



(51) International Patent Classification:

A22B 5/00 (2006.01) A22C 17/04 (2006.01)
A22C 17/00 (2006.01)

(21) International Application Number:

PCT/EP2023/062589

(22) International Filing Date:

11 May 2023 (11.05.2023)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

22173090.6 12 May 2022 (12.05.2022) EP

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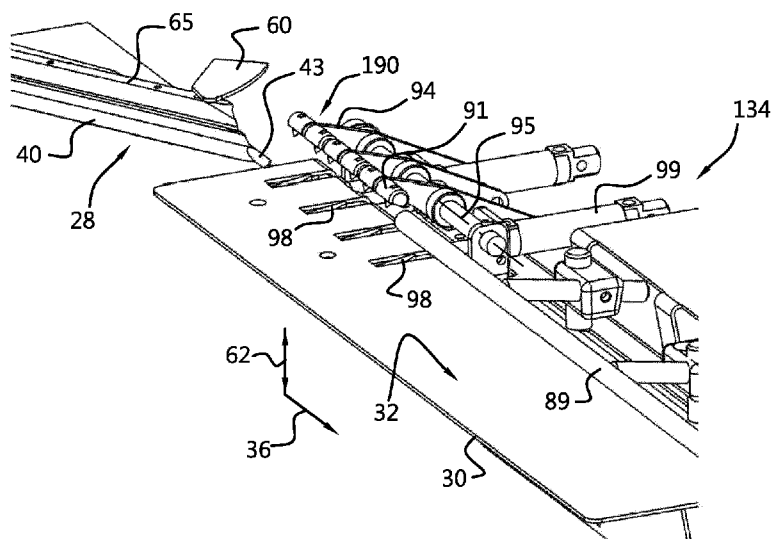
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(54) Title: SPINE PROCESSING DEVICE

Fig. 6



(57) Abstract: The invention provides a method, system and a spine processing device, for loosening meat from a spine portion of a split carcass part of a four-legged slaughter animal, such as a pork carcass part, the spine processing device comprising a cutting device for loosening the meat, by cutting, from the spine portion; a positioning device for positioning the carcass part at least while cutting, comprising: a positioning element configured to contact a cut surface of the spine portion, wherein the positioning element defines a positioning plane for the cut surface; and a pressing device for pressing the spine portion against the positioning element.



(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

TITLE Spine processing device

TECHNICAL FIELD

The present invention relates to a spine processing device, for loosening
5 meat, preferably loin meat, from a spine portion of a split carcass part of a four-legged
slaughter animal, such as a pork carcass part, the spine portion including split
vertebrae with respective spinous process parts, spinal body parts, articular processes
and transverse processes. Such split carcass parts of other four-legged slaughter
10 animals such as of cattle or sheep may be processed with the device and method
according to the present invention as well.

BACKGROUND

WO 2004/103080 A1 relates to a loin boning apparatus. Meat is removed
from the loin region of the slaughtered animal by clamping the loin to a moveable
15 carriage and advancing the carriage toward and past first and second knives mounted
on adjustable arms and perpendicular to each other. The apparatus comprises a
relatively complex combination of cutters and positioning means for cutting along the
spine.

It is an object of the present invention to provide an improved spine
20 processing device and method.

It is an object of the present invention to provide a spine processing
device and method by means of which a spine portion is more robustly positioned for
the purpose of cutting.

It is an object of the present invention to provide a spine processing
25 device and method by means of which a spine portion is positioned, for the purpose
of cutting, in a manner less sensitive for deviations in shape of the spine portion.

SUMMARY

One or more of the above mentioned objects have been achieved by the
30 spine processing device, the spine processing system and the method according to
the present invention.

According to the invention, a spine processing device is provided, as defined in claim 1, for loosening meat, preferably loin meat, from a spine portion of a split carcass part of a four-legged slaughter animal, such as a pork carcass part, the spine processing device comprising:

- 5 - a cutting device for loosening the meat, by cutting, from the spine portion;
- a positioning device for positioning the carcass part at least while cutting, comprising:
- a positioning element configured to contact a cut surface of the
- 10 spine portion, wherein the positioning element defines a positioning plane for the cut surface; and
- a pressing device for pressing the spine portion against the positioning element.

An effect of the spine processing device according to the invention is

15 that by the provision of the positioning element configured to contact a cut surface of the carcass part and defining a positioning plane, combined with the pressing device, a stable and well-defined positioning of the carcass part for the purpose of the cutting operations is achieved, by means of which the spine portion is more robustly positioned. The splitting of carcass parts typically is a less precise operation. It may

20 thus well be, for example, that the spine is not exactly cut in half, in which the cut for example passes besides the neural canal instead of through the neural canal, at least for some of the vertebrae. This may lead to positioning difficulties in prior art systems. With the device according to the invention, also less accurately split carcass parts may be robustly and reliably positioned for the purpose of loosening meat from the spine

25 portion.

The invention also relates to a system according to claim 12 and to a method according to claim 14.

In an embodiment, the carcass part is of a porcine, bovine, caprine, ovine or camelid slaughter animal. In an embodiment, the carcass part is a pork, cattle,

30 sheep or goat carcass part, preferably a pork carcass part.

In the present description and claims, with 'a spine portion' is meant a portion of the spine obtained by an earlier operation of a splitting of a carcass part or part thereof along the spine. The spine portion may include split vertebrae with

respective spinous process parts, spinal body parts, articular processes and transverse processes.

In an embodiment, the cutting device may be arranged for loosening the meat, by cutting, from the spinous process parts and from the articular processes, in
5 a cutting direction in use parallel to a length direction of the spine portion, that means, parallel to the positioning plane.

In an embodiment, the positioning element may be configured to contact a cut surface of the spine portion.

In an embodiment, the pressing device may be arranged for pressing
10 directly against the spine portion for the purpose of pressing the spine portion against the positioning element, preferably against spinal body parts of the spine portion.

In an embodiment, the positioning element is plate-shaped. A front, contact surface of the plate-shaped positioning element then defines the positioning plane. The cutting direction may in an embodiment be parallel to the positioning plane.
15 The mentioned cut surface is a cut surface resulting from a previously performed cutting action through the spine for the purpose of splitting the carcass part.

In an embodiment, the pressing device comprises a plurality of successive pressing units arranged successively in a cutting direction of the cutting device, the cutting direction being parallel to the positioning plane and thus to a length
20 direction of the spine portion in use, the plurality of successive pressing units each having:

- a pressing element movable towards and from the positioning element for pressing the spine portion against the positioning element; and
- a moving device for moving the pressing element from an
25 inactive position in which it is free from the carcass part in use, towards an active position in which the pressing element pushes against the carcass part for positioning the spine portion against the positioning element.

Using such pressing units, the spine portion may be very effectively pressed against the positioning element and thereby effectively and reliably be
30 positioned and held for the purpose of cutting. In a preferred embodiment, the plurality of successive pressing units may each have a pressing element that is individually movable towards and from the positioning element for pressing the spine portion against the positioning element. The pressing elements being individually movable, for

example by applying a dedicated actuator, such as a pneumatic cylinder, for each pressing element, allows the plurality of pressing elements to individually adapt to the specific shape of the spine portion. However, in an alternative embodiment, at least two pressing elements of the plurality of successive pressing units may be jointly
5 movable, for example by means of a common pneumatic cylinder, wherein each pressing element comprise a resilient member to allow the pressing elements to individually adapt to the specific shape of the spine portion. The resilient member may comprises a flexible rubber material, allowing for grabbing non-flat objects as the rubber will allow movement of the positioning elements relative to each other.

10 In an embodiment, each pressing element is pivotable about a pivot axis extending in the cutting direction.

In an embodiment, each pressing element has a knob shaped engagement element, preferably a plurality of knob shaped engagement elements, engaging with the spine portion in the active position of the pressing element. By such
15 knob shaped elements a good grip on the carcass part may be obtained.

In an embodiment, the positioning device further comprises a rod-shaped element in a fixed position relative to the positioning element, wherein the rod-shaped element extends in the cutting direction, that means parallel to the positioning plane, in line with the successive pressing elements at least in a position of the
20 pressing elements between the passive and the active position. In use, a first part of the length of the spine portion may be pressed against the positioning element by the plurality of pressing elements and a second, remaining part of the length of the spine portion may lie against the rod-shaped element. Such a rod-shaped element is of very simple construction but is a very effective manner of positioning a part of the spine
25 portion for the purpose of cutting. In an embodiment, the spine portion lies with spinal body parts thereof against the rod-shaped element.

In an embodiment, the positioning device has a plurality of gripping elements, each protruding from the positioning element and configured to engage the spine portion from the cut surface, preferably hook into a split neural canal of the spine
30 portion, preferably wherein each of the plurality of pressing units has an associated gripping element. Such gripping elements further contribute to the reliable and effective positioning of the spine portion.

In an embodiment, the third cutter has a fixed part fixated to the first cutter, and has a movable part fixated to the second cutter, so that in use the movable part moves relative to the first cutter jointly with the second cutter, preferably wherein the fixed part and the movable part have overlapping respective cutting edges
5 configured such that in use, upon movement of the second cutter relative to the first cutter, said respective cutting edges remain in an overlapping arrangement with respect to each other.

The invention also relates to a spine processing system for loosening meat, preferably loin meat, from a spine portion of a split carcass part of a four-legged
10 slaughter animal, such as a pork carcass part, the spine processing system comprising:

- an overhang transport system having a plurality of carriers for transporting the split carcass part along a transport trajectory, each of the plurality of carriers arranged for suspending a carcass part therefrom;

- a spine processing device according to the invention, provided along
15 the transport trajectory.

In an embodiment of the device and/or of the system in which the carcass part is suspended from such a carrier, the spine processing device may comprise a moving device for moving the spine processing device over a
20 predetermined distance along the conveying trajectory, at least during the loosening of the meat from the spine portion. This way, the carriers may be moved in a continuous manner, by which is meant opposite to an indexing manner, along the spine processing device.

The invention also relates to a method for loosening meat, preferably
25 loin meat, from a spine portion of a split carcass part of a four-legged slaughter animal, such as a pork carcass part, the method comprising:

- positioning the carcass part by means of a positioning device, wherein the carcass part, with a cut surface thereof, is brought into contact with a positioning
30 element that defines a positioning plane for the cut surface;

- pressing the spine portion against the positioning element using a pressing device; and

- loosening the meat, by cutting, from the spine portion.

In an embodiment of the method, a device according to the invention or a system according to the invention may be used.

In an embodiment, the step of loosening may comprise loosening meat from spinous process parts and from the articular processes, by cutting in a cutting
5 direction in use parallel to a length direction of the spine portion.

In an embodiment, the method comprises:

- positioning the carcass part;

- loosening the meat, by cutting using a cutting device, from the spinous
10 process parts and from the articular processes, in a cutting direction in use parallel to a length direction of the spine portion,

the cutting comprising:

- cutting along the spinous process parts using a first cutter of the
cutting device;

- cutting along an outer side of the articular processes using a
15 second cutter of the cutting device, wherein the second cutter is movable in a transverse direction transverse to the cutting direction relative to the first cutter;

- cutting along an upper, dorsal side of the articular processes
using a third cutter of the cutting device in between the first cutter and the second
cutter;

20 the first, second and third cutter jointly moving relative to the carcass part during cutting, and

urging the second cutter towards the first cutter in the transverse
direction during cutting, such that the second cutter cuts directly along the outer side
of the articular processes, using an urging element of the cutting device.

25 Embodiments of the invention described in relation to the device according to the invention apply in an analogous manner to the system and method according to the invention, and vice versa. Effects of embodiments of the device also apply to embodiments of the system and method according to the invention, and vice versa.

30

BRIEF DESCRIPTION OF DRAWINGS

The present invention is described hereinafter with reference to the accompanying schematic drawings in which embodiments of the present invention are shown and in which like reference numbers indicate the same or similar elements.

5 Figure 1 shows, in front view, an embodiment of a spine processing device according to the present invention;

Figure 2 shows, in side view, a part of the spine processing device of figure 1, as part of an embodiment of a spine processing system according to the present invention;

Figure 3 shows a cross-section of a spine;

10 Figure 4 shows a part of the spine processing device of figure 1 in greater detail;

Figure 5 shows, in side view, a part of the spine processing device of figure 1 in greater detail;

15 Figure 6 shows, from the side and below, a part of the spine processing device, similar to that of figure 1 but having a different embodiment of a pressing device, in greater detail;

Figure 7 shows, in bottom view, parts of a cutting device and of a positioning device of the spine processing device of figure 1 in greater detail;

20 Figure 8 shows, in bottom view, parts of the cutting device of the spine processing device of figure 1, in combination with a cross-section of a spine portion;

Figures 9a and 9b show, in front view and side view respectively, parts of the cutting device of the spine processing device of figure 1, in a first operating state thereof;

Figure 9c shows section IXc of figure 9a;

25 Figures 10a and 10b show, in front view and side view respectively, the parts of the cutting device of the spine processing device of figure 9a and 9b, in a second operating state thereof;

30 Figure 11 shows, from the side and below, a part of the cutting device and of the positioning device of the spine processing device of figure 1 in greater detail; and

Figures 12a and 12b show, in top view, parts of the positioning device of the spine processing device of figure 1 in two respective operating states thereof.

DESCRIPTION OF EMBODIMENTS

Figure 1 shows a spine processing device 1, which is an example of a spine processing device according to the invention. The spine processing device 1 is configured for loosening meat 11, preferably loin meat, from a spine portion 2 (indicated highly schematically by the dashed line in figure 2), of a split carcass part 3 of a four-legged slaughter animal. The example shown in figure 2 is a split pork carcass part. The cross-section of the spine portion 2 as shown in figure 3 has split vertebrae 4. The spine portion 2 has been obtained by an earlier operation of a splitting of a carcass along the spine thereof, that means by an earlier longitudinal cut through the spine. Such splitting, as is commonly done in carcass part processing and as well-known to the skilled person, results in a split spine, having split vertebrae. In order to be complete, a remaining, that-means cut-off part of the split vertebra shown in figure 3 has been indicated by the dashed line identified by reference sign 4'. The split vertebra 4 has a cut surface 5 (resulting from said splitting of the spine). The split vertebra has a spinous process part 6 (in the example shown about half of the spinous process), a spinal body portion 7 (in the example shown about half of the spinal body), an articular process 8, a transverse process 9 and a split neural canal 10. In general it is noted that the shape of such spine vertebrae may differ depending at least on the position of the vertebra along the length direction of the spine (which is perpendicular to the plane of the paper in figure 3) and on the age of the slaughter animal, for example. The articular processes 8 on lumbar vertebrae may be larger than on thoracic vertebrae, and may generally decrease in size from the rear end to the front end of the spine, for example.

Figure 2 shows a part of a spine processing system 100. The carcass part 3 is suspended by the rear ankle 12, so head-down although the head has already been removed in an earlier processing step, from a carrier 14 connected to and moved by an overhang transport system 16 (shown highly schematically) arranged for conveying the carcass part along a transport trajectory 18 past the spine processing device 1. The spine processing device 1 has a moving device 20 for moving the spine processing device 1 over a predetermined distance along the conveying trajectory 18, at least during the loosening of the meat 11 from the spine portion 2. The moving device 20 may have a linear guide 22 and a drive unit 24 for moving the device 1 back and forth along with the carriers 14.

During use of the system 100, the carcass parts 3 passing along the device 1 for the purpose of loosening meat from the spine thereof, may have been subjected to preceding processing steps upstream along the trajectory 18 like the mentioned splitting of the carcass, and may be subjected to further processing steps like deboning steps, for example.

The spine processing device 1 comprises a positioning device 26 for positioning the carcass part 3. The positioning device 26 has a positioning element 30, which is plate-shaped at least in the present example, configured to contact a cut surface 5 of the spine portion 2. The positioning element 30 defines a positioning plane, which is a plane through, that means flush with, a front contact surface 32 of the plate shaped positioning element 30 for the cut surface 5. The positioning device 26 also has a pressing device 34 for pressing the spine portion 2 against the front, contact surface 32 of the plate-shaped positioning element 30. Further aspects of the positioning device 26 will be detailed below.

The spine processing device 1 also comprises a cutting device 28 for loosening the meat 11, by cutting, from the spinous process parts 6 and from the articular processes 8, in a cutting direction 36 in use parallel to a length direction 38 of the spine portion 2 (that means out of (or into) the plane of the paper in the view of figure 3 as indicated). The cutting device 28 is moved along the spine portion 2 in the cutting direction 36 during use of the spine processing device 1. As figure 2 shows, the cutting direction 36 is vertical, downward so that the cutting starts at a rear end of the vertically extending spine portion 2 and progresses to a forward end of the spine portion 2. During such a downward cutting movement, the processing device 1 is temporarily moved along with the carrier 14 suspending the carcass part 3. After release of the carcass part 3, the spine processing device 1 moves back upstream so that it is ready for processing a next carcass part suspended from a carrier passing along the device 1.

The cutting device 28 comprises a first cutter 40 configured for cutting along the spinous process parts 6. For that purpose, the first cutter 40 has a cutting edge 42 inclined backwards from a forward side 44 of the first cutter 40 as figure 4 shows. This way, it gradually cuts along the spinous process part 6. Figure 9c shows a cross-section of a part of the first cutter 40 as such comprising the cutting edge 42. As shown, the first cutter 40 has a blade portion 46 having a spinous process contact

side 46a on a left side in the view of figure 9b, which blade portion contact side 46a faces the plate-shaped positioning element 30 and thus faces the spinous process part 6 during use while cutting. As figure 9c shows, the first cutter 40 has a small bevel 48 at the contact side 46a and a much larger bevel 50 on an opposite, outer side. As a result, the first cutter 40 will tend to move towards the spinous process part 6 during cutting as a result of forces acting on the cutter 40 by the meat 11, more specifically acting on the larger bevel 50 of the first cutter 40. The small bevel 48 has been provided to reduce the risk of inadvertent cutting into the spinous process part 6. The first cutter 40 also has a guide pin 43 projecting from the forward side 44 of the first cutter 40 in the cutting direction 36, for guiding the first cutter 40 along the spinous process parts 6 in between the spinous process part 6 and the articular process 8. A blunt tip of the guide pin 43 prevents the guide pin 43 from penetrating bone parts and provides a reliable guidance of the first cutter 40 through the typically concave, or, curved shaped space 13 between the spinous process part 6 and the articular process 8 and running parallel along the spine portion.

The first cutter 40 is fixedly connected via slotted mounting holes 58 to a moving device 52 for moving the cutting device 28 downward in the cutting direction 36 and upwards against the cutting direction. The moving device 52 may comprise a guide 56 and a chain or belt drive 54 for providing the vertical movement.

The cutting device 28 also has a second cutter 60 configured for cutting along an outer side 8a of the articular processes 8. The second cutter 60 has a cutting edge 64, which, although only visible in figure 8, has a similar shape having an inner, smaller bevel and an outer, larger bevel as the first cutter 40 as shown in figure 9c and explained above. The second cutter 60 has a blade portion 68 with the cutting edge 64 on a forward facing side of the blade portion 68, the blade portion 68 being designed, that means having a dimension in the cutting direction 36, such that it extends along a plurality of successive articular processes 8 in the cutting direction 36. In other words, a dimension of the second cutter 60 in the cutting direction 36 is such that the second cutter 60 cannot end up between two successive vertebra 4, or at least the change thereof is relatively small. The cutting edge 64 of the second cutter is at least substantially parallel to the cutting edge 42 of the first cutter 40, seen in the cutting direction 36 as figures 9b and 10b show. With 'at least substantially' is meant in this regard that irrespective of a slight possible pivoting movement of the second

cutter 60 with respect to the first cutter 40, as will be explained next, that still both cutters can be considered to be oriented about parallel during use.

The second cutter 60 is movable in a horizontal transverse direction 62 transverse to the cutting direction 36, relative to the first cutter 40. The transverse direction 62 extends perpendicular to the plate-shaped positioning element 30 and thereby to the mentioned positioning plane. In order to provide for said movement, the blade portion 68, having the cutting edge 64, is mounted to a free end of a pivot arm 65 of the second cutter 60. The pivot arm 65 is connected, in a pivotal manner about a pivot axis 66, to the first cutter 40. The pivot axis 66 extends perpendicular to the cutting direction 36 and to the transverse direction 62 as figure 9a shows. That means, like the cutting direction 36, the pivot axis 66 extends in a virtual plane parallel to the plate-shaped positioning element 30. Figure 9b shows a maximum pivoting movement of the second cutter 60 away from the first cutter in the transverse direction 62. Figure 10b shows a position of the second cutter 60 in which it has pivoted in the transverse direction 62 towards the first cutter to a position closest to the first cutter 40. The purpose of this movability of the second cutter 60 relative to the first cutter 40 is to realise that, while the first cutter 40 cuts along the spinous process 6, the cutting edge 64 of the second cutter 60 cuts, that means, keeps cutting, directly along the outer side 8a of the articular processes 8 during use, also when the cross-sectional shape of the successive spinous process parts 6 and/or articular processes 8 of the vertebrae 4 would vary over the length of the spine portion 2. For this purpose, the cutting device 28 further has an urging element 69 (see figure 9a) in the form of a compression spring, for urging the second cutter 60 towards the first cutter 40 in the transverse direction 62 during use while cutting. The urging element acts on the pivot arm 65 to which the blade portion 68 of the second cutter 60 is connected, and urges it to pivot about pivot axis 66 in the direction of the first cutter 40, that means, in consideration of figures 9b and 10b, from the maximal position shown in figure 9b towards the minimal position shown in figure 10b. As a result of the provision of the urging element 69, the blade portion 68 of the second cutter 60 is, that means, remains urged against the outer side 8a of the articular processes 8 during the cutting along the spine portion 2. Consequently, a highly effective cut directly along the outer sides 8a of the articular processes 8 may be made, resulting in a high meat yield. With regard to the mentioned varying cross-sectional shape of the spine portion 2 figure 8 may be compared to figure

3. Both may show, although drawn highly schematic, a cross-section of a vertebra of the same spine portion. For convenience the same parts of the vertebra have been identified by the same reference signs.

5 The blade portion 68 of the second cutter 60 is pivotable relative to the first cutter 40 about a further pivot axis 70 extending in the transverse direction 62. More specifically, the blade portion 68 is pivotally connected, about the pivot axis 70, to the pivot arm 65 of the second cutter 60. The cutting device 28 has a further urging element 73 (see figure 10a) in the form of a torsion spring, operative at the location of the pivot axis 70 between the blade portion 68 and the pivot arm 65, for urging the
10 cutting edge 64 of the blade portion 68 of the second cutter 60 towards the transverse processes 9 in use, in a direction 72 perpendicular to the cutting direction 36 and to the transverse direction 62. The function of this pivoting movement about the further pivot axis 70 is that the second cutter 40 keeps following the transverse processes 9 while cutting along the spine portion 2 and achieves that the cut by the second cutter
15 60 is as deep into the meat 11 along the articular processes 8 as possible, limited by the transverse processes 9. Figure 9a and 9b show the blade portion 68 pivoted to a larger extent in the direction 72 compared to figure 10a and 10b.

The cutting device 28 also has a third cutter 80 in between the first cutter 40 and the second cutter 60, for cutting along an upper, dorsal side 8b of the articular
20 processes 8. The first, second and third cutters are mutually connected for joint movement relative to the carcass part 3 in the cutting direction 36. This is achieved by the fact that the second cutter 60 and third cutter 80 cutter are mounted to the first cutter 40, the latter being moved in the cutting direction 36 in use thereby automatically letting the second 60 and third 80 cutter move along. The third cutter 80 has a fixed
25 part 81 fixated to the first cutter 40, and has a movable part 82 fixated to the second cutter 40, so that in use the movable part 82 moves relative to the first cutter 40 jointly with the second cutter 60. The movable part 82 is fixated to the pivot arm 65 which includes an embodiment in which the movable part 82 is a cutter-shaped end of the pivot arm 65.

30 The third cutter has a cutting edge 83, 84 and a guide portion 87 past the cutting edge, the guide portion 87 being designed such that it extends over a plurality of successive articular processes 8 in the cutting direction 36 so as to avoid that the third cutter cuts into an articular process 8. The fixed part 81 and the movable

part 82 have overlapping respective cutting edges 83 and 84 configured such that in use, upon movement of the second 60 cutter relative to the first cutter 40 and consequently of the movable part 82 relative to the fixed part 81, said respective cutting edges 83, 84 remain in an overlapping arrangement with respect to each other
5 as can be understood from figure 11. The cutting edge 84 of the movable part 82 is a continuation of the cutting edge 83 of the fixed part 81 at least seen in the cutting direction 36 as figure 7 shows in detail. During movement of the cutting device 28 in the cutting direction, a slight movement of the first, second and third cutter relative to the moving device 52 in the direction 72 is allowed so that the third cutter 80 may slide
10 over the tops 8b of the articular processes, as it were, while urged in the direction 72 against the upper sides 8b of the articular processes. The device 1 has still a still further urging element, such as formed by a pneumatic cylinder, operative between the first cutter 40 and the moving device 52 for the purpose of providing said slight movement of the first cutter 40, and thereby jointly of the first, second and third cutter,
15 in the direction 72.

As explained above, the positioning device 26 is configured to position the carcass part 3 with the cut surface 5 of the spine portion 2 in a positioning plane, against the plate-shaped positioning element 30. The cutting direction 36 is parallel to the positioning plane 32 and vertically downwards in the example according to the
20 figures. In any case, the cutting direction 36 is in the direction of extension of the spine portion 2. A cutting edge 42 of the first cutter 40 extends in a virtual plane parallel to the positioning plane. The cutting edge 64 of the second cutter 60 extends in another virtual plane also parallel to the positioning plane, more specifically at least substantially parallel within the bounds of the mutual movement of the second cutter
25 60 relative to the first cutter 40.

The positioning device 26 will now be described in more detail. As already described above, the positioning device 26 has a plate-shaped positioning element 30, configured to contact the cut surface 5 of the spine portion 2, and has a pressing device 34 for pressing the spine portion 2 against the contact surface 32 of
30 the plate-shaped positioning element 30. The plate-shaped positioning element 30 is formed as a flat contact plate. This way, the spine portion 2 of the carcass part 3 to be processed is pressed and thereby well-positioned against a defined contact surface.

The pressing device 34 comprises a plurality of, in the positioning device 26 four, successive pressing units 90 arranged successively in the cutting direction 36. The embodiment of the pressing device 134 shown in figure 6 has a plurality of three successive pressing units 190. Other than that, the pressing device 134 is the same as, or at least very similar to, pressing device 34 so the below description of pressing device 34 also applies to pressing device 134 in an analogous manner.

Each of the plurality of successive pressing units 90 has a pressing element 91 movable towards and from the positioning element 30 for pressing the spine portion 2 against the positioning element 30 by pressing against a body portion 7 underneath the transverse process 9 as figure 8 shows. Each pressing unit 90 also has a moving device 93 for moving the pressing element 91 from an inactive position (shown in figure 12a) in which it is free from the carcass part 3 in use, towards an active position (shown in figure 12b) in which the pressing element 91 is closer to the positioning element 30 compared to the inactive position and pushes against the carcass part 3, more specifically against the spinal body portion 7, for positioning the spine portion 2 against the positioning element 30. As figures 12a and 12b show, the moving 93 device has a lever 94 pivotable about a pivot axis 95 for each pressing element 91. The lever 93 can be pivoted through suitable actuation of pneumatic actuator 96. The pivot axes 95 extend in the cutting direction 36. Each pressing element 91 has two knob shaped engagement elements 92, preferably a plurality of knob shaped engagement elements, engaging with the spine portion 2 in the active position of the pressing element 91.

The positioning device 126 further comprises a rod-shaped element 89 in a fixed position relative to the positioning element 30, wherein the rod-shaped element 89 extends in the cutting direction 36 in line with the successive pressing elements 91 at least in a position of the pressing elements 91 between the passive and the active position as figure 12a and 12b show. During use, while cutting, a first part of the length of the spine portion 2, which may comprise lumbar vertebrae, is pressed against the positioning element 30 by the plurality of pressing elements 91 and a second, remaining part of the length of the spine portion 2 lies against the rod-shaped element 89 as shown in figure 2.

In order to even more robustly position the spine portion 2 against the positioning element 30, the positioning device 26 has a plurality of gripping elements

98, each protruding from the positioning element 30 and configured to engage the spine portion and depending on an accuracy of the cut made by the splitting, into a split neural canal 10 of the spine portion 2. Each of the plurality of pressing units 90 has an associated gripping element 98, which, as shown in figures 12a and 12b, is pivotable between a rest position (figure 12a, figure 6) and a gripping position (figure 12b, figure 7, figure 11), in the latter position protruding from the positioning element 30. The gripping element 98 is configured to be moved between said rest position and gripping position by means of a pneumatic cylinder 99. In the present example, two pairs of grippers 98 are provided, each pair being movable by a cylinder 99.

As will already be clear from the above description of the spine processing device 1, a method for loosening meat, preferably loin meat, from a spine portion 2 of a split carcass part 3 of a four-legged slaughter animal, such as a pork carcass part, comprises:

- positioning the carcass part using the positioning device 26. The carcass part 3, with a cut surface 5 thereof, may be brought into contact with a positioning element 30 that defines a positioning plane 32 for the cut surface 5;

- pressing the spine portion 2 against the positioning element 30 using the pressing device 34;

- loosening the meat, by cutting using the cutting device 28, from the spinous process parts 6 and from the articular processes 8, in the cutting direction 36 in use parallel to a length direction 38 of the spine portion 2.

The cutting comprises:

- cutting along the spinous process parts 6 using the first cutter 40;

- cutting along an outer side 8a of the articular processes 8 using the second cutter 60 which is movable in the transverse direction 62 transverse to the cutting direction 36 relative to the first cutter 40;

- cutting along an upper, dorsal side 8b of the articular processes 8 using a third cutter 80 provided in between the first cutter 40 and the second cutter 60;

the first, second and third cutter jointly moving relative to the carcass part 3 during cutting, and

urging the second cutter 60 towards the first cutter 40 in the transverse direction 62 during cutting, such that the second cutter 60 cuts directly along the outer side 8a of the articular processes 8, using the urging element 69.

CLAIMS

1. A spine processing device, for loosening meat, preferably loin meat, from a spine portion of a split carcass part of a four-legged slaughter animal, such as a pork carcass part,
5 the spine processing device comprising:
- a cutting device for loosening the meat, by cutting, from the spine portion;
- a positioning device for positioning the carcass part at least while
10 cutting, comprising:
- a positioning element configured to contact a cut surface of the spine portion, wherein the positioning element defines a positioning plane for the cut surface; and
- a pressing device for pressing the spine portion against the
15 positioning element.
2. The spine processing device according to claim 1, wherein the positioning element is plate-shaped.
- 20 3. The spine processing device according to claim 1 or 2, wherein the pressing device comprises:
- a plurality of successive pressing units arranged successively in a cutting direction of the cutting device, the cutting direction being parallel to a length direction of the spine portion in use, the plurality of successive pressing units each
25 having:
- a pressing element movable towards and from the positioning element for pressing the spine portion against the positioning element; and
- a moving device for moving the pressing element from an inactive position in which it is free from the carcass part in use, towards an active
30 position in which the pressing element pushes against the carcass part for positioning the spine portion against the positioning element.

4. The spine processing device according to claim 3, wherein each pressing element is pivotable about a pivot axis extending in the cutting direction.

5. The spine processing device according to claim 3 or 4, wherein each pressing element has a knob shaped engagement element, preferably a plurality of knob shaped engagement elements, engaging with the spine portion in the active position of the pressing element.

6. The spine processing device according to claim 3 or a claim dependent thereof, wherein the positioning device further comprises a rod-shaped element in a fixed position relative to the positioning element, wherein the rod-shaped element extends in the cutting direction in line with the successive pressing elements at least in a position of the pressing elements between the passive and the active position, wherein, in use, a first part of the length of the spine portion is pressed against the positioning element by the plurality of pressing elements and a second, remaining part of the length of the spine portion lies against the rod-shaped element.

7. The spine processing device according to any one of the preceding claims, wherein the positioning device has a plurality of gripping elements, each protruding from the positioning element and configured to engage the spine portion from the cut surface, preferably hook into a split neural canal of the spine portion, preferably wherein each of the plurality of pressing units has an associated gripping element.

8. The spine processing device according to any one of the preceding claims, wherein the spine portion includes split vertebrae with respective spinous process parts, spinal body parts, articular processes and transverse processes, wherein the cutting device is arranged for loosening the meat, by cutting, from the spinous process parts and from the articular processes, in a cutting direction parallel to a length direction of the spine portion, the cutting device comprising:

- a first cutter configured for cutting along the spinous process parts;

- a second cutter configured for cutting along an outer side of the articular processes;

- a third cutter in between the first cutter and the second cutter, for cutting along an upper, dorsal side of the articular processes;

5 wherein first, second and third cutters are mutually connected for joint movement relative to the carcass part,

 wherein the second cutter is movable in a transverse direction transverse to the cutting direction, relative to the first cutter,

 the cutting device further having an urging element for urging the second
10 cutter towards the first cutter in the transverse direction during use while cutting, such that the second cutter cuts directly along the outer side of the articular processes.

9. The spine processing device according to claim 8, wherein the second
15 cutter is pivotable relative to the first cutter about a pivot axis extending perpendicular to the cutting direction and to the transverse direction, preferably wherein the second cutter is provided at a free end of a pivot arm pivotally connected to the first cutter about the pivot axis.

10. The spine processing device according to claim 8 or 9, wherein the third
20 cutter has a fixed part fixated to the first cutter, and has a movable part fixated to the second cutter, so that in use the movable part moves relative to the first cutter jointly with the second cutter, preferably wherein the fixed part and the movable part have overlapping respective cutting edges configured such that in use, upon movement of the second cutter relative to the first cutter, said respective cutting edges remain in an
25 overlapping arrangement with respect to each other.

11. The spine processing device according to any one of the preceding
claims, wherein, in use, the carcass part is suspended from a carrier connected to and
moved by an overhang transport system arranged for conveying the carcass part along
30 a transport trajectory past the spine processing device, the spine processing device comprising a moving device for moving the spine processing device over a predetermined distance along the conveying trajectory, at least during the loosening of the meat from the spine portion.

12. A spine processing system, for loosening meat, preferably loin meat, from a spine portion of a split carcass part of a four-legged slaughter animal, such as a pork carcass part, the spine processing system comprising:

- 5
- an overhang transport system having a plurality of carriers for transporting the split carcass part along a transport trajectory, each of the plurality of carriers arranged for suspending a carcass part therefrom;
 - a spine processing device according to any one of the preceding claims, provided along the transport trajectory.
- 10

13. The spine processing system according to claim 12, wherein the spine processing device comprising a moving device for moving the spine processing device over a predetermined distance along the conveying trajectory, at least during the loosening of the meat from the spine portion.

15

14. A method for loosening meat, preferably loin meat, from a spine portion of a split carcass part of a four-legged slaughter animal, such as a pork carcass part, the method comprising:

- 20
- positioning the carcass part by means of a positioning device, wherein the carcass part, with a cut surface thereof, is brought into contact with a positioning element that defines a positioning plane for the cut surface;
 - pressing the spine portion against the positioning element using a pressing device; and
 - loosening the meat, by cutting, from the spine portion.
- 25

15. The method according to claim 14, using a device according to any one of the preceding claims 1 – 11 or a system according to any one of the preceding claims 12 or 13.

30

Fig. 1

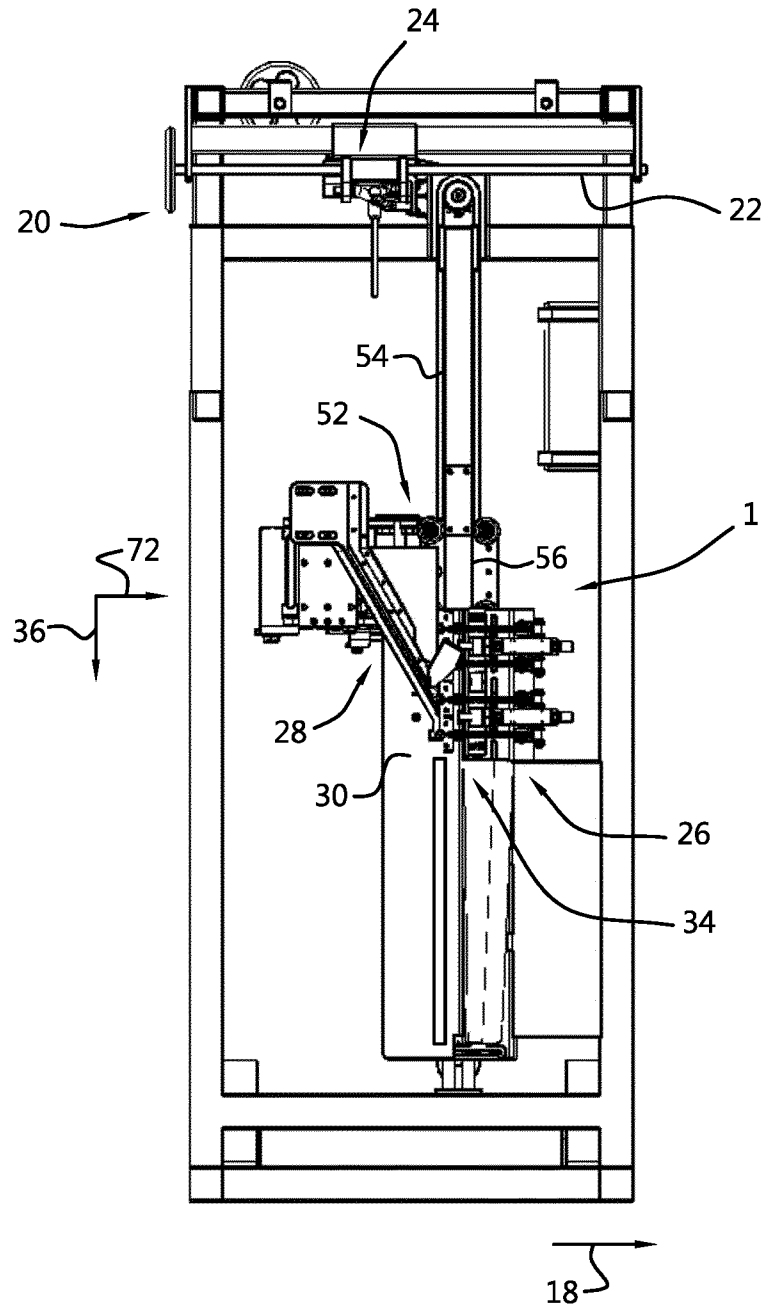


Fig. 2

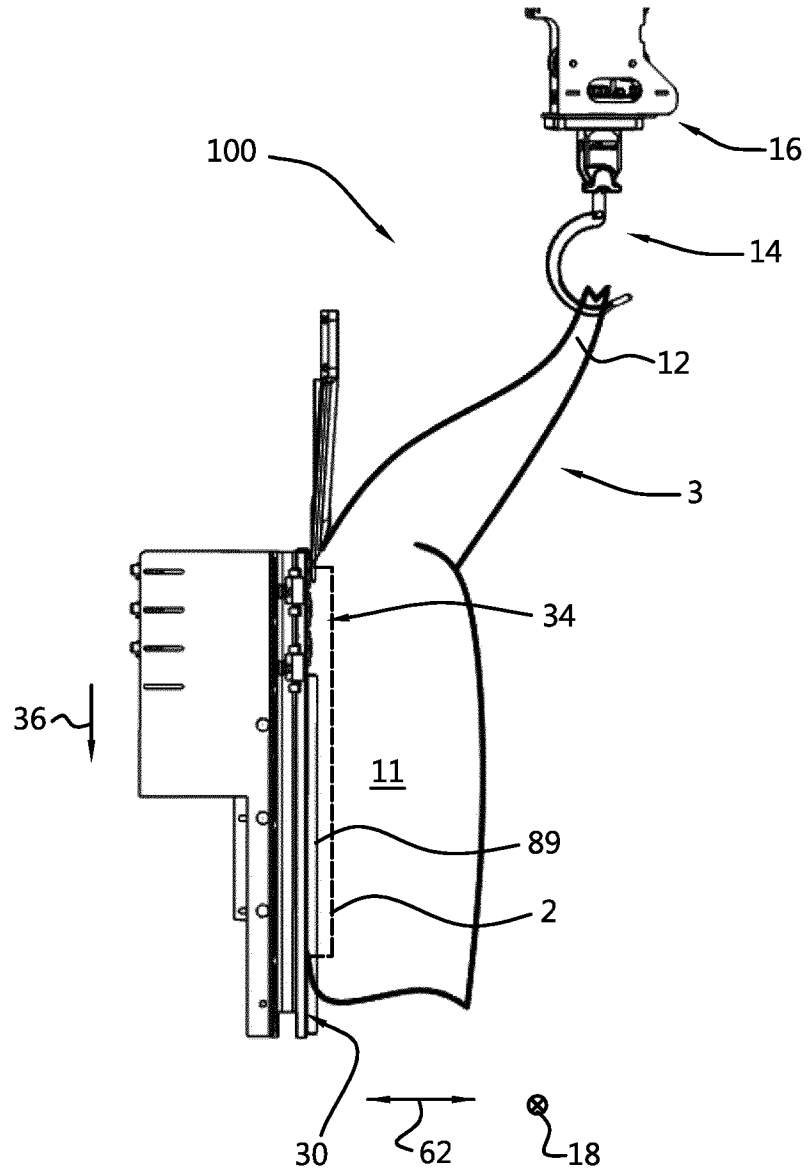


Fig. 3

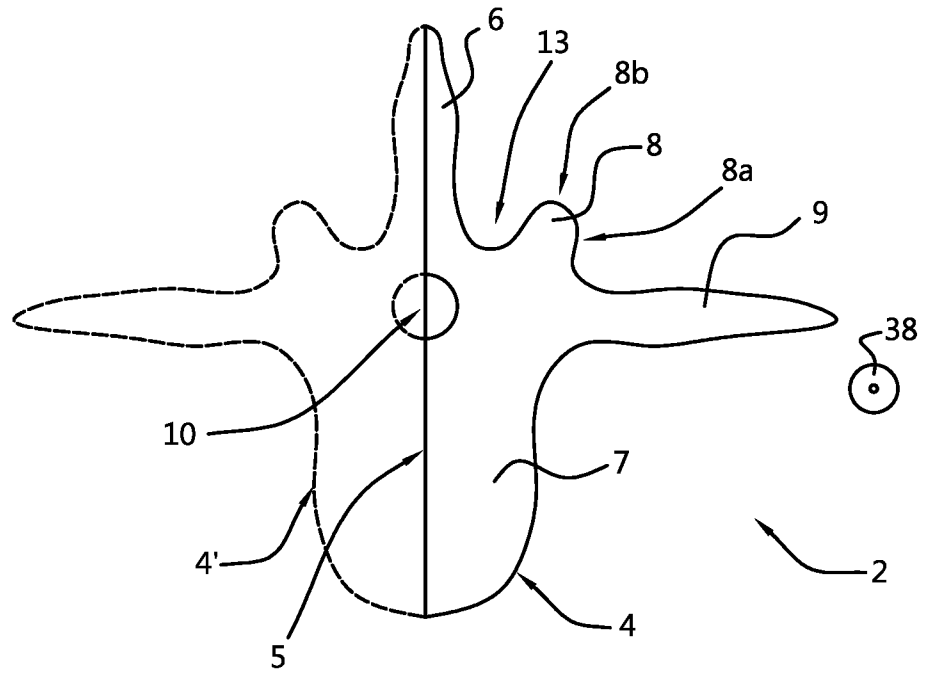


Fig. 4

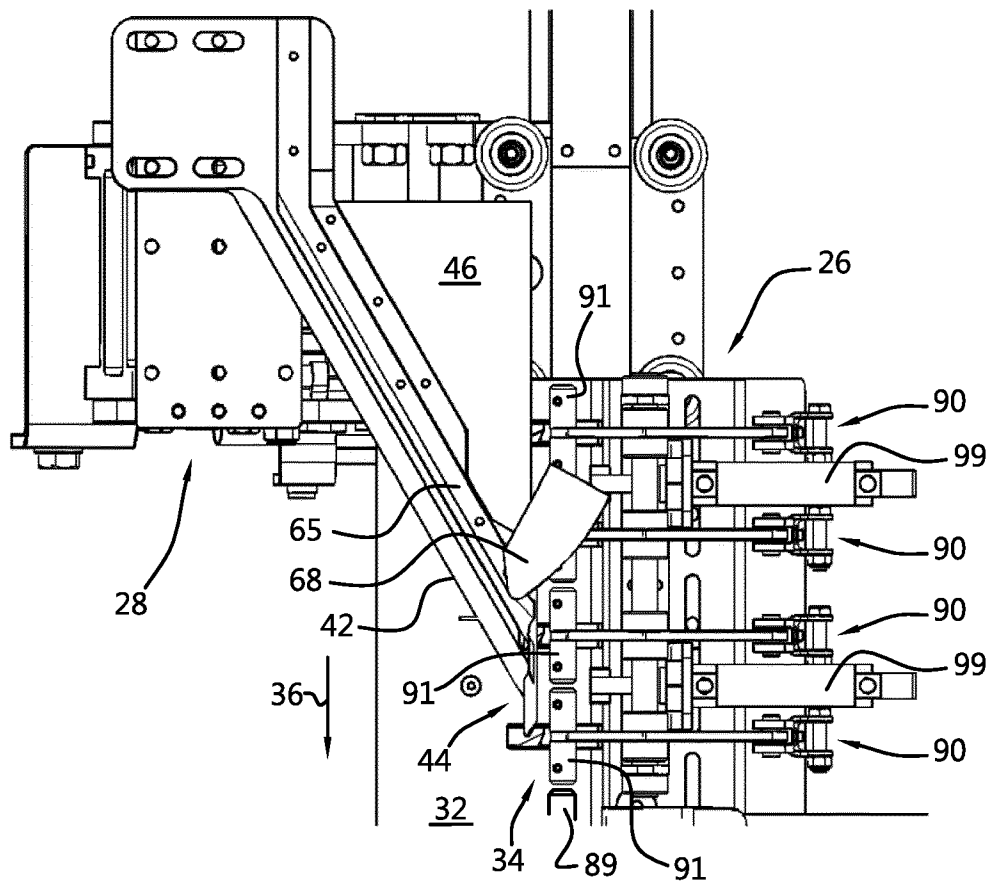


Fig. 5

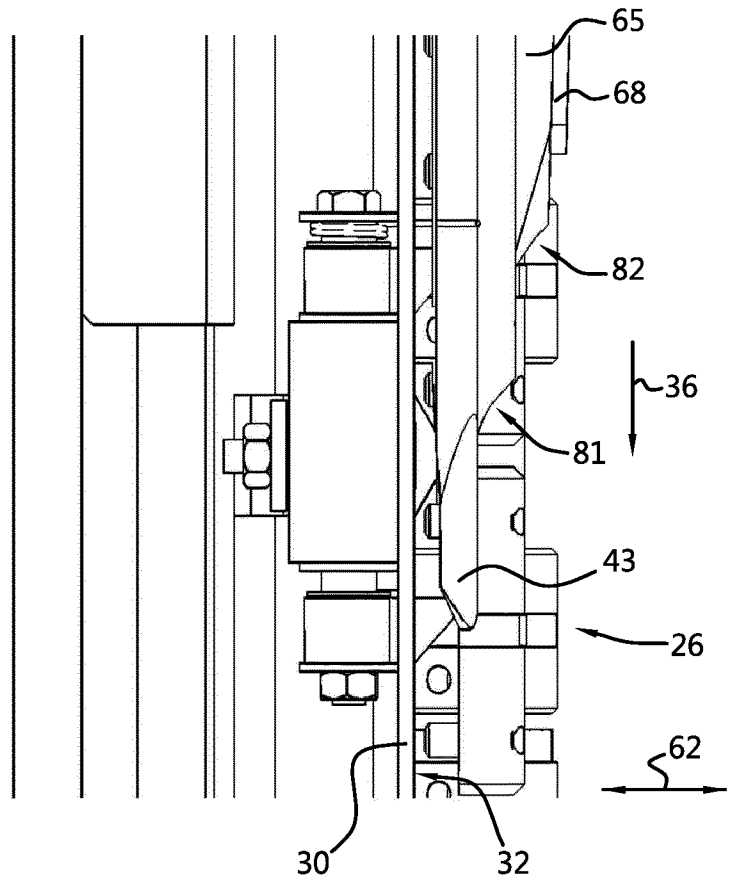


Fig. 6

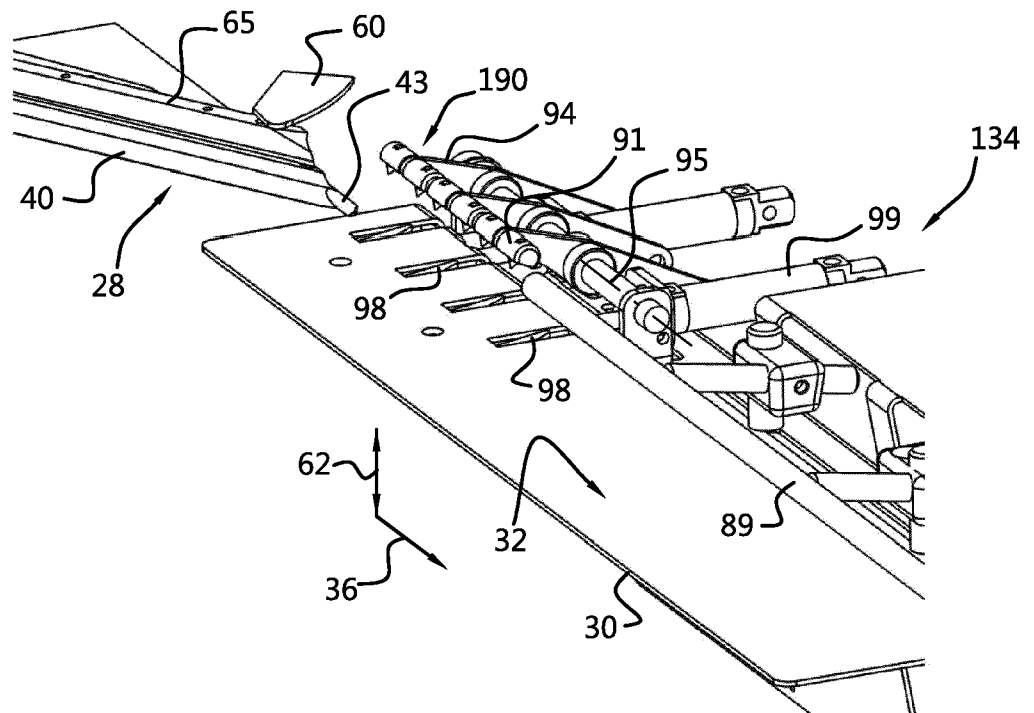


Fig. 7

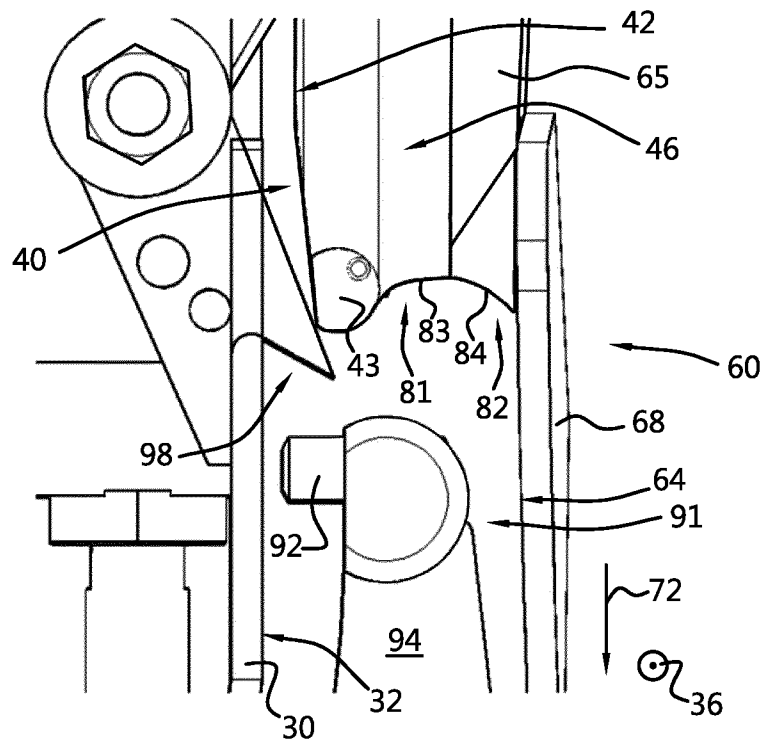


Fig. 8

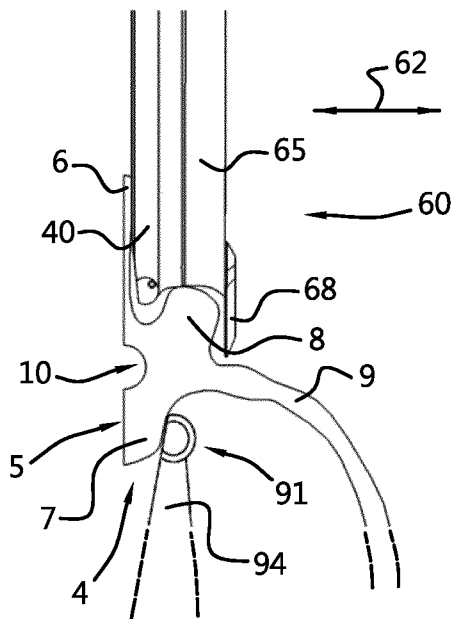


Fig. 10A

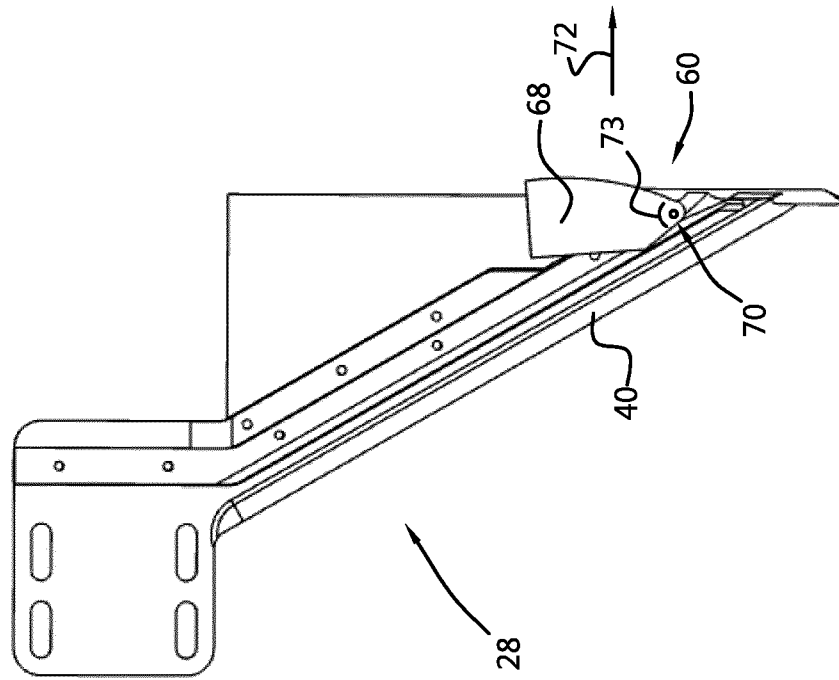


Fig. 10B

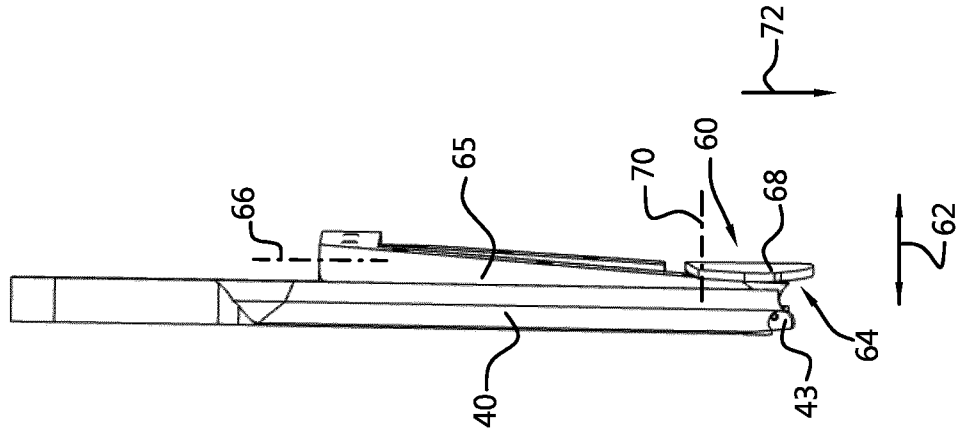


Fig. 11

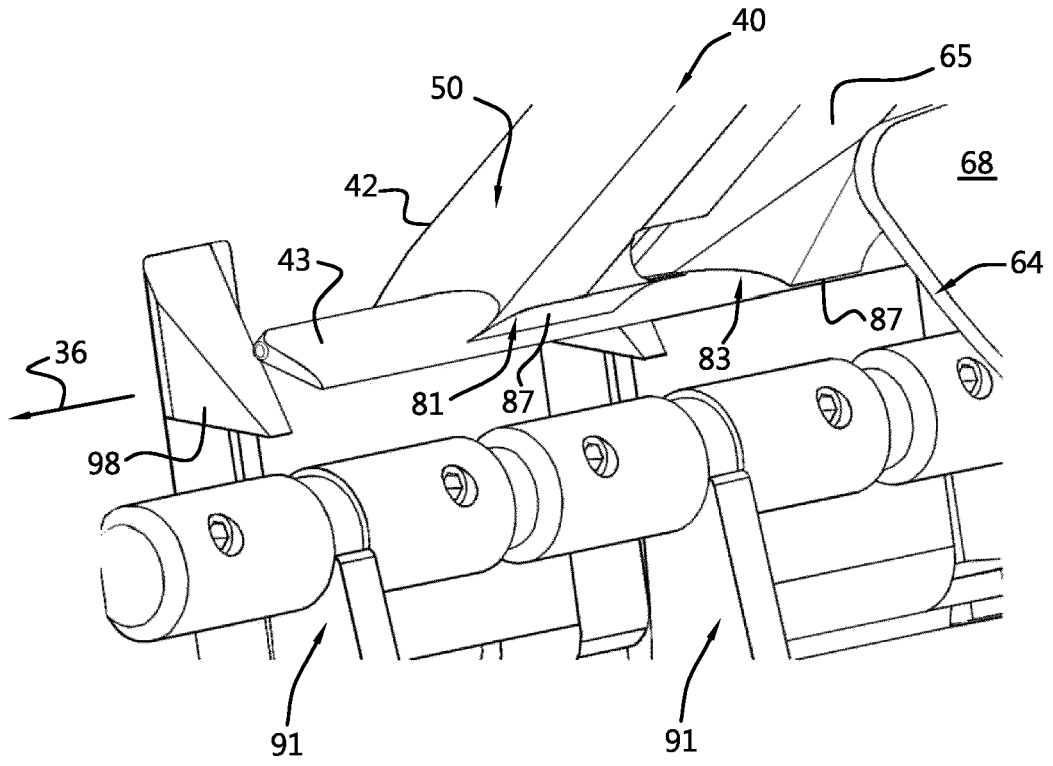


Fig. 12A

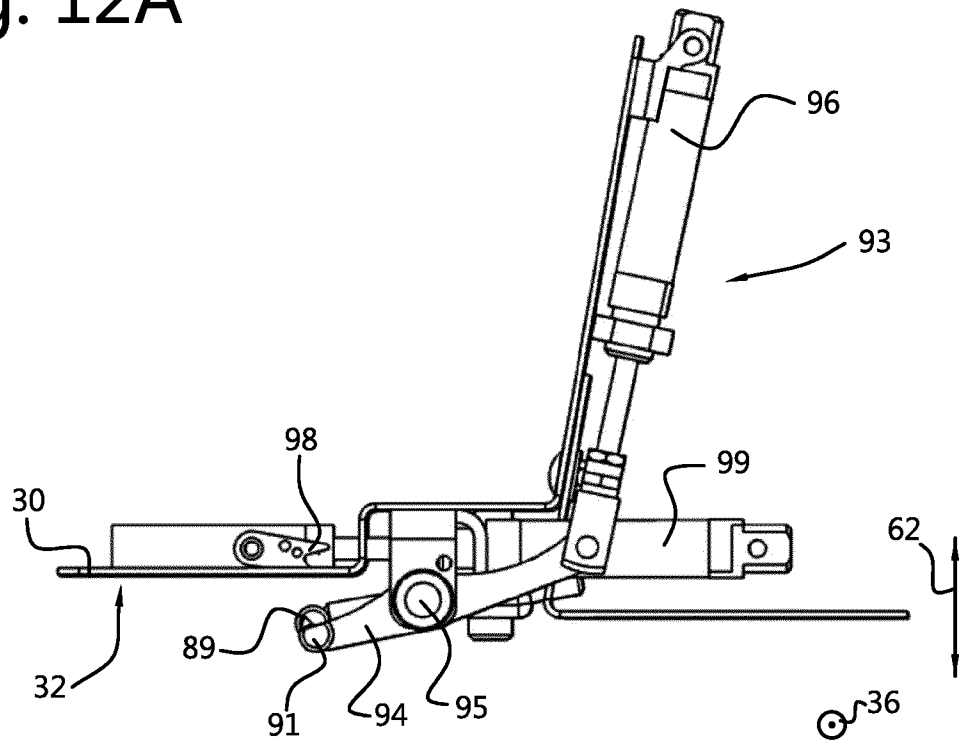
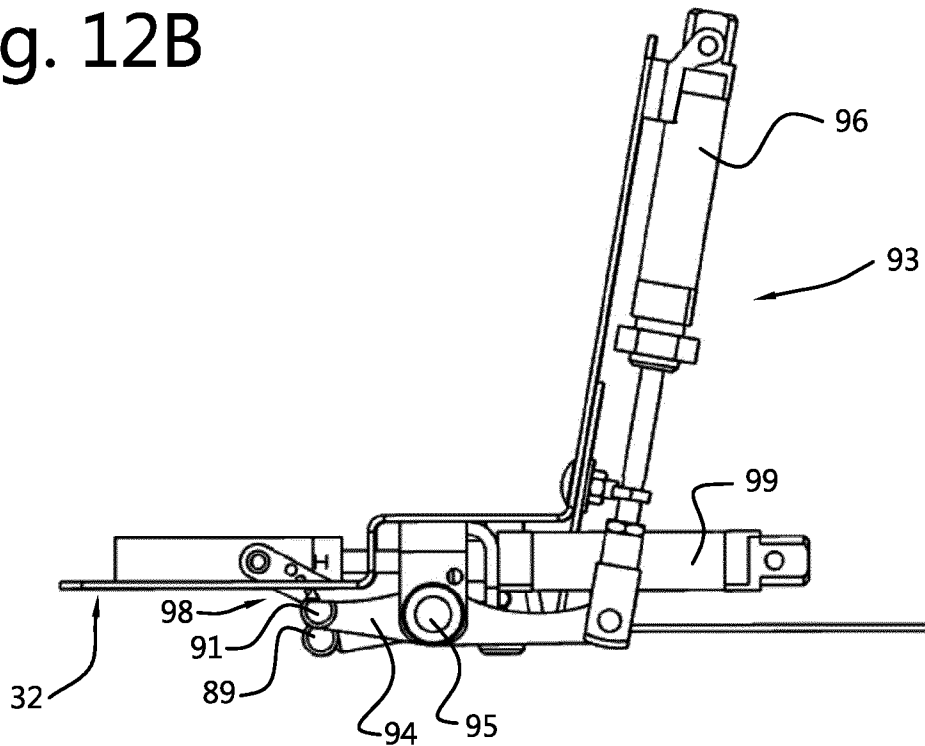


Fig. 12B



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/062589

A. CLASSIFICATION OF SUBJECT MATTER
INV. A22B5/00 A22C17/00 A22C17/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
A22B A22C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	figures 2-6 page 1, lines 9-12, 16-19 page 12, lines 35-39 page 14, lines 19-24	5, 7
X	EP 2 022 334 A1 (MAEKAWA SEISAKUSHO KK [JP]) 11 February 2009 (2009-02-11)	1, 11-15
A	paragraphs [0008], [0020], [0028]; figures 1, 4-10	2-10
Y	WO 98/53695 A2 (ACRALOC CORP [US]) 3 December 1998 (1998-12-03)	5, 7
A	figures 1, 2	1-4, 6, 8-15
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 18 August 2023	Date of mailing of the international search report 28/08/2023
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Ciubotariu, Adrian
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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2023/062589

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

International application No

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