extends horizontally and longitudinally. The rectangular table 5 is also fixed to the frame of the cutting machine A.

As shown in Figure 2, a cutter assembly 6 is disposed in the vicinity of the fore end of the upper run 2a of the endless chain 2. The cutter assembly 6 is disposed to the right of the upper run 2a.

The cutter assembly 6 has an air cylinder 6a. The air cylinder 6a is fixed to the frame of the cutting machine A by a bracket 6b. The piston 6a1 of the air cylinder 6a extends downward. The upper end of a rectangular cutter base 6c is connected to the lower end of the piston 6a1. The cutter base 6c is supported to move only in the vertical direction by guides 6d fixed to the frame of the cutting machine A. A rotation shaft 6e is disposed to the rear of the cutter base 6c and extending in the vertical direction is supported rotatably around its vertical axis by two bearings fixed to the cutter base 6c. The two bearings are not illustrated for simplicity.

A coil spring 6g fits on the rotation shaft 6e. The coil spring 6g engages, with one end, a hole 6c2 of an eye plate 6c1. The eye plate 6c1 is fixed to the cutter base 6c and extends rearward. The other end of the coil spring 6g is fixed to a plate member 6f which is in turn fixed to the lower end of the rotation shaft 6e. The coil spring 6g applies an initial moment M1 to the rotation shaft 6e so as to drive the rotation shaft 6e rotationally in the direction indicated by a double arrow, or counterclockwise as viewed downward.

An arm 6e1 is fixed to the upper end of the rotation shaft 6e. The arm 6e1 abuts against a stopper 6c3 which is fixed to the cutter base 6c and extends rearward, thereby keeping the rotation shaft 6e from rotating in the direction indicated by the double arrow.

The upper end of a connection shaft 6h is fixed to the lower surface of the plate member 6f. The lower end of the connection shaft 6h is fixed to a connection bracket 6j. The connection shaft 6h is located offset leftwardly relative to the rotation shaft 6e.

The upper end of a cutter body 6k is fixed to the connection bracket 6j. The cutter body 6k is located offset forwardly relative to the rotation shaft 6h. The cutter body 6k comprises a rectangular plate and is provided with a fixed cutting blade 6m at its lower end.

As shown in Figure 4, the fixed cutting blade 6m comprises an upper portion 6m1 made of a rectangular plate, and a lower portion 6m2. The lower portion 6m2 has a wedge shaped configuration in horizontal cross section and extends rearward from the lower end of the upper portion 6m1. The front surface of the upper portion 6m1 is fixed to the rear surface of the cutter body 6k. The wedge shaped horizontal sectional configuration of the lower portion 6m2 is formed such that the rear portion is thinner than the fore portion, and the maximum thickness of the fore portion is substantially one half of the width of the upper portion 6m1. The lower portion 6m2 is located offset rightward relative to the centerline of the upper portion 6m1. The lower edge of the lower portion 6m2 inclines downward from its fore end toward its rear end, so that the rear edge of the lower portion 6m2 forms a sharp tip 6m2' .

As shown in Figure 2, a motor 6n is mounted on the cutter body 6k. A shaft 6p extends through the cutter body 6k below the motor 6n, and is rotatably supported around its longitudinal axis by the cutter body 6k. The shaft 6p is connected to the output shaft of the motor 6n by a belt 6q. A pin 6r is eccentrically fixed to the rear end of the shaft 6p and extends rearward. A rod 6s is rotatably supported by the rear end portion of the pin 6r around the longitudinal axis of the pin 6r and extends downward. A pin 6t is rotatably supported around its longitudinal axis by the lower end portion of the rod 6s and extends rearward. A rod 6u is rotatably supported by the pin 6t around the longitudinal axis of the pin 6t and extends downward. The rod 6u is supported, movably in the vertical direction, by a guide 6v fixed to the cutter body 6k. A block 6w is fixed to the lower end of the rod 6u.

As shown in Figure 4, the upper end of a movable cutting blade 6x, made of a thin rectangular plate, fits within a slit in the block 6w. The slit is formed on the lower surface of the block 6w and extends in the longitudinal direction. The movable cutting blade 6x is fixed to the block 6w by means of a pin 6y. The block 6w is located such that its fore surface abuts against the rear surface of the upper portion 6m1 of the fixed cutting blade 6m. The movable cutting blade 6x is located so as to abut against the left side surface of the lower portion 6m2 of the fixed cutting blade 6m. The left side surface defines the rear edge of the lower portion 6m2, or a cutting edge 6m3. The movable cutting blade 6x is located so as to protrude slightly rearward from the cutting edge 6m3 at its rear edge 6x1. The lower edge of the movable cutting blade 6x is sharpened to form a sharp cutting edge 6x2, and is made inclined downward from the fore end to the rear end so that the rear edge of the lower edge of the movable cutting blade 6x forms a sharp tip 6x2'. The movable cutting blade 6x is located such that the cutting edge 6x3 protrudes slightly downward from the lower edge of the lower portion 6m2 of the fixed cutting blade 6m when the movable cutting blade 6x is in the lowest position.

The movable cutting blade 6x is disposed to the left of and to the rear of the rotation shaft 6e when the initial moment M0 is applied to the rotation shaft 6e so as to drive the shaft 6e rotationally in the direction indicated by the double arrow. Moreover, the arm 6e1 abuts against the stopper 6c3, thereby keeping the rotation shaft 6e from rotating in the direction indicated by the double arrow. In this condition, the movable cutting blade 6x inclines slightly rightward from the fore edge 6x2 toward the rear edge 6x1 as viewed downward. Also in this condition, the right side surface of the lower portion 6m2 of
the fixed cutting blade 6m, which defines the cutting edge 6m9, extends in the longitudinal direction.

The cutter assembly 6 is located such that the movable cutting blade 6x is situated in the vicinity of the left end of the cutout 3j2 of the second clamping member 3j.

Hereinafter, what is referred to as the initial rotational condition of the movable cutting blade 6x is the condition in which an initial moment M0 is applied to the rotation shaft 6e so as to drive the shaft 6e rotationally in the direction indicated by the double arrow. In the initial rotational condition, the arm 6e1 abuts against the stopper 6c3 thereby keeping the rotation shaft 6e from rotating in the direction indicated by the double arrow. The movable cutting blade 6x is disposed to the left of and to the rear of the rotation shaft 6e, the movable cutting blade 6x inclines slightly rightward from the fore edge 6x2 toward the rear edge 6x1 as viewed downward, and the right side surface of the lower portion 6m2 of the fixed cutting blade 6m extends in the longitudinal direction. That is, the cutting blade 6x is in the initial rotational condition.

As shown in Figure 2, a biasing roll assembly 7 is disposed to the right of the fixed cutting blade 6m. As shown in Figure 5, the biasing roll assembly 7 has a biasing roll 7b rotatably supported by a shaft 7a which extends in the transverse direction. The shaft 7a is fixed to the lower end portion of an upwardly-extending rectangular plate 7c. The upper end of plate 7c is bent leftward and fixed to the rear end portion of a bracket 7d. The fore end portion of the bracket 7d extends upward and is fixed to the cutter base 6c at its upper end portion. A rod 7e extends in the transverse direction through a hole 7c1 formed in the mid portion of the plate 7c. The left end of rod 7e is fixed to the bracket 7d. The portion of the rod 7e located to the right of the plate 7c is fitted with a coil spring 7f. A nut 7g engages the right end portion of the rod 7e so as to apply a compressive force to the coil spring 7f.

As shown in Figure 2, a limit switch 8a is disposed to the rear of the movable cutting blade 6x of the cutter assembly 6 and just above the upper run 2a of the endless chain 2. A limit switch 8b is disposed to the fore of the movable cutting blade 6x of the cutter assembly 6 and just above the upper run 2a of the endless chain 2. The limit switches 8a, 8b are fixed to the frame of the cutting machine A. The limit switches 8a, 8b detect the existence of the clamp assembly 3 when they abut against the protrusion 3k provided on the upper surface of the bracket 3b of the clamp assembly 3. Based on the detection signal from the limit switch 8a, the piston 6a1 of the air cylinder 6a advances downward, and the motor 6n starts. Based on the detection signal from the limit switch 8b, the piston 6a3 of the air cylinder 6a retracts upward, and the motor 6n stops.

The operation of the above constructed cutting machine A is described as follows.

An electric power supply of the cutting machine A is turned on, the motor 1c starts, and the upper run 2a of the endless chain 2 moves forward as indicated by an arrow in Figure 2. The piston 6a1 of the air cylinder 6a is in a retracted position so that the cutter body 6k is pulled up. The initial moment M0 is applied to the rotation shaft 6e so as to drive the rotation shaft 6e in the direction indicated by the double arrow. The arm 6e1 then abuts against the stopper 6c3 thereby keeping the rotation shaft 6e from rotating in the direction indicated by the double arrow. The movable cutting blade 6x is disposed to the left of and to the rear of the rotation shaft 6e, the movable cutting blade 6x is inclined slightly rightward from the fore edge 6x2 toward the rear edge 6x1 as viewed downward, and the right side surface of the lower portion 6m2 of the fixed cutting blade 6m extends in the longitudinal direction. That is, the cutting blade 6x is in the initial rotational condition.

Then, as shown in Figure 2, a right leg S is set into the clamp assembly 3 by an operator, which assembly 3 is located in the vicinity of the rear end of the upper run 2a of the endless chain 2. The clamp assembly 3 is in the initial condition wherein the open end of the U-shaped groove of the first clamping member 3d is directed upward.

The right leg S is set by the following procedure.

1. The inner side surface of the leg S is directed leftward and the outer side surface of the leg S is directed rightward, and the connecting joint between the lower leg bone S1 and the upper leg bone S2 or the knee joint S4 of the leg S protrudes upward.
2. The lower end of the lower leg bone S1 or the ankle S3 of the leg S is inserted into the U-shaped groove of the first clamping member 3d, and the portion of the lower leg bone S1 adjacent to the ankle S3 is inserted into the U-shaped cutout 3j2 of the second clamping member 3j.

Thus, the ankle S3 of the leg S is clamped by the first clamping member 3d, and the portion of the lower leg bone S1 adjacent to the ankle S3 is clamped by the second clamping member 3j.

The leg S set into the clamp assembly 3 then moves forward following the forward movement of the clamp assembly 3 which is driven by the upper run 2a of the endless chain 2. The forward movement of the clamp assembly 3 causes the engagement between the guide-roll 3f and the line cam 4. The guide-roll 3f or the first clamping member 3d is guided by the line cam 4 so as to rotate, against the biasing force of the spring 3h, by 90°, clockwise as viewed in the forward direction. Following the rotation of the first clamping member 3d, the right leg S clamped by the first clamping member 3d is also rotated by 90°, so that the inner side surface of the right leg S is directed upward and the outer side surface of the right leg S abuts against the upper surface of the table 5.

Thereafter, the upper leg bone S2, the lower leg bone S1 and the ankle S3 are all in the same horizontal plane. As viewed downward, the lower leg bone S1 inclines slightly rightward from its fore end toward its rear end, the upper leg bone S2 inclines slightly leftward from its fore end toward its rear end. The open end of the U-
shaped groove of the first clamping member 3d is directed rightward, and the open end of the U-shaped cutout 3j2 of the second clamping member 3j is directed upward.

Thus, the ankle S3 of the leg S can not be released from the first clamping member 3d and the second clamping member 3j in either the vertical direction or the transverse direction. The ankle S3 of the leg S can not go through the U-shaped cutout 3j2 of the second clamping member 3j the width L ‘whereof is made a little smaller than the width L of the U-shaped groove of the first clamping member 3d, so that the ankle S3 of the leg S can not be released from the clamping by the first clamping member 3d and the second clamping member 3j further in the longitudinal direction. The width L of the U-shaped groove of the first clamping member 3d is made larger than the width of the ankle S3 of the leg S and the width L’ of the U-shaped cutout 3j2 of the second clamping member 3j is made larger than the width of the portion of the lower leg bone S1 adjacent to the ankle S3, so that the leg S can rotate to some extent around the ankle S3 in a horizontal plane.

When the clamp assembly 3 moves forward further and the rotation of the first clamping member 3d by 90° is completed, the limit switch 8a detects the existence of the clamp assembly 3, the piston 6a1 of the air cylinder 6a advances downward from the retracted position, and the motor 6n starts. Following the advance of the piston 6a1, the cutter base 6c or the cutter body 6k moves downward. Following the downward movement of the cutter base 6c, the biasing roll assembly 7 or the biasing roll 7b also moves downward. After the start of the motor 6n, the shaft 6p rotates via the belt 6q, the eccentric pin 6r rotates, and the rod 6u reciprocates in the vertical direction via the rod 6s and the pin 6t, so that the movable cutting blade 6x reciprocates vertically between its lowest and highest positions.

When the clamp assembly 3 moves forward further, as shown in Figure 6A, the sharp tip 6m2’ of the fixed cutting blade 6m, which has been moving downward, pierces into the meat of the leg S in the vicinity of the lower leg bone S1 adjacent to the ankle S3. As described above, the movable cutting blade 6x or the fixed cutting blade 6m is located in the vicinity of the left end of the cutout 3j2 of the second clamping member 3j and the lower leg bone S1 inclines slightly rightward from its fore end to its rear end as viewed downward, so that the sharp tip 6m2’ of the fixed cutting blade 6m pierces into the leg S at the left of the lower leg bone S1. The biasing roll 7b abuts against the leg S at the right of the movable cutting blade 6x and at the right of the lower leg bone S1 so as to bias the leg S leftward. As a result, the leg S rotates, clockwise as viewed downward, around the ankle S3. Thus, the lower leg bone S1 extends in the longitudinal direction and the sharp tip 6m2’ of the fixed cutting blade 6m abuts against the left side surface of the lower leg bone S1. When the sharp tip 6m2’ of the fixed cutting blade 6m has pierced into the meat of the leg S to the bone, the piston of 6a1 of the air cylinder 6a reaches the advanced position, and the sharp tip 6m2’ of the fixed cutting blade 6m is retained at that height.

The movable cutting blade 6x is in the initial rotational condition so that the right side surface of the lower portion 6m2 of the fixed cutting blade 6m, the right side surface of which extends in the longitudinal direction, abuts closely against the left side surface of the lower leg bone S1 which extends in the longitudinal direction. The movable cutting blade 6x, which inclines slightly rightward from the fore edge 6x2 to the rear edge 6x1 as viewed downward, abuts against the left side surface of the lower leg bone S1 extending in the longitudinal direction at its rear edge 6x1. The movable cutting blade 6x reciprocates in the vertical direction under the guidance of the left side surface of the lower portion 6m2 of the fixed cutting blade 6m so as to cut open the meat of the leg S. The movable cutting blade 6x is slender and abuts against the left side surface of the lower leg bone S1 at its rear edge 6x1, so that the meat of the leg S is cut open at a position adjacent to the left side surface of the lower leg bone S1. The rear edge 6x1 of the movable cutting blade 6x protrudes only slightly rearward from the cutting edge 6m3 of the lower portion 6m3 of the fixed cutting blade 6m, so that the movable cutting blade 6x neither cuts into nor chips off the lower leg bone S1.

As the clamp assembly 3 moves forward and the leg S moves forward, the meat of the leg S is cut open by the movable cutting blade 6x along the left side surface of the lower leg bone S1 extending in the longitudinal direction. The opening made by the cutting blade 6x is further enlarged by the wedge shaped lower portion 6m2 of the fixed cutting blade 6m.

When the meat of the leg S is cut open by the lower portion 6m2, it applies forward resistant force to the rear edge 6m3 of the lower portion 6m2. The movable cutting blade 6x and the fixed cutting blade 6m are located offset leftward relative to the rotation shaft 6e, so that a resistant moment, directed opposite to the direction indicated by the double arrow in Figure 2, is generated around the rotation shaft 6e by the forward resistant force applied to the rear edge 6m3. But, the forward resistant force is small because it is applied by the meat of the leg S, so that the resistant moment generated around the rotation shaft 6e does not exceed the initial moment M0. Thus, the movable cutting blade 6x is retained in the initial rotational condition.

When the clamp assembly 3 moves forward further, as shown in Figure 6B, the right side surface of the lower portion 6m2 of the fixed cutting blade 6m comes to abut against the portion of the lower leg bone S1 adjacent to the knee joint S4. The left side surface of the portion of the lower leg bone S1 adjacent to the knee joint S4 is curved and inclines leftward from its fore portion toward its rear portion. The right side surface of the lower portion 6m2 of the fixed cutting blade 6m, which extends in the longitudinal direction, inclines relative to the left side surface of the lower leg bone S1.

Thus, the left side surface of the lower leg bone S1 applies forward resistant force to the rear edge 6m3 of
the lower portion 6m₂, which resistant force is larger than
that applied by the meat of the leg S. Thus, a resistant moment which is larger than the initial moment M₀ is gen-
erated around the rotation shaft 6e by the forward resist-
ance force applied by the left side surface of the lower leg
bone S₁, so that the rotation shaft 6e rotates in the direc-
tion opposite to the direction indicated by the double
arrow in Figure 2 or clockwise as viewed downward
against the biasing force of the coil spring 6g.

Accordingly, the movable cutting blade 6x and the
fixed cutting blade 6m rotate and move to a position to
the left of and to the edge of the rotation shaft 6e. The
movable cutting blade 6x comes to incline leftward from
the fore edge 6x₁ toward the rear edge 6x₁ as viewed
downward, and the right side surface of the lower portion
6m₂ of the fixed cutting blade 6m comes to incline left-
ward from its fore edge toward its rear edge as viewed
downward.

As a result, the right side surface of the lower portion
6m₂ of the fixed cutting blade 6m abuts again, closely
against the left side surface of the lower leg bone S₁
which inclines leftward from its fore portion toward its
rear portion. Thus, the operation for cutting open the
meat of the leg S along the left side surface of the lower
leg bone S₁ continues smoothly.

When the lower leg bone S₁ moves forward, the lower portion 6m₁ of the fixed cutting blade 6m applies
a rightward force to the lower leg bone S₁, so that the leg
S rotates around the ankle S₃ counterclockwise as
viewed in Figure 6C, which causes the knee joint S₄ to
move rightward. The knee joint S₄ applies a rightward
force to the biasing roll 7b, so that the biasing roll 7b
moves rightward against the biasing force of the spring
7f, which makes the space between the lower portion
6m₂ of the fixed cutting blade 6m and the biasing roll 7b
increase.

The aforementioned rightward movement of the
knee joint S₄ and the increase of the space between the
lower portion 6m₂ of the fixed cutting blade 6m and the
biasing roll 7b allows the knee joint S₄ to go smoothly
through the space between the lower portion 6m₂ of the
fixed cutting blade 6m and the biasing roll 7b.

When the clamp assembly 3 moves forward further,
as shown in Figure 6D, the right side surface of the lower
portion 6m₂ of the fixed cutting blade 6m comes to abut
against the upper leg bone S₂. The left side surface of
the upper leg bone S₂ inclines leftward from its fore por-
tion toward its rear portion, so that the right side surface
of the lower portion 6m₂ of the fixed cutting blade 6m,
which now extends in the longitudinal direction, inclines
relative to the left side surface of the upper leg bone S₂.

Thus, the left side surface of the upper leg bone S₂
applies forward resistant force to the rear edge 6m₃ of
the lower portion 6m₂. Thus, a resistant moment which
is larger than the initial moment M₀ is generated around
the rotation shaft 6e by the forward resistant force
applied by the left side surface of the upper leg bone S₂,
so that the rotation shaft 6e rotates in the direction oppo-
site to the direction indicated by the double arrow in Fig-
ure 2 or clockwise as viewed downward against the
biasing force of the coil spring 6g.

Accordingly, the movable cutting blade 6x and the
fixed cutting blade 6m rotate and move to a position to
the left of and to the fore of the rotation shaft 6e. The
movable cutting blade 6x comes to incline leftward from
the fore edge 6x₂ toward the rear edge 6x₁ as viewed
downward, and the right side surface of the lower portion
6m₂ of the fixed cutting blade 6m comes to incline left-
ward from its fore edge toward its rear edge as viewed
downward.

As a result, the right side surface of the lower portion
6m₂ of the fixed cutting blade 6m once again abuts
closely against the left side surface of the upper leg bone
S₂. The upper leg bone S₂ inclines leftward from its fore
portion toward its rear portion as viewed downward.
Thus, the operation for cutting open the meat of the leg
S along the left side surface of the upper leg bone S₂
continues smoothly. When the upper leg bone S₂ moves
forward, the lower portion 6m₂ of the fixed cutting blade
6m applies rightward force to the upper leg bone S₂, so
that the leg S rotates around the ankle S₃ counterclock-
wise as viewed in Figure 6D, which causes the upper leg
bone S₂ to move rightward. This rightward movement
allows the upper leg bone S₂ to go smoothly through the
space between the lower portion 6m₂ of the fixed cutting
blade 6m and the biasing roll 7b.
In the same manner as with the knee joint \( S_4 \), the operation for cutting open the meat of the leg \( S \) along the left side surface of the coxa \( S_5 \) continues smoothly. Thus, the operation for cutting open the meat of the leg \( S \) along the lower leg bone \( S_1 \) and the upper leg bone \( S_2 \) is completed.

When the aforementioned operation for cutting open the meat of the leg \( S \) is completed, the limit switch \( 8b \) detects the clamp assembly \( 3 \), the piston \( 6a_1 \) of the air cylinder \( 6a \) retracts form the advanced position and the motor \( 6n \) stops.

Following to the retraction of the piston \( 6a_1 \), the cutter base \( 6c \) or the cutter body \( 6k \) moves upward. Thus, the fixed cutting blade \( 6m \) and the movable cutting blade \( 6x \) move upward so that they leave the leg \( S \). Following the stop of the motor \( 6n \), the movable cutting blade \( 6x \) stops reciprocating in the vertical direction.

When the clamp assembly \( 3 \) moves forward further, the guide-roller \( 3f \) passes by the fore end of the line cam \( 4 \). The first clamping member \( 3d \) is rotated counterclockwise as viewed forward by the biasing force of the spring \( 3h \). Thus, the clamp assembly \( 3 \) comes back to the initial condition. Then, the leg \( S \) is taken from the clamp assembly \( 3 \) by the operator.

As described above, the right side surface of the lower portion \( 6m_2 \) of the fixed cutting blade \( 6m \) always abuts closely against the left side surfaces of the lower leg bone \( S_1 \) and the upper leg bone \( S_2 \). The movable cutting blade \( 6x \), which is guided by the left side surface of the lower portion \( 6m_2 \) of the fixed cutting blade \( 6m \), cuts open the meat of the leg \( S \). The rear edge \( 6x_1 \) is always abutted against the left side surfaces of the lower leg bone \( S_1 \) and the upper leg bone \( S_2 \) so that the meat of the leg \( S \) is cut open along the the lower leg bone \( S_1 \) and the upper leg bone \( S_2 \) without any meat being left on the bones. The rear edge \( 6x_1 \) of the movable cutting blade \( 6x \) protrudes only slightly rearward from the rear edge \( 6m_3 \) of the lower portion \( 6m_2 \) of the fixed cutting blade \( 6m \), so that the movable cutting blade \( 6x \) neither cuts into nor chips off the bones.

The biasing roll \( 7 \) may be freed from the cutter base \( 6c \) and be moved close to the fixed cutting blade \( 6m \) from right and away from the fixed cutting blade \( 6m \) to right.

The movable cutting blade \( 6x \) may be reciprocated by an air cylinder similar to the air cylinder \( 6a \), or by a cam rotated by a flexible shaft driven by a suitable motor. The cutter base \( 6c \) may be driven in the vertical direction by a link mechanism engaging a cam driven by the motor \( 1c \).

A variation of the clamp assembly as shown in Figure 7 will now be discussed.

A clamp assembly \( 10 \) shown in Figure 7 has a mechanism for rotating the first clamping member which is different from that of the clamp assembly \( 3 \) in Figure 2.

The clamp assembly \( 10 \) has a bevel gear \( 10k \) fixed to the fore end of a shaft \( 10c \). The bevel gear \( 10k \) engages a bevel gear \( 10m \) fixed to the right end of a shaft \( 10m \). The shaft \( 10m \) extends in the transverse direction rotatably through a hole formed in a longitudinal leg \( 10a_1 \). The shaft \( 10m \) fits in the hole formed in the leg \( 10a_1 \) rotatably but tightly. Thus, the shaft \( 10m \) rotates only when it is provided with a large torque. A triangular cam plate \( 10p \) is fixed to the left end of the shaft \( 10m \). A baffle plate \( 11 \) is disposed above the mid portion of the upper run \( 2a \) of the endless chain \( 2 \). A baffle plate \( 12 \) is disposed above the fore end portion of the upper run \( 2a \) of the endless chain \( 2 \) and above the baffle plate \( 11 \). The baffle plates \( 11, 12 \) are fixed to the frame of the cutting machine \( A \). As shown in Figure 7, when the clamp assembly \( 10 \) is located in the vicinity of the rear end of the upper run \( 2a \) of the endless chain \( 2 \), the cam plate \( 10p \) is in a position indicated by a solid line wherein an apex \( 10p_1 \) of the cam plate \( 10p \) is directed downward. In this position, the open end of a U-shaped groove of a first clamping member \( 10d \) is directed upward. When the clamp assembly \( 10 \) moves forward to the mid portion of the the upper run \( 2a \) of the endless chain \( 2 \), an edge of the cam plate \( 10p \) extending upward from the apex \( 10p_1 \) abuts against the baffle plate \( 11 \), so that the cam plate \( 10p \) rotates by \( 90^\circ \) in the direction indicated by an arrow.

Thus, the cam plate \( 10p \) comes to be in a position indicated by a phantom line wherein the apex \( 10p_1 \) of the cam plate \( 10p \) is directed rearward. Following to the rotation of the cam plate \( 10p \), the first clamping member \( 10d \) rotates by \( 90^\circ \) in the direction indicated by an arrow.

Thus, the first clamping member \( 10d \) comes to be in a rotated position. As aforementioned, the shaft \( 10m \) tightly fits in the hole formed in the leg \( 10a_1 \), so that the cam plate \( 10p \) is kept in the position indicated by the phantom line in Figure 7 even after it goes through the baffle plate \( 11 \). Accordingly, the first clamping member \( 10d \) is kept in the rotated position. When the clamp assembly \( 10 \) moves forward further to the fore end portion of the upper run \( 2a \) of the endless chain \( 2 \), an edge of the cam plate \( 10p \) extending upward from an apex adjacent to the shaft \( 10m \) abuts against the baffle plate \( 12 \), so that the cam plate \( 10p \) rotates back to the position indicated by the solid line in Figure 7. Thus, the first clamping member \( 10d \) comes back to the position indicated in Figure 7.

The cutting machine \( A \) for a right leg has been described in the above. In the cutting machine \( A \) for a left leg, the clamp assembly \( 3 \), the line cam \( 4 \), the table \( 5 \), the cutter assembly \( 6 \) and the biasing roll assembly \( 7 \) should be disposed in a mirror image of those shown in Figure 2 in association with a vertical plane which includes the endless chain \( 2 \).

A second embodiment of the cutting machine \( A \) is shown in Figure 8. The same members as in the first embodiment are denoted by the same reference numerals as in the first embodiment. In the following descriptions, the directions indicated by arrows \( I, II, III, IV, V \) and \( VI \) in Figure 8 are referred to as forward direction, rearward direction, leftward direction, rightward direction, upward direction and downward direction, respectively. Moreover, in the following descriptions, the direction parallel to the arrows \( I, II \) is referred to as the
longitudinal direction, the direction parallel to the arrows III., IV., is referred to as the transverse direction, and the direction parallel to the arrows V., VI is referred to as the vertical direction.

As understood from Figure 8, in the second embodiment, the endless chain 2 is disposed in the transverse direction and the upper run 2a of the endless chain 2 is driven leftward. The body 3a of the clamp assembly 3 is fixed directly to the endless chain 2. The guide roll 3f is mounted on the free end portion of the arm 3e of the clamp assembly 3, which is bent forward. The line cam 4 is disposed to the rear of and above the upper run 2a of the endless chain 2 and extends transversely. The line cam 4 is located sufficiently above the upper run 2a in the vicinity of the right end portion of the upper run 2a. At the midway point of the upper run 2a, the line cam 4 is bent downward to a height a little higher than the upper run 2a. In the vicinity of the left end of the upper run 2a, the line cam 4 is located at a height a little higher than the upper run 2a. The table 5 is disposed to the rear of the endless chain 2, and extends in the transverse direction. The bracket 6b of the cutter assembly 6 is mounted movably in the longitudinal direction on the frame of the cutting machine A. The guides 6d are fixed to the bracket 6b. An air cylinder 6a' is directed longitudinally and is fixed to the frame of the cutting machine A. The piston 6a of the air cylinder 6a is connected to the bracket 6b. The operations of the motors 1c, 6n and the air cylinders 6a, 6a' are controlled not by the limit switches 8a, 8b, but by a sequence controller. Except as described above, the constitution of the second embodiment is the same as the first embodiment.

In this embodiment, the operation for cutting open the meat of the leg S is carried out as follows. That is, the leg S is set into the clamp assembly 3 which is located in the vicinity of the right end of the upper run 2a, where the line cam 4 is located sufficiently above the upper run 2a, so that the guide roll 3f does not engage the line cam 4, whereby the clamp assembly 3 is in the initial condition.

As the clamp assembly 3 moves leftward, the guide roll 3f engages the line cam 4. Thus, the guide roll 3f and the first clamping member 3d rotate by 90°, clockwise as viewed forward.

When the clamp assembly 3 has reached the position just below the cutter assembly 6, the motor 1c is stopped and the leftward movement of the clamp assembly 3 is stopped. Then the piston 6a of the air cylinder 6a is advanced and the cutter assembly 6 is moved downward. After that, the piston 6a' of the air cylinder 6a' is advanced and the cutter assembly 6 is moved rearward so as to cut open the meat of the leg S. After the operation for cutting open the meat of the leg S is completed, the pistons 6a and 6a' retract, so that the cutter assembly 6 is moved upward and forward.

Then the motor 1c is restarted and the leftward movement of the clamp assembly 3 is restarted. The guide roll 3f passes by the left end of the line cam 4, so that the first clamping member 3d is rotated counterclockwise as viewed forward by the biasing force of the spring 3h. Thus, the clamp assembly 3 comes back to the initial condition. Then, the leg S is taken from the clamp assembly 3 by the operator.

In the second embodiment, a plurality of poultry legs can be processed simultaneously even in a small working space by means of disposing a plurality of cutter assemblies 6 along the endless chain 2.

It may be possible that, instead of the provision of the arm 3e, the guide roll 3f, the stopper 3g, the spring 3h and the line cam 4, a cam plate similar to the cam plate 10p in Figure 7 is connected to the fore end portion of the shaft 3c of the clamp assembly 3, and a pair of baffle plates similar to the baffle plates 11, 12 in Figure 7 are disposed transversely above the upper run 2a of the endless chain 2.

Working Table C

As shown in Figure 1, the working table C has a belt conveyor 20 and a working table 21.

The leg S which is cut open by the cutting machine A is taken off the clamp assembly 3 by an operator at the fore end of the upper run 2a of the endless chain 2. Then, the leg S undergoes the sequential steps (2), (3) and (4) in the manual boning work on the working table C. The transportation of the leg S between the steps is achieved by the belt conveyor 20.

Second, Tendon Cutting Machine B

The tendon cutting machine B will be described with reference to Figures 9 to 11. In the following descriptions, the directions indicated by arrows I, II, III, IV, V and VI in Figure 9 are referred to as forward direction, rearward direction, leftward direction, rightward direction, upward direction and downward direction, respectively. Moreover, in the following descriptions, the direction parallel to the arrows I, II is referred to as the longitudinal direction, the direction parallel to the arrows III, IV, is referred to as the transverse direction, and the direction parallel to the arrows V, VI is referred to as the vertical direction.

The tendon cutting machine B has a cutter assembly 31 disposed on the rear end of a rectangular supporting table 30 which extends longitudinally. As shown in Figures 9 and 10, the cutter assembly 31 has an annular cutting blade 31a, the central axis X3 of which extends in the longitudinal direction.

The cutting blade 31a is provided with a cutting edge 31a1 along its rear surface. The cutting edge 31a1 is directed rearward. The cutting blade 31a is provided with teeth 31a2 around its outer side surface. The cutting blade 31a has a sufficient thickness t so that it has a large rigidity. The cutting blade 31a is supported rotatably around the central axis X3 by a casing 31b which is fixed to the supporting table 30 at its lower end. The portion of the casing 31b which accepts the cutting blade 31a is made dividable into a plurality of pieces so that the cutting blade 31a can be renewed.
An idling gear 31c is disposed below the cutting blade 31a. The idling gear 31c engages both the teeth 31a₂ and a driving gear 31d which is disposed below the idling gear 31c. The gears 31c and 31d are rotatably supported around their own axes by the casing 31b. The axes of gears 31c and 31d extend in the longitudinal direction.

The driving gear 31d is connected to a motor 31f by means of a flexible shaft 31e. Thus, the rotation of the motor 31f is transmitted to the cutting blade 31a through the flexible shaft 31e, the driving gear 31d and the idling gear 31c, and causes the cutting blade 31a to rotate around the central axis X₃.

A clamp assembly 32 is mounted on the fore end portion of the supporting table 30. As shown in Figure 9, the clamp assembly 32 has a rod 32b which extends in the longitudinal direction through a supporting box 32a fixed to the supporting table 30. The rod 32b is supported by the supporting box 32a slidably in the longitudinal direction. The rod 32b is disposed coaxially with the central axis X₃ of the cutting blade 31a.

A pair of clamping arms 32c are disposed parallel to one another and extend in the longitudinal direction. The fore end 32c₁ of clamping arms 32c are connected to the rear end 32c₂ of the rod 32b so as to swing around vertical axes. The clamping arms 32c are provided with curved portions 32c₂ at their rear ends. The curved portions 32c₂ are provided with opposed, semicircular cutouts 32c₂ at their rear ends. One of the arms 32c is provided with an air cylinder 32d directed in the transverse direction.

The piston 32d₁ of the air cylinder 32d extends through an arm 32c and is pivotally attached to the other arm 32c. When the piston 32d₁ of the air cylinder 32d is in a retracted position, the clamping arms 32c are closed as indicated by the solid line in Figure 9, and the cutouts 32c are close to one another. When the piston 32d₁ advances, the clamping arms 32c swing to an open position indicated by the phantom line in Figure 9, and the cutouts 32c are apart from one another. A bracket 32e is connected to the fore end portion 32b of the rod 32b immovably in the longitudinal direction relative to the rod 32b.

The bracket 32e is connected to the piston 32g₁ of an air cylinder 32g which extends parallel to the rod 32b and is fixed to the supporting box 32a by a bracket 32f. When the piston 32g₁ of the air cylinder 32g is in a retracted position, the clamping arms 32c are in the initial position indicated by the solid line in Figure 9, and are close to the cutting blade 31a. When the piston 32g₁ of the air cylinder 32g advances, the rod 32b moves forward and thus the clamping arms 32c move to the working position indicated by the phantom line in Figure 9, and are apart from the cutting blade 31a.

A biasing assembly 33 is disposed on the rear end 30a of the supporting table 30 and to the rear of the cutter assembly 31. The biasing assembly 33 has a pair of rods 33a which extend on either side of the axis X₃ and parallel to one another. The rods 33a are inclined upward from their rear ends toward their fore ends.

The rods 33a are fixed to a pair of shafts 33c by a pair of brackets 33b. The shafts 33c extend parallel to the axis X₃ and are provided with a pair of gears 33d at their rear ends. The pair of gears 33d engage with one another. One of the brackets 33b is connected to the piston 33e₁ of an transversely disposed air cylinder 33e. The air cylinder 33e is fixed to the rear end 30a of the supporting table 30 by a bracket 33f. When the piston 33e₁ of the air cylinder 33e is in a retracted position, the rods 33a are closed as indicated by the solid line in Figure 9 by the biasing force of a spring 33g which is mounted on the piston 33e₁. When the piston 33e₁ advances, the gears 33d rotate and thus, the pair of rods 33a move to an open position indicated by the phantom line in Figure 9.

The supporting table 30 is provided with an inclined shute 34 at its rear end. The table 30 is provided with an opening 35 at its mid portion, below where the cutout 32c₂ of the clamping arm 32c are in the working position.

The air cylinders 32d, 32g, 33e, and the motor 31f are controlled by a sequence controller which is not illustrated in Figure 9 for simplicity.

The operation of the tendon cutting machine B constructed as above, will be described hereinafter with reference to Figures 11A to 11C.

1. The meat around the lower leg bone S₁ is peeled off manually along the lower leg bone S₁ from the ankle S₃ toward the knee joint S₄, so that the meat S₆ of the leg is connected only to the knee joint S₄ by meat-to-bone connecting tendon tissues. Then, as shown in Figure 11A, the lower leg bone S₁ is passed through the cutting blade 31a from the rear side of the cutting blade 31a toward the fore side of the the cutting blade 31a, with the ankle S₃ being directed forward. The piston 32g₁ of the air cylinder 32g is in the retracted position, so that the clamping arms 32c are in the initial position wherein the clamping arms 32c are close to the cutting blade 31a. The piston 32d₁ of the air cylinder 32d is in the advanced position, so that the clamping arms 32c are in the open position. The piston 33e₁ of the air cylinder 33e is in the advanced position, so that the pair of rods 33a of the biasing assembly 33 are in the open position. The motor 31f does not operate, so that the cutting blade 31a does not rotate.

2. As shown in Figure 11B, the piston 32d₁ retracts so as to close the clamping arms 32c. Thus, the portion of the lower leg bone S₁ adjacent to the ankle S₃ is clamped by the clamping arms 32c at the closely-opposed cutouts 32g₂. The piston 33e₁ of the air cylinder 33e retracts so as to close the rods 33a of the biasing assembly 33. Thus, the lower leg bone S₁ is clamped by the rods 33a. The motor 31f starts so as to rotate the cutting blade 31a.

3. As shown in Figure 11C, the piston 32g₁ of the air cylinder 32g advances so as to move the clamp-
ing arms 32c forward to the working position. Thus, the lower leg bone S1 is clamped by the clamping arms 32c moves forward through the cutting blade 31a, and the meat S6 abuts against the rods 33a of the biasing assembly 33. As meat S6 moves forward, it moves upward along the upwardly-inclined rods 33a. Thus, the upper portion of the knee joint S4 is pressed against the cutting edge 31a1 of the cutting blade 31a, so that the meat-to-bone connecting tendon tissues which connect the meat S6 to the knee joint S4 are cut off the knee joint S4. As a result, the meat S6 is removed from the lower leg bone S1.

Lastly, the piston 33e1 of the air cylinder 33e advances so as to open the rods 33a of the clamping assembly 33. Thus, the meat S6 which is removed from the lower leg bone S1 falls on to the shute 34 and then falls into a collecting box (not shown). When the clamping arm 32c has reached the working position, the motor 31f stops, and then the piston 32d1 of the air cylinder 32d advances so as to open the clamping arms 32c. Thus, the lower leg bone S1, which is now free from the meat S6, falls through the opening 35 into another collecting box (not shown). Then, the piston 32g1 of the air cylinder 32g retracts so as to move the clamping arms 32c rearward back to the initial position. Thus, the tendon cutting machine B returns to the initial condition described in ①.

As clearly understood from the above descriptions, according to the second, tendon cutting machine B, the meat-to-bone connecting tendon tissues which connect the meat S6 to the knee joint S4 are cut off the knee joint S4 by the annular cutting blade 31a. The cutting blade 31a is disposed at a predetermined position, has a large rigidity and rotates around the axis x3a, and the knee joint S4 is biased against the cutting edge 31a1 of the blade 31a.

Thus, different from the existing manual boning process with a knife, the cutting edge 31a1 of the bone can stably abut against the meat-to-bone connecting tendon tissues during the cutting operation. Thus, the boning work is made safe and the cut surface of the meat S6 is made smooth, which increases the commercial value of the meat S6. The knee joint S4 is biased against the cutting edge 31a1, so that the meat-to-bone connecting tendon tissues are cut in the vicinity of the knee joint S4. Thus, a high yield of the meat S6 removed from the lower leg bone S1 can be achieved.

The biasing force is generated by the upward movement of the meat S6 along the rods 33a, so that the biasing force can easily be controlled by controlling the inclination of the rods 33a, the spring constant of the spring 33g, etc. The supporting table 30 is provided with a shute 34 and the opening 35, so that the meat S6 and the lower leg bone S1 can be collected separately. Thus, the boning process can be carried out efficiently.

The clamping arm 32c may further be reciprocally rotated around the longitudinal axis of the rod 32b. Thus, the meat-to-bone connecting tendon tissues can be cut around the knee joint S4, so that the yield of the meat S6 removed from the lower leg bone S1 can be more increased. In this case, as indicated by a phantom line in Figure 9, a rack-pinion mechanism 37 is disposed so as to reciprocally rotate the rod 32b around its longitudinal axis. The rack-pinion mechanism 37 is driven by an air cylinder 36.

The cutter assembly 31 and the biasing assembly 33 may be moved in the longitudinal direction instead of the clamping arms 32c.

While the present invention has been described with reference to preferred embodiments, one of ordinary skill in the art will recognize that modifications and improvements may be made while remaining within the scope of the present invention. The scope of the invention is determined solely by the appended claims.

Claims

1. A cutting machine for cutting open meat of a poultry leg along one side of the upper leg bone and the lower leg bone, which comprises:
   first clamping means (3) for clamping the ankle (S3) of the leg (S) while allowing the leg (S) to rotate around the ankle (S3);
   first supporting means (5) for supporting the leg (S);
   cutting means (6) for cutting open the meat of the leg, which means includes a first cutting blade (6m)

 Having a wedge-shaped cross section and a vertical cutting edge, a second cutting blade (6s) abutting against a first side of the cutting edge of the first cutting blade (6m) and slightly protruding from the cutting edge of the first cutting blade (6m), and first driving means (6n) for vertically reciprocating the second cutting blade (6s) relative to the first cutting blade (6m):

 first biasing means (7) for biasing the leg (S) against a second side of the cutting edge of the first cutting blade (6m);
 second driving means (6a) for vertically moving the cutting means (6) into and out of engagement with the meat of the leg (S);
 third driving means (1c) for horizontally moving the first clamping means (3); and
 restricting means (6e,6g,6c) for restricting rotation of the cutting means (6) around a vertical axis when a force directed to the cutting edge of the first cutting blade (6m) is smaller than a predetermined magnitude, and permitting the rotation of the cutting means (6) around the vertical axis when a force directed to the cutting edge of the first cutting blade (6m) is larger than the predetermined magnitude.

2. A cutting machine of claim 1, wherein said restricting means comprises:

 a vertical shaft member (6e) fixed to the cutting means (6), which shaft member (6e) is located offset relative to the first and the second cutting blades
(6m,6x) in a direction at right angles to the direction of the horizontal movement of the first clamping means (3); spring means (6g) for applying a predetermined initial moment to the cutting means (6), thereby driving the cutting means (6) rotationally around the vertical axis of the shaft member (6e); and stopper means (6c2) for restricting the rotation of the cutting means (6) by the initial moment when a force directed to the cutting edge of the first cutting blade (6m) is smaller than a predetermined magnitude, thereby making the second side of the cutting edge of the first cutting blade (6m) extend in the direction of the horizontal movement of the first clamping means (3).

3. A cutting machine of claim 1 or 2, wherein said first clamping means (3) comprises:
   a first clamping member (3d) having a groove extending in the direction of the horizontal movement of the first clamping means (3);
   a second clamping member (3j) disposed adjacent to the first clamping member (3d) and behind the first clamping member (3d) in the direction of the horizontal movement of the first clamping means (3), which second clamping member (3j) is provided with a cutout (3j2) facing the groove of the first clamping member (3d), the breadth of the cutout (3j2) being smaller than that of the groove of the first clamping member (3d); and
   means (3f,3g,3h,4,10k,10n,10p,11,12) for rotating the first clamping member (3d) relative to the second clamping member (3j) around an axis extending in the direction of the horizontal movement of the first clamping means (3) between a first position wherein the open end of the groove of the first clamping member (3d) is directed in the same direction as the open end of the cutout (3j2) of the second clamping member (3j) and a second position wherein the open end of the groove of the first clamping member (3d) is directed at right angles to the open end of the cutout (3j2) of the second clamping member (3j).

4. A cutting machine of claim 3, wherein said means for rotating the first clamping member (3f) relative to the second clamping member (3j) comprises:
   a guide roll (3f) connected to the first clamping member (3d);
   a line cam (14) for engaging the guide roll (3f), thereby rotating the guide roll (3f) to a predetermined direction around an axis extending in the direction of the horizontal movement of the first clamping means (3d);
   a spring (34) for biasing the guide roll (3f) to a direction opposite to said predetermined direction; and
   a stopper (3g) for engaging the guide roll (3f) when the guide roll (3f) is free from the line cam (4), thereby retaining the guide roll (3f) in a predetermined position in association with the rotation.

5. A cutting machine of claim 3, wherein said means (10k,10n,10p,11,12) for rotating the first clamping member relative to the second clamping member comprises:
   a first bevel gear (10k) connected to the first clamping member (3d);
   a second bevel gear (10n) for engaging the first bevel gear (10k);
   a cam plate (10p) connected to the second bevel gear (10n); and
   a pair of baffle plates (11,12) for engaging the cam plate (10p), thereby rotating the cam plate (10p).

6. A cutting machine for cutting open meat of a poultry leg along one side of the upper leg bone and the lower leg bone, which comprises:
   first clamping means (3) for clamping the ankle (S3) of the leg (S) while allowing the leg (S) to rotate around the ankle (S3);
   first supporting means (5) for supporting the leg (S);
   cutting means (6) for cutting open the meat of the leg (S) which means includes a first cutting blade (6m) having a wedge-shaped cross section and a vertical cutting edge, a second cutting blade (6x) abutting against a side of the cutting edge of the first cutting blade (6m) and slightly protruding from the cutting edge of the first cutting blade (6m), and first driving means (6n) for vertically reciprocating the second cutting blade (6x) relative to the first cutting blade (6m);
   first biasing means (7) for biasing the leg (S) against a second side of the cutting edge of the first cutting blade (6m);
   second driving means (6a) for vertically moving the cutting means (6) into and out of engagement with the meat of the leg (S);
   third driving means (6a) for horizontally moving the cutting means (6); and
   restricting means (6e,6g,6c3) for restricting the rotation of the cutting means (6) around a vertical axis when a force directed to the cutting edge of the first cutting blade (6m) is smaller than a predetermined magnitude, and permitting the rotation of the cutting means (6) around the vertical axis when a force directed to the cutting edge of the first cutting blade (6m) is larger than the predetermined magnitude.

7. A cutting machine of claim 6, wherein said restricting means comprises:
   a vertical shaft member (6e) fixed to the cutting means (6), which shaft member (6e) is located offset relative to the first and the second cutting blades (6m) in a direction at right angles to the direction of the horizontal movement of the cutting means (6);
   a spring means (6g) for applying a predetermined initial moment to the cutting means (6), thereby driving the cutting means (6) rotationally around the vertical axis of the shaft member (6e); and
   stopper means (6c3) for restricting the rotation of the
cutting means (6) by the initial moment when a force directed to the cutting edge of the first cutting blade (6m) is smaller than a predetermined magnitude, whereby making the second side of the cutting edge of the first cutting blade (6m) extend in the direction of the horizontal movement of the cutting means (6).

8. A cutting machine of claim 6 or 7 wherein said first clamping means comprises:
a first clamping member (3d) having a groove extending in the direction of the horizontal movement of the cutting means (6);
a second clamping member (3i) disposed adjacent to the first clamping member (3d) and in front of the first clamping member (3d) in the direction of the horizontal movement of the cutting means (6), which second clamping member (3i) is provided with a cut-out (3j) facing the groove of the first clamping member (3d), the breadth of the cut-out (3j) being smaller than that of the groove of the first clamping member (3d); and
means (1c,3f,3g,4,1c,10p,11,12) for rotating the first clamping member (3d) relative to the second clamping member (3i) around an axis extending in the direction of the horizontal movement of the cutting means (6) between a first position wherein the open end of the groove of the first clamping member is directed in the same direction as the open end of the cutout (3j) of the second clamping member (3i) and a second position wherein the open end of the groove of the first clamping member (3d) is directed at right angles to the open end of the cut-out (3j) of the second clamping member (3i).

9. A cutting machine of claim 8, wherein said means (1c,3f,3g,3h,4) for rotating the first clamping member relative to the second clamping member comprises:
fourth driving means (1c) for horizontally moving the first clamping means (3) in a direction at right angles to the direction of the horizontal movement of the cutting means (6);
a guide roll (3f) connected to the first clamping member (3d);
a line cam (4) for engaging the guide roll (3f), thereby rotating the guide roll (3f) to a predetermined direction around an axis extending in the direction of the horizontal movement of the cutting means (6);
a spring (3h) for biasing the guide roll (3f) to a direction opposite to said predetermined direction; and
a stopper (3g) for engaging the guide roll (3f) when the guide roll (3f) is free from the line cam (4), thereby retaining the guide roll (3f) in a predetermined position in association with the rotation.

10. A cutting machine of claim 8, wherein said means (1c,10p,11,12) for rotating the first clamping member relative to the second clamping member comprises:

Patentansprüche

1. Schneidemaschine zum Aufschneiden von Fleisch einer Geflügelkeule entlang einer Seite des oberen Keulenknöchens und des unteren Keulenknöchens, welche umfaßt:
eine erste Klemmeinrichtung (3) zum Klemmen des Knöchels (3s) der Keule (S), wobei der Keule (S) ermöglicht wird, sich um den Knöchel (3s) zu drehen;
eine erste Stützeinrichtung (5) zum Stützen der Keule (S);
eine Schneideinrichtung (6) zum Aufschneiden des Fleisches der Keule, wobei die Einrichtung ein erstes Schneidemesser (6m) einschließlich, das einen keilförmigen Querschnitt und eine vertikale Schneidkante aufweist, ein zweites Schneidemesser (6x) einschließlich, das gegen eine erste Seite der Schneidkante des ersten Schneidmessers (6m) anstößt und geringfügig von der Schneidkante des
ersten Schneidmessers (6m) hervorsteht, und eine erste Antriebsseineinrichtung (6n) einschließt zum senkrechten Hinein- und Herbewegen des zweiten Schneidmessers (6x) relativ zum ersten Schneidmesser (6m);
eine erste Vorbelastungseinrichtung (7) zum Vorbelasten der Keule (S) gegen eine zweite Seite der Schneidkante des ersten Schneidmessers (6m);
eine zweite Antriebsseineinrichtung (6a) zum vertikalen Bewegen der Schneideeinrichtung (6) in Eingriff und außer Eingriff zum Fleisch der Keule (S);
eine dritte Antriebsseineinrichtung (1c) zum horizontalen Bewegen der ersten Klemmeinrichtung (3); und
eine Beschränkungseinrichtung (6e, 6g, 6c4) zum Beschränken der Drehung der Schneideeinrichtung (6) um eine vertikale Achse, wenn eine Kraft, die zur Schneidkante des ersten Schneidmessers (6m) gerichtet ist, kleiner als ein vorbestimmter Wert ist, und zum Ermöglichen der Drehung der Schneideeinrichtung (6) um die vertikale Achse, wenn eine Kraft, die zur Schneidkante des ersten Schneidmessers (6m) gerichtet ist, größer als der vorbestimmte Wert ist.

1. Schneidemaschine nach Anspruch 1, wobei die Beschränkungseinrichtung umfaßt:
ein vertikales Achsenelement (6e), das mit der Schneideeinrichtung (6) befestigt ist, wobei das Achsenelement (6e) relativer zum ersten und zweiten Schneidmesser (6m, 6x) in einer Richtung rechtwinklig zur Richtung der Horizontalbewegung der Klemmeinrichtung (3) versetzt angeordnet ist;
an eine Federeinrichtung (6g) zum Aufbringen eines vorbestimmten Anfangsmomentes auf die Schneideeinrichtung (6), um dadurch die Schneideeinrichtung (6) drehend um die Vertikalachse des Achsenelementes (6e) anzutreiben; und
anderer Sperreinrichtung (6c4) zum Beschränken der Drehung der Schneideeinrichtung (6) durch das Anfangsmoment, wenn eine Kraft, die zur Schneidkante des ersten Schneidmessers (6m) gerichtet ist, kleiner als ein vorbestimmter Wert ist, um dadurch zu erreichen, daß die zweite Seite der Schneidkante des ersten Schneidmessers (6m) sich in einer Richtung zur Horizontalbewegung der Klemmeinrichtung (3) erstreckt.

2. Schneidemaschine nach Anspruch 1 oder 2, wobei die erste Klemmeinrichtung (3) umfaßt:
ein erster Klemmelement (3d), das eine Aussparung aufweist, die sich in einer Richtung der Horizontalbewegung der ersten Klemmeinrichtung (3) erstreckt;
ein zweites Klemmelement (3j), das benachbart zur ersten Klemmeinrichtung (3d) und hinter dem ersten Klemmelement (3d) in Richtung der Horizontalbewegung der ersten Klemmeinrichtung (3) angeordnet ist, wobei das zweite Klemmelement (3j) mit einem Ausschnitt (3j2) versehen ist, der der Aussparung des ersten Klemmelementes (3d) gegenüberliegt, wobei die Breite des Ausschnittes (3j2) kleiner als die der Aussparung des ersten Klemmelementes (3d) ist; und
eine Einrichtung (3f, 3g, 3h, 4; 10k, 10n, 10p, 11, 12) zum Drehen des ersten Klemmelementes (3d) relativ zu dem zweiten Klemmelement (3j) um eine Achse, die sich in Richtung der Horizontalbewegung der ersten Klemmeinrichtung (3) erstreckt zwischen einer ersten Position, bei der das offene Ende der Aussparung des ersten Klemmelementes (3d) in die gleiche Richtung wie das offene Ende des Ausschnittes (3j2) des zweiten Klemmelementes (3j) gerichtet ist und einer zweiten Position, bei der das offene Ende der Aussparung des ersten Klemmelementes (3d) in einem rechten Winkel zum offenen Ende des Ausschnittes (3j2) des zweiten Klemmelementes (3j) gerichtet ist.

4. Schneidemaschine nach Anspruch 3, wobei die Einrichtung zum Drehen des ersten Klemmelementes (3f) relativ zum zweiten Klemmelement (3j) umfaßt:
eine Führungsrolle (3f), die mit dem ersten Klemmelement (3d) verbunden ist;
einen Liniensteuernocken (4) zum Eingriff mit der Führungsrinne (3f), um damit die Führungsrinne (3f) in eine vorbestimmte Richtung über eine Achse zu drehen, die sich in einer Richtung der Horizontalbewegung der ersten Klemmeinrichtung (3d) erstreckt;
eine Feder (34) zum Vorbelasten der Führungsrinne (3f) in eine Richtung entgegengesetzt zu der vorbestimmten Richtung; und
einen Anschlag (3g) zum Eingriff mit der Führungsrolle (3f), wenn die Führungsrinne (3f) von dem Liniensteuernocken (4) frei ist, und um damit die Führungsrinne (3f) in einer vorbestimmten Position in Verbindung mit der Drehung zurückzuhalten.

5. Schneidemaschine nach Anspruch 3, wobei die Einrichtung (10k, 10n, 10p, 11, 12) zum Drehen des ersten Klemmelementes relativ zum zweiten Klemmelement umfaßt:
ein erstes Kegelrad (10k), das mit dem ersten Klemmelement (3d) verbunden ist;
ein zweites Kegelrad (10n) zum Eingriff mit dem ersten Kegelrad (10k);
eine Nockenplatte (10p), die mit dem zweiten Kegelrad (10n) verbunden ist; und
ein Paar Leiplatten (11, 12) zum Eingriff mit der Nockenplatte (10p), um dadurch die Nockenplatte (10p) zu drehen.

6. Schneidemaschine zum Aufschneiden von Fleisch einer Geflügelkeule entlang einer Seite des oberen Keulenknocks und des unteren Keulenknocks, welche umfaßt:
eine erste Klemmeinrichtung (3) zum Klemmen des Knöchels (S3) der Keule (S), wobei der Keule (S)
ermöglicht wird, sich um den Knöchel ($S_3$) zu drehen;
eine erste Stützeinrichtung ($S_5$) zum Stützen der
Keule ($S_5$);
eine Schneideeinrichtung ($S_6$) zum Aufschneiden
des Fleisches der Keule ($S_5$), wobei die Einrichtung
eines ersten Schneidmessers ($S_6m$) einschließt, das
einen keilförmigen Querschnitt und eine vertikale
Schneidkante aufweist, ein zweites Schneidmesser
($S_6x$) einschließt, das gegen eine erste Seite der
Schneidkante des ersten Schneidmessers ($S_6m$)
anstößt und geringfügig von der Schneidkante des
ersten Schneidmessers ($S_6m$) hervorsteht, und eine
erste Antriebsseinrichtung ($S_6n$) einschließt zum ver-
tikalen Hin- und Herbewegen des zweiten Schneid-
messers ($S_6x$) relativ zu dem ersten Schneidmesser
($S_6m$);
eine erste Vorbelastungseinrichtung ($S_7$) zum Vorbe-
lasten der Keule gegen eine zweite Seite der
Schneidkante des ersten Schneidmessers ($S_6m$);
eine zweite Antriebsseinrichtung ($S_6a$) zum vertikalen
Bewegen der Schneideinrichtung ($S_6$) in Fingriff und
äußerer Eingriff mit dem Fleisch der Keule ($S_5$);
eine dritte Antriebsseinrichtung ($S_6a'$) zum horizon-
talen Bewegen der Schneideinrichtung ($S_6$) und
Beschränkungseinrichtung ($S_6e$, $S_6g$, $S_6c_3$) zum
Beschränken der Drehung der Schneideinrichtung
($S_6$) um eine Vertikalachse, wenn eine Kraft, die zu
der Schneidkante des ersten Schneidmessers ($S_6m$)
gerichtet ist, kleiner als ein vorbestimmter Wert ist,
und zum Ermöglichen der Drehung der Schneide-
einrichtung ($S_6$) um die vertikale Achse, wenn eine
Kraft, die zur Schneidkante des ersten Schneidmes-
sers ($S_6m$) gerichtet ist, größer als der vorbestimmte
Wert ist.

7. Schneidemaschine nach Anspruch 6, wobei die
Beschränkungseinrichtung umfaßt:
ein vertikales Achsenelement ($S_6e$), das mit der
Schneideinrichtung ($S_6$) befestigt ist, wobei das
Achsenelement ($S_6e$) relativ zu dem ersten und zwei-
ten Schneidmesser ($S_6m$, $S_6x$) in einer Richtung im
rechten Winkel zur Richtung der Horizontalbeweg-
gung der Schneideinrichtung ($S_6$) versetzt angeord-
net ist;8. Schneidemaschine nach Anspruch 6 oder 7, wobei
die erste Klemmeinrichtung umfaßt:
ein erstes Klemmelement ($S_3d$), das eine Ausspa-
runung aufweist, die sich in einer Richtung der Horiz-
onalbewegung der Schneideinrichtung ($S_6$)
erstreckt;
ein zweites Klemmelement ($S_3j$), das benachbart zu
dem ersten Klemmelement ($S_3d$) und vor dem
ersten Klemmelement ($S_3d$) in einer Richtung der
Horizontalbewegung der Schneideinrichtung ($S_6$
angeordnet ist, wobei das zweite Klemmelement ($S_3j$
mit einem Ausschnitt ($S_3j$) versehen ist, der der Aus-
sparung des zweiten Klemmelementes ($S_3d$) gegen-
überliegt, wobei die Breite des Ausschnittes ($S_3j$
kleiner als die der Aussparung des ersten Klem-
melementes ($S_3d$) ist; und
eine Einrichtung ($S_{1c}$, $S_{1f}$, $S_{1g}$, $S_{1h}$, $S_{1i}$, $S_{1j}$, $S_{1k}$, $S_{1l}$, $S_{1m}$, $S_{1n}$, $S_{1o}$) zum
Drehen des ersten Klemmelementes ($S_{1d}$) relativ zu
dem zweiten Klemmelement ($S_{1j}$) um eine Achse, die
sich in Richtung der Horizontalbewegung der
Schneideinrichtung ($S_6$) erstreckt, wobei an der
ersten Position, bei der das offene Ende der Aus-
sparung des ersten Klemmelementes in die gleiche
Richtung gerichtet ist, wie das offene Ende des Auss-
nchnittes ($S_{3j}$) des zweiten Klemmelementes ($S_3j$
und einer zweiten Position, bei der das offene Ende
der Aussparung des ersten Klemmelementes ($S_3d$
im rechten Winkel zum offenen Ende des Ausschnitt-
es ($S_{3j}$) des zweiten Klemmelementes ($S_3j$) gerichtet
ist.

9. Schneidemaschine nach Anspruch 8, wobei die Ein-
richtung ($S_{1c}$, $S_{1f}$, $S_{1g}$, $S_{1h}$, $S_{1i}$, $S_{1j}$, $S_{1k}$, $S_{1l}$, $S_{1m}$, $S_{1n}$, $S_{1o}$) zum
Drehen des ersten Klemmelementes relativ zum zweiten Klemme-
ement umfaßt:
eine vierte Antriebsseinrichtung ($S_{1c}$) zum horizonta-
len Bewegen der ersten Klemmeinrichtung ($S_3d$) in
eine Richtung im rechten Winkel zur Richtung der
Horizontalbewegung der Schneideinrichtung ($S_6$);
eine Führungsrolle ($S_3f$), die mit dem ersten Klem-
melement ($S_3d$) verbunden ist;
einen Liniensteuernocken ($S_4$) zum Eingriff mit der
Führungsrolle ($S_3f$), um dadurch die Führungsrolle
($S_3f$) in eine vorbestimmte Richtung um eine Achse
durchzudrehen, die sich in Richtung der Horizontalbeweg-
gung der Schneideinrichtung ($S_6$) erstreckt;
eine Feder ($S_3h$) zum Vorbelasten der Führungsrolle
($S_3f$) in eine Richtung gegenüberliegend zu der vor-
bestimmten Richtung; und
einen Anschlag ($S_3g$) zum Eingriff mit der Führungs-
rolle ($S_3f$), wenn die Führungsrolle ($S_3f$) von den Linien-
steuernocken ($S_4$) frei ist, um dadurch die
Führungsrolle ($S_3f$) in eine vorbestimmte Position in
Verbindung mit der Drehung zurückzuhalten.

10. Schneidemaschine nach Anspruch 8, wobei die Ein-
richtung ($S_{1c}$, $S_{1f}$, $S_{1g}$, $S_{1h}$, $S_{1i}$, $S_{1j}$, $S_{1k}$, $S_{1l}$, $S_{1m}$, $S_{1n}$, $S_{1o}$) zum
Drehen des ersten Klemmelementes relativ zum zweiten Klemme-
lement umfaßt:
eine vierte Antriebseinrichtung (1c) zum horizontalen Bewegen der ersten Klemmeinrichtung (3) in eine Richtung im rechten Winkel zur Richtung der Horizontalbewegung der Schneideeinrichtung (6); eine Nockenplatte (10p), die mit dem ersten Klemmelement (3d) verbunden ist; und ein Paar Leitplatten (11, 12) zum Eingriff mit der Nockenplatte (10p), um dadurch die Nockenplatte (10p) um eine Achse zu drehen, die sich in Richtung der Horizontalbewegung der Schneideeinrichtung (6) erstreckt.

11. Verfahren zum Aufschneiden von Fleisch entlang des oberen und unteren Keulenknochens einer Geflügelkeule unter Verwendung der Maschine nach den Ansprüchen 1 oder 6, welches umfaßt: Klemmen eines Knöchels (S3) der Geflügelkeule (S), wobei der Keule (S) ermöglicht wird, sich um dessen Knöchel (S3) zu drehen; Stützen der Keule (S); Ineingriffbringen der Schneideeinrichtung (6), die das erste keilförmige Schneidmesser (6m) und ein benachbartes zweites hin- und herbewegliches Schneidmesser (6x) umfaßt, mit dem Fleisch der Geflügelkeule (S), wobei das sich hin- und herbewegende Messer (6x) geringfügig von der Schenk kante des ersten Schneidmessers (6m) hervorsticht; Vorbelasten der Keule (S) gegen die zweite Seite der Schenkkante des ersten Schneidmessers (6m); Erzeugen einer Relativbewegung zwischen der Schneideeinrichtung (6) und der Klemmeinrichtung (3) zum Klemmen der Keule, während sich das zweite Schneidmesser hin- und herbewegt; und Beschränken der Drehung der Schneideeinrichtung (6) um eine vertikale Achse, wenn eine Kraft, die zu der Schenk kante des ersten Schneidmessers (6m) gerichtet ist, kleiner als ein vorbestimmter Wert ist, und Ermöglichen der Drehung der Schneideeinricht ung (6) in die vertikale Achse, wenn die Kraft, die zu der Schenk kante des ersten Schneidmessers (6m) gerichtet ist, größer als ein vorbestimmter Wert ist, wobei das Fleisch benachbart zu dem oberen und unteren Keulenknochen aufgeschnitten wird, ohne daß die Knochen absplitten.

Revendikations

1. Machine à découper pour ouvrir la viande d'une patte de volaille le long d'un côté de l'os de la partie supérieure de la patte et de l'os de la partie inférieure de la patte, qui comprend :
   des premiers moyens de serrage (3) pour serrer la cheville (S3) de la patte (S) tout en permettant à la patte (S) de tourner autour de la cheville (S3);
   des premiers moyens de support (S) pour soutenir la patte (S);
   des moyens de découpage (6) pour ouvrir la viande de la patte, lesquels moyens comprennent une première lame coupante (6m) ayant une coupe transversale en forme de coin et un bord couplant vertical, une seconde lame coupante (6x) en butée contre un premier côté du bord couplant de la première lame coupante (6m) et débordant légèrement du bord couplant de la première lame coupante (6m), et des premiers moyens de commande (6n) pour actionner en va et vient verticalement la seconde lame coupante (6x) par rapport à la première lame coupante (6m);
   des premiers moyens d'application (7) pour appliquer la patte (S) contre un second côté du bord couplant de la première lame coupante (6m);
   des seconds moyens de commande (6a) pour déplacer verticalement les moyens de découpage (6) en prise et hors prise avec la viande de la patte (S);
   des troisièmes moyens de commande (1c) pour déplacer horizontalement les premiers moyens de serrage (3) ; et
   des moyens de restriction (6e, 6g, 6o) pour restreindre la rotation des moyens de découpage (6) autour d'un axe vertical quand une force dirigée vers le bord couplant de la première lame coupante (6m) est plus petite qu'une amплur préédéterminée, et pour permettre la rotation des moyens de découpage (6) autour de l'axe vertical quand une force dirigée vers le bord couplant de la première lame coupante (6m) est plus grande que l'amplitude préédéterminée.

2. Machine à découper selon la revendication 1, dans laquelle lesdits moyens de restriction comprennent :
   un élément d'arbre vertical (6e) fixé aux moyens de découpage (6), lequel élément d'arbre (6e) est situé décalé par rapport aux premiers et seconds lames coupantes (6m, 6x) dans une direction à angles droits par rapport à la direction du mouvement horizontal des premiers moyens 5e serrage (3) ;
   des moyens formant ressort (6g) pour appliquer un moment initial préédéterminé aux moyens de découpage (6), commandant de ce fait les moyens de découpage (6) de manière rotative autour de l'axe vertical de l'élément d'arbre (6e) ; et
   des moyens formant arrêt (6C3) pour restreindre la rotation des moyens de découpage (6) par le moment initial quand une force dirigée vers le bord couplant de la première lame coupante (6m) est plus petite qu'une amплur préédéterminée, faisant s'étendre, de ce fait, le second côté du bord couplant de la première lame coupante (6m) dans la direction du mouvement horizontal des premiers moyens de serrage (3).

3. Machine à découper selon la revendication 1 ou 2, dans laquelle lesdits premiers moyens de serrage (3) comprennent :
   un premier élément de serrage (3d) ayant
une cannelle s'étendant dans la direction du mouvement horizontal des premiers moyens de serrage (3) ;

un second élément de serrage (3j) placé contigu au premier élément de serrage (3d) et derrière le premier élément de serrage (3d) dans la direction du mouvement horizontal des premiers moyens de serrage (3), lequel second élément de serrage (3j) est pourvu d'une découpe (3j2) faisant face à la cannelle du premier élément de serrage (3d), la largeur de la découpe (3j2) étant plus petite que celle de la cannelle du premier élément de serrage (3d) ; et
des moyens (3f, 3g, 3h, 4 ; 10k, 10n, 10p, 11, 12) pour tourner le premier élément de serrage (3d) par rapport au second élément de serrage (3j) autour d'un axe s'étendant dans la direction du mouvement horizontal des premiers moyens de serrage (3) entre une première position dans laquelle l'extrémité ouverte de la cannelle du premier élément de serrage (3d) est dirigée dans la même direction que l'extrémité ouverte de la découpe (3j2) du second élément de serrage (3j) et une seconde position dans laquelle l'extrémité ouverte de la cannelle du premier élément de serrage (3d) est dirigée à angles droits par rapport à l'extrémité ouverte de la découpe (3j2) du second élément de serrage (3j).

4. Machine à décourer selon la revendication 3, dans laquelle lesdits moyens pour tourner le premier élément de serrage (3d) par rapport au second élément de serrage (3j) comprennent :

un rouleau de guidage (3f) relié au premier élément de serrage (3d) ;

une came de ligne (4) pour mise en prise avec le rouleau de guidage (3f), tournant de ce fait le rouleau de guidage (3f) vers une direction prédéterminée autour d'un axe s'étendant dans la direction du mouvement horizontal des premiers moyens de serrage (3d) ;

un ressort (34) pour appliquer le rouleau de guidage (3f) vers une direction opposée à ladite direction prédéterminée ; et

un arrêt (3g) pour mise en prise avec le rouleau de guidage (3f) quand le rouleau de guidage (3f) est libéré de la came de ligne (4), retenant de ce fait le rouleau de guidage (3f) dans une position prédéterminée associée à la rotation.

5. Machine à décourer selon la revendication 3, dans laquelle lesdits moyens (10k, 10n, 10p, 11, 12) pour tourner le premier élément de serrage par rapport au second élément de serrage comprennent :

un premier engrenage conique (10k) relié au premier élément de serrage (3d) ;

un second engrenage conique (10n) pour mise en prise avec le premier engrenage conique (10k) ;

une plaque de came (10p) reliée au second engrenage conique (10n) ; et

deuX déflecteurs (11, 12) pour mise en prise avec la plaque de came (10p), tournant de ce fait la plaque de came (10p).

6. Machine à décourer pour ouvrir la viande d'une patte de volaille le long d'un côté de l'os de la partie supérieure de la patte et de l'os de la partie inférieure de la patte, qui comprend :

des premiers moyens de serrage (3) pour serrer la cheville (S3) de la patte (S) tout en permettant à la patte (S) de tourner autour de la cheville (S3) ;
des premiers moyens de support (5) pour soutenir la patte (S) ;
des moyens de découpage (6) pour ouvrir la viande de la patte (S) lesquels moyens comprennent une première lame coupante (6m) ayant une coupe transversale en forme de coin et un bord coupant vertical, une seconde lame coupante (6x) en butée contre un premier côté du bord coupant de la première lame coupante (6m) et débordant légèrement du bord coupant de la première lame coupante (6m), et des premiers moyens de commande (6n) pour actionner en va et vient verticalement la seconde lame coupante (6x) par rapport à la première lame coupante (6m) ;
des premiers moyens d'application (7) pour appliquer la patte (S) contre un second côté du bord coupant de la première lame coupante (6m) ;
des seconds moyens de commande (6a) pour déplacer verticalement les moyens de découpage (6) en prise et hors prise avec la viande de la patte (S) ;
des troisièmes moyens de commande (6a) pour déplacer horizontalement les moyens de découpage (6) ; et
des moyens de restriction (6e, 6g, 6c) pour restreindre la rotation des moyens de découpage (6) autour d'un axe vertical quand une force dirigée vers le bord coupant de la première lame coupante (6m) est plus petite qu'une ampleur prédéterminée et pour permettre la rotation des moyens de découpage (6) autour d'une direction à angles droits par rapport à la direction du mouvement horizontal des moyens de découpage (6) ;

des moyens formant ressort (6g) pour appliquer un moment initial prédéterminé aux moyens de découpage (6), commandant de ce fait les moyens
de découpage (6) de manière rotative autour de l'axe vertical de l'élément d'arbre (6e) ; et des moyens formant arrêt (5c₉) pour restreindre la rotation des moyens de découpage (6) par le moment initial quand une force dirigée vers le bord coupant de la première lame coupante (6m) est plus petite qu'une ampreur prédéterminée, faisant s'étendre, de ce fait, le second côté du bord coupant de la première lame coupante (6m) dans la direction du mouvement horizontal des moyens de découpage (6).

8. Machine à découper selon la revendication 6 ou 7, dans laquelle lesdits premiers moyens de serrage comprennent :

un premier élément de serrage (3d) ayant une cannelure s'étendant dans la direction du mouvement horizontal des moyens de découpage (6) ;
un second élément de serrage (3j) placé contigu au premier élément de serrage (3d) et devant le premier élément de serrage (3d) dans la direction du mouvement horizontal des moyens de découpage (6), lequel second élément de serrage (3j) est pourvu d'une découpe (3j₂) faisant face à la cannelure du premier élément de serrage (3d), la largeur de la découpe (3j₂) étant plus petite que celle de la cannelure du premier élément de serrage (3d) ; et des moyens (1c, 3f, 3g, 4 ; 1c, 10p, 11, 12) pour tourner le premier élément de serrage (3d) par rapport au second élément de serrage (3j) autour d'un axe s'étendant dans la direction du mouvement horizontal des moyens de découpage (6) entre une première position dans laquelle l'extrémité ouverte de la cannelure du premier élément de serrage est dirigée dans la même direction que l'extrémité ouverte de la découpe (3j₂) du second élément de serrage (3j) et une seconde position dans laquelle l'extrémité ouverte de la cannelure du premier élément de serrage (3d) est dirigée à angles droits par rapport à l'extrémité ouverte de la découpe (3j₂) du second élément de serrage (3j).

9. Machine à découper selon la revendication 8, dans laquelle lesdits moyens (1c, 3f, 3g, 3h, 4) pour tourner le premier élément de serrage par rapport au second élément de serrage comprennent :

des quatrièmes moyens de commande (1c) pour déplacer horizontalement les premiers moyens de serrage (3) dans une direction à angles droits par rapport à la direction du mouvement horizontal des moyens de découpage (6) ;
un rouleau de guidage (3f) relié au premier élément de serrage (3d) ;
une lame de ligne (4) pour mise en prise avec le rouleau de guidage (3f), tournant de ce fait le rouleau de guidage (3f) vers une direction prédéterminée autour d'un axe s'étendant dans la direction du mouvement horizontal des moyens de découpage (6) ;
un ressort (3h) pour appliquer le rouleau de guidage (3f) vers une direction opposée à ladite direction prédéterminée ; et un arrêt (3g) pour mise en prise avec le rouleau de guidage (3f) quand le rouleau de guidage (3f) est libéré de la came de ligne (4), retenant de ce fait le rouleau de guidage (3f) dans une position prédéterminée associée à la rotation.

10. Machine à découper selon la revendication 8, dans laquelle lesdits moyens (1c, 10p, 11, 12) pour tourner le premier élément de serrage par rapport au second élément de serrage comprennent :

des quatrièmes moyens de commande (1c) pour déplacer horizontalement les premiers moyens de serrage (3) dans une direction à angles droits par rapport à la direction du mouvement horizontal des moyens de découpage (6) ;
une plaque de came (10p) reliée au premier élément de serrage (3d) ; et deux déflecteurs (11, 12) pour mise en prise avec la plaque de came (10p), tournant de ce fait la plaque de came (10p) autour d'un axe s'étendant dans la direction du mouvement horizontal des moyens de découpage (6).

11. Procédé pour ouvrir la viande le long des os des parties supérieure et inférieure de patte de la patte de volaille utilisant la machine des revendications 1 ou 6, qui comprend :
serrer une cheville (S₆) de patte de volaille (S) tout en permettant à la patte (S) de tourner autour de sa cheville (S₆) ;
supporter la patte (S) ;
amener les moyens de découpage (6) comprenant la première lame coupante (6m) en forme de coin et la seconde lame coupante (6x) contigue actionnée en va et vient en prise avec la viande de la patte de volaille (S), où la lame (6x) actionnée en va et vient déborde légèrement du bord coupant de la première lame coupante (6m) ;
appliquer la patte (S) contre le second côté du bord coupant de la première lame coupante (6m) ;
générer un mouvement relatif entre les moyens de découpage (6) et les moyens de serrage (3) pour serrer la patte tout en actionnant en va et vient la seconde lame coupante ; et restreindre la rotation des moyens de découpage (6) autour d'un axe vertical quand une force dirigée vers le bord coupant de la première lame coupante (6m) est plus petite qu'une ampreur prédéterminée, et permettre la rotation des moyens de découpage (6) autour de l'axe vertical quand la force dirigée vers le bord coupant de la première lame coupante (6m) est plus grande qu'une ampreur prédéterminée, par quoi la viande est ouverte contiguë aux os des parties de patte supérieure et inférieure sans ébrécher les os.