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**The present invention relates to the slaughtering industry where slaughtered animals are cut along the median plane to provide a pair of half-carcasses, and the spinal column, also referred to as the vertebral column, is removed from the half-carcasses.**

Fig. 2

## REMOVING THE SPINAL COLUMN FROM A HALF-CARCASS OF A SLAUGHTERED ANIMAL

### FIELD OF THE INVENTION

5 The present invention relates to the slaughtering industry where slaughtered animals are cut along the median plane to provide a pair of half-carcasses, and the spinal column, also referred to as the vertebral column, is removed from the half-carcasses.

### 10 BACKGROUND OF THE INVENTION

US 8,915,773 discloses a method for separation of the spinal column from a carcass middle part. The method disclosed therein comprises the steps of determining a cutting path for a cutting device for the separation of the spinal column from the carcass middle part; separating the spinal column from the  
15 carcass middle part by causing a relative movement between the middle part and the cutting device and simultaneously causing the cutting device to engage the carcass middle. The method includes: optically scanning the middle part to provide a scan of an outer surface of the carcass middle part and identifying and locating the spinal canal in the spinal column on the basis of digital processing.  
20 The cutting path is subsequently to the scanning determined on the basis of the position of the spinal canal and the cutting is carried subsequent to the scanning and determination of the cutting path.

The method disclosed in US 8,915,773 requires that the spinal cord is optically  
25 detectable and the accuracy of the method therefore depends on the accuracy with which the carcass has been split along the median plane and reveals the spinal canal. Thus, if the carcass is not split perfectly along the median plane, e.g. if the cut is laterally offset, the spinal canal may not be detectable in an optical scan of the half-carcass. When this occurs, the method disclosed in US 8,915,773  
30 fails to provide cutting path and removal of the spinal column is to be removed by other means such as manually resulting in increased labour cost. In addition, the split may typically be offset typically up till 10 mm from a perfect split and/or it may further be angled relatively the median plane. Thus, even if the spinal column is detectable, the use of the position of the spinal column may lead to a

relative high offset of the cutting plane may be offset too much or too little resulting in that either too much meat or too little bone is removed.

Hence, an improved method for removing the spinal column would be  
5 advantageous, and in particular a more efficient and/or reliable method for removing the spinal column would be advantageous.

#### OBJECT OF THE INVENTION

10 It is an object of the invention to provide a cutting method substantially independent of the cutting path used to split a carcass into two half-carcasses.

It is a further object of the present invention to provide an alternative to the prior art.

15

In particular, it may be seen as an object of the present invention to provide a method and device that solves the above mentioned problems of the prior art.

#### SUMMARY OF THE INVENTION

20 The invention provides a method of removing, at least partly, the spinal column from a half-carcass of a slaughtered animal that has been cut substantially along the median plane of the slaughtered animal thereby providing a median cut surface of the half-carcass. A method according to the present invention preferably comprises:

- 25 - locating, on the ventral side of the half-carcass, an anatomical structure defined in relation to joints between rib heads and the spinal column of the half-carcass,  
- determining a characteristic geometrical feature of the median cut surface and/or of the ventral side of the half-carcass, where the characteristic  
30 geometrical feature typically comprises:  
o a position on and/or a spatial orientation of at least a part of the exposed rib or spinal column,  
- cutting along a cutting path, the cutting path being defined in relation to said anatomical structure and said characteristic geometrical feature of the

median cut surface and/or of the ventral side of the half-carcass, so as to remove, at least partly, the spinal column from the half-carcass.

Thus, the present invention resides inter alia in the concept of locating an  
5 anatomical structure and determining a characteristic feature, and the anatomical structure and characteristic feature may be seen fixtures or waypoints relatively to which the cutting path is defined. While the anatomical structure is located in the sense that it represents an image of a well-defined anatomical element of the bones in half-carcass, the characteristic feature is determined as it relates to  
10 geometry of a point or part of the bones in the half-carcass.

The method of the invention thus bases the location of the cutting path on an anatomical structure on the ventral side of the half-carcass, e.g. the concavity defined in relation to joints between rib heads and a characteristic geometrical  
15 feature.

Preferably, the cutting path may pass through a position being offset a predetermined first offset to the located anatomical feature and a position in the half-carcass being offset a predetermined second offset from the characteristic  
20 geometrical feature. Typically, the offset may be determined by an operator by adjusting the offset(s) until a desired cut is produced; once the offsets are determined, they are typically used for subsequent cuts as predetermined offsets. The offsets may take typical values ranging from 0mm to e.g. 30mm, although the invention is not considered limited to offsets being within this range. Further,  
25 some embodiments of the uses an angle as offset.

Accordingly, in preferred embodiments the characteristic geometrical feature may be a spatial orientation, such as the spatial orientation of the median cut surface and wherein the second offset may be a predetermined angle with the  
30 characteristic geometrical feature. Also in this case, predetermined may refer to a situation, where the operator adjust the angle until a desired cut is produced and used for subsequent cuts as a predetermined angle.

The characteristic geometrical feature may preferably be a position and the  
35 second offset may be a predetermined orientated distance from the characteristic

geometrical feature. By orientated distance it typically meant to denote a vector having a direction relative to a fix orientation (e.g. horizontal) and having a length.

- 5 As disclosed herein, the first and/or the second offset may be equal to zero.

According to preferred embodiments, the anatomical structure may be a concavity defined in relation to the joint between rib heads and thoracic vertebrae, top of rib heads, or a concavity below the rib head. Further, the characteristic geometrical  
10 feature may be a spinous process, the spatial orientation of the median cut surface, the spinal canal, the upper most position of the spinal column, or the tangent to the surface between the upper most position of the spinal column and the anatomical structure.

- 15 In embodiments in which the anatomical structure located is a concavity defined in relation to joints between rib heads and the spinal column of the half-carcass, the characteristic geometrical feature determined may be the spatial orientation of the median cut surface, and the cutting path may be provided so that it intersects the concavity or intersects a predetermined first offset therefrom and forming a  
20 predetermined angle with the median cut surface so as to remove, at least partly, the spinal column from the half-carcass.

Locating the anatomical feature can be performed using optical and/or mechanical means providing data on a zone of the half-carcass, preferably including at least  
25 the concavity. Such optical means include taking video images, stereo vision, scanning, time-of-flight measurements, X-rays, structured light, mechanical means, and suitable combinations of such methods. Preferably, the characteristic geometrical feature and the anatomical feature are determined using optical and/or mechanical means.

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The method of the invention can be performed on half-carcasses when arranged suspended in an orientation or when supported by a conveyor.

In an embodiment of the invention the method comprises moving the half-carcass, while supported by a conveyer, along a longitudinal direction of the spinal column, illuminating the ventral side of the moving half-carcass, and obtaining image data on the zone of the half-carcass, preferably including at least the  
5 concavity.

More specifically, in an embodiment of the invention illuminating the ventral side of the half-carcass includes projecting a beam of light defining a plane of light transverse to the direction of movement, and receiving projected light reflected  
10 from the half-carcass with a camera situated outside the plane of light to obtain profile information on the zone of the half-carcass, preferably including at least the concavity.

Preferably, the half-carcass may be arranged on a conveyor and means may be  
15 provided for stabilising the position of the half-carcass on the conveyor.

The half-carcass may preferably be arranged suspended in an orientation, and a method according to preferred embodiment of the invention may further comprise:

- 20 - illuminating the ventral side of the half-carcass by projecting a beam of light defining a plane of light transverse to the longitudinal direction of the spinal column, and
- receiving projected light reflected from the half-carcass with a camera situated outside the plane of light to obtain profile information on the zone of the  
25 half-carcass including at least the concavity.

In embodiments wherein the half-carcass is arranged on a conveyer, the conveyer may preferably comprise an encoder providing data on movements of the conveyer and thereby the half-carcass.

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The spatial orientation of the median cut surface can be determined using optical means including e.g. taking video images, stereo vision, scanning, time-of-flight measurements, X-rays, structured light, mechanical means, and suitable combinations of such methods.

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Advantageously, the method of the invention is carried out so that preferably immediately after a first portion of the concavity has been located and the spatial orientation of a portion of the median cut surface at the portion of the concavity has been determined, the located first portion will be cut concurrently with a  
5 second portion of the concavity will be located. This sequence is repeated until the spinal column is at least partly removed and ensures a fast and efficient removal of the spinal column.

As there is no need for identifying by the method according to the invention  
10 whether the half-carcass is a right side or left side, the present invention is capable of handling both left and right sides of half-carcasses. Cutting to remove the spinal column can be performed using e.g. a circular cutting blade, a reciprocating cutting blade, an endless cutting blade or water-jet cutting.

15 In the present context a number of terms are used in manner being ordinary to a skilled person. Some of these terms are detailed below.

A carcass having been *cut substantially along the median plane* is used to mean that the carcass has been cut along the median plane so that each of the thereby  
20 to half-carcass comprises a section of the spinal column.

*Half-carcass* is used to mean an piece of meat including a part of the spinal column.

25 *Longitudinal orientation or direction of the spinal column* is used to mean the orientation from head to tail of the animal or vice versa.

#### BRIEF DESCRIPTION OF THE FIGURES

The present invention and in particular a preferred embodiment thereof will now  
30 be described in more detail with regard to the accompanying figures. The figures show ways of implementing the present invention and are not to be construed as being limiting to other possible embodiments falling within the scope of the attached claim set.

35 Figure 1 is a schematically cross sectional view of a carcass

Figure 2 is a schematically illustration of a half-carcass located on a conveyer prior to removal of spinal column,

5 Figure 3 is a schematically illustration of a method according to a preferred embodiment of the invention; in figure 3 the following legends are used to indicates preferred steps according to the invention:

- I: locating an anatomical structure ( $X_A, Y_A$ ),
- II: determining a characteristic geometrical feature as a spatial orientation
- 10 III: using a predetermined offset (angle)
- IV: providing a cutting path passing through the located anatomical feature and a position being offset a predetermined amount from the characteristic geometrical feature
- X-Y coordinate system indicates that positions etc are preferably given with
- 15 reference to a fixed coordinate system,

Figure 4 is a schematically illustration of a method according to a further preferred embodiment of the invention; in figure 4 the following legends are used to

20 indicates preferred steps according to the invention:

- I: locating an anatomical structure ( $X_A, Y_A$ ),
- II: determining a characteristic geometrical feature as a position
- III: using a predetermined 1st offset to offset the located anatomical feature, and using a predetermined 2nd offset, to
- 25 IV: provide a cutting path passing through the offset located anatomical feature and a position being offset a predetermined amount from the characteristic geometrical feature,
- X-Y coordinate system indicates that positions etc are preferably given with
- reference to a fixed coordinate system,

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Figure 5 is a schematically illustration of a method according to a further embodiment of the invention; figure 5A illustrates the spinal column and figure 5B is a flow chart illustration steps involved in determining a cutting path,

Figure 6 is a schematic illustration of an embodiment of removal of the spinal column according to a further embodiment of the invention where the half-carcass is suspended in a vertical orientation, and

5 Figure 7 is a schematic illustration of two different cutting paths.

#### DETAILED DESCRIPTION OF AN EMBODIMENT

Figure 1 shows a cross section of the carcass of a slaughtered animal. A dotted line II-II indicates the medial plane 2 along which the carcass is to be cut to  
10 provide two half-carcasses 1A and 1B. The spinal column 3 with the spinal canal 5 and ribs 4 connected to the spinal column are seen.

Figure 2 shows the half-carcass 1A supported by a conveyer 8. A scanner 10 projects light towards a zone of the ventral side of the half-carcass 1A, the zone  
15 including at least the concavity 7 defined in relation to joints between rib heads and the spinal column 3 of the half-carcass 1A. Light is reflected from the carcass and is received by a light receiver such as a camera in the scanner 10, and image data from the camera is processed to identify and locate the concavity 7.

20 It is noted that the half-carcass 1A, 1B may be provided in such a manner that it only has ribs along a part of the longitudinal direction thereof. In such cases, the method according to the invention is applied for the section comprising ribs and in the region not comprising ribs, e.g. the concavity between spinal column and a transverse process may be used for determining a cutting path.

25

Reference is made to figure 3, 4 and 5. As shown in these figures, the method of removing, at least partly, the spinal column from a half-carcass 1A, 1B of a slaughtered animal that has been cut substantially along the median plane 2 of the slaughtered animal thereby providing a median cut surface 6 of the half-  
30 carcass (1A, 1B), may comprise the steps of locating, on the ventral side of the half-carcass 1A, 1B, an anatomical structure 7 defined in relation to joints between rib heads and the spinal column 3 of the half-carcass 1A, 1B, and determining a characteristic geometrical feature 15 of the median cut surface 6 and/or of the ventral side of the half-carcass 1A, 1B.

35

It is noted that "locating" and "determining" both refers to a situation where an image is obtained of the half-carcass 1A, 1B and that locating is used to indicate that the position of well-defined anatomical structure is located in the image, and the determining is used to indicate that the feature relates to the geometry of a  
5 point or part of the bones in the half-carcass.

The characteristic geometrical feature 15 may as indicated in figures 3 and 4 comprise a position (fig. 4) on and/or a spatial orientation (fig. 3) of at least a part of the exposed rib or spinal column.

10

Based on the characteristic geometrical feature 15 is located and the anatomical structure 7 is located, the cutting along a cutting path 13 is defined in relation to those two features said anatomical structure (7) so as to, at least partly, remove the spinal column from the half-carcass 1A, 1B.

15

As shown in fig. 3 and 4, the cutting path 13 pass through a position being offset a predetermined first offset to the located anatomical feature 7 and a position in the half-carcass 1A, 1B being offset a predetermined second offset from the characteristic geometrical feature 15. It is noted, that the first and/or the second  
20 offset may be zero.

The offset may typically be predetermined by an operator operating the cutting equipment input a value for the first and the second offset to cutting device (controlled by a computer). The operator evaluates the cut provided and if the  
25 initial input offset values provides a cut which is not the operator's satisfaction due to e.g. too much removal of meat or to little removal of spinal column the operator adjust the first and/or second offset. This procedure is continued until the operator is satisfied with the cutting. After that, the offsets typically remains unchanged until an operator finds reason to change one or more of the offsets.

30

While the offsets typically are predetermined by an operator, the offsets may alternatively be predetermined in an automated manner, where vision equipment evaluates the cutting and changes the offsets until a desired result is obtained.

As shown in fig.s 3 and 5A, the characteristic geometrical feature may be a spatial orientation. In figure 3, the characteristic geometrical feature 15 is the angle of the tangent in a point on the spinal column which in the example of fig. 3 is shown to be  $65.5^\circ$  and the predetermined offset angle is  $15.7^\circ$  (as indicated in fig. 5 3, reference III). Thus, the cutting is made so that the cutting path is angled  $65.5^\circ + 15.7^\circ$  to the tangent in the point considered.

As shown in fig. 5, the characteristic geometrical feature 15 is the spatial orientation of the median cut surface 6, and the second offset is a predetermined 10 angle  $V$  with the characteristic geometrical feature. In this case, no first offset is used. As indicated above, the first and/or the second offset is equal to zero.

Reference is made to fig. 4. In this embodiment, the characteristic geometrical feature 15 is a position and the first and second offset is a predetermined 15 orientated distance from the characteristic geometrical feature 15. The characteristic geometrical feature 15 is typically selected as a position on the spinal column which is easy recognisable in an image and may e.g. be selected as the point positioned a certain distance from e.g. the upper most position of the spinal column 16. Similarly, the location of the anatomical structure may be 20 carried out in a similar manner.

The anatomical structure 7 may preferably be selected as a concavity defined in relation to the joint between rib heads and thoracic vertebrae, top of rib heads, or a concavity below the rib head 17.

25

The characteristic geometrical feature 15 may preferably be selected as spinous process, the spatial orientation of the median cut surface 6, spinal canal, the upper most position of the spinal column 16, or the tangent to the surface between the upper most position of the spinal column 16 and the anatomical 30 structure 7.

Reference is made to figure 5A and 5b. As disclosed herein, a cutting path is determined to optimally remove the spinal column, i.e. without removing too much meat and not leaving too much bone. Figure 5A shows a half vertebra of the 35 spinal column 3 and a rib 4 in the half-carcass. It is desired to cut along a plane

cutting path defined by the line  $L_2$  intersecting the concavity 7 such as its "deepest" point and the point  $(X_B, Y_B)$  near the tip of the spinous process of the vertebra. The point  $(X_A, Y_A)$  can be identified and located optically by means corresponding to the optical scanner 10 used to locate the concavity 7 whereby

5 the cutting path can be determined, or the cutting path 13 can be determined based on the spatial orientation of the median cut surface 6, which is preferably determined optically. The cutting path 13 is then determined as the plane intersecting the concavity 7 and forming a predetermined angle  $V$  with the median cut surface 6. Although the cutting path 13 herein is disclosed as a straight line,

10 the cutting path may be curved. For instance, in cases where curved saw is used, the cutting path may reflect the shape of the knife.

The predetermined angle  $V$  of the cutting path 13 relative to the median cut surface 6 depends on e.g. the species of the animal and/or the size of the animal

15 and/or the position along the spinal column. The location and angle of the cutting path 13 may be further adjusted manually or adaptively. Figure 2 shows the cutting path 13A as determined automatically, and alternative cutting paths 13B and 13C are examples of further adjusted cutting paths.

20 Figure 5B illustrates steps in the process of determining the cutting path 13. The median cut surface 6 as represented by the line  $L_1$  is defined by  $Y = \alpha_1 x + \beta_1$  which is preferably determined using optical means. The coordinates  $(X_A, Y_A)$  of the concavity 7 are determined as mentioned above, preferably by optical means. The predetermined angle  $V$  is retrieved from a storage, and the cutting path 13 as

25 represented by the line  $L_2$  defined by  $Y = \alpha_2 x + \beta_2$  is determined by a controller (not shown) based on the values of  $X_A, Y_A, \alpha_1$  and  $V$ . The predetermined angle ( $V$ ) of the cutting path typically depends on the species of the animal and/or the size of the animal and/or the position along the spinal column 3. In a further embodiment, an offset may be added to one or both of the coordinates  $(X_A, Y_A)$ ,

30 for instance to alter the orientation of the line  $L_2$  if so desired.

Cutting can be performed by using cutting device known in the art, such as a circular cutting blade 12 driven by a motor 11, a reciprocating cutting blade 12 driven by a motor 11, an endless cutting blade 12 driven by a motor 11 or a

35 water-jet cutting device. . The motor 11 with the cutting blade 12 (or water-jet

cutting device) is moved by a robotic arm (not shown) controlled by the controller so that the cutting blade follows the determined cutting path 13 to eventually remove the spinal column at least partly.

- 5 The interaction of the cutting blade with the half-carcass may cause the half-carcass to move on the conveyer which may cause the cutting blade to follow a wrong cutting path. In order to ensure that the cutting blade follows the desired cutting path it is advantageous to have means for stabilising the position of the half-carcass on the conveyor against undesired movements on the conveyer.

10

It is noted that the present invention also includes embodiments in which the half-carcass is not moved during cutting, in which case the cutting blade is moved along the longitudinal direction of the half-carcass. Further, the cutting may be performed from ventral side, towards the ventral side or combinations thereof.

15

As shown in fig. 7 the actual provided cutting path 13 may depend on the cutting device used. The straight line 13 indicates a cut provided with e.g. a cutting blade formed as flat disc thereby providing a straight cut. The curved line 13 illustrates a cut provided with a curved cutting blade e.g. with a band saw.

20

The invention can be implemented by means of hardware, software, firmware or any combination of these. The invention or some of the features thereof can also be implemented as software running on one or more data processors and/or digital signal processors.

25

As presented herein, many of the embodiments of the invention resides in locating an anatomical structure and determining a characteristic geometrical feature by use of imaging. Preferably, the imaging is based on electromagnetic radiation which may be characterised as making use of reflection of electromagnetic

30 radiation or transmission of electromagnetic radiation.

#### *On reflection of electromagnetic radiation*

1. In one embodiment laser light (or other light source) is directed towards the half-carcass. One or more cameras are used in a triangulation to obtain an

image. The half-carcass can be moved and/or the camera as well as the light source can be moved in order to obtain an image.

2. In a further embodiment, stereo-vision is applied. In such embodiments, two cameras are used, in which a calibration of the mutual positioning of the cameras is carried out prior to use. An image is obtained by each camera of the same object and by combining the images information about the depth (distance from camera) can be provided.

3. In yet a further embodiment, the so-called time-of-flight method is applied. The time-of-flight method may be implemented in different manner and comprises on an overall level measuring the time spend for the light to travel from the light source, to the half-carcass and to a light receiver, typically placed at the light source. Thereby, the distance from the light source to the position where the light "hits" the half-carcass can be determined. In order to increase the precision, phase shift technologies (or similar) may be implemented. The time-of-flight method may be implemented both with and without measurements of the light intensity.

4. In yet a further embodiment, so-called structural light is applied. The structural light is characterised by a light source emitting a light pattern (often infra-red). A camera makes an image of the reflected light pattern. By use of image processing the light pattern can be identified in the image. The size of individual elements in the pattern provides the distance to the object reflecting the elements in the pattern. A calibration is performed between the light source and the camera. Advantageously, this approach may be supplemented by a providing an image without a light pattern so this image may be combined with the image obtained by the light pattern in order to get both depth and light intensity measurements.

30

*On transmission of electromagnetic radiation*

1. In one embodiment, x-ray radiation is applied. An x-ray source transmit x-ray and a detector is arranged to detect x-rays transmitted through the half-carcass. The amount of x-rays detected is used to provide a 3D image of the half-carcass; in order to obtain the 3D image, a number of x-ray sources are used, the

35

half-carcass is moved during radiation and/or the x-ray source(s) are moved. The use of x-ray can further provide information as to the thickness of bones and position thereof.

- 5 The individual elements of an embodiment of the invention may be physically, functionally and logically implemented in any suitable way such as in a single unit, in a plurality of units or as part of separate functional units. The invention may be implemented in a single unit, or be both physically and functionally distributed between different units and processors.

10

Although the present invention has been described in connection with the specified embodiments, it should not be construed as being in any way limited to the presented examples. The scope of the present invention is to be interpreted in the light of the accompanying claim set. In the context of the claims, the terms  
15 "comprising" or "comprises" do not exclude other possible elements or steps. Also, the mentioning of references such as "a" or "an" etc. should not be construed as excluding a plurality. The use of reference signs in the claims with respect to elements indicated in the figures shall also not be construed as limiting the scope of the invention. Furthermore, individual features mentioned in different claims,  
20 may possibly be advantageously combined, and the mentioning of these features in different claims does not exclude that a combination of features is not possible and advantageous.

## KRAV

1. Fremgangsmåde til fjernelse, mindst delvist, af rygsøjlen fra en halv slagtekrop (1A, 1B) fra et slagtet dyr som i det væsentlige er blevet skåret langs  
5 midterplanen (2) af det slagtede dyr hvorved der tilvejebringes en midterskåret overflade (6) af den halve slagtekrop (1A, 1B), idet fremgangsmåden omfatter
  - lokalisering, på bugsiden af den halve slagtekrop (1A, 1B), af en anatomisk struktur (7, 17) defineret i forhold til leddene mellem ribbenshovederne og rygsøjlen (3) på den halve slagtekrop (1A, 1B),
  - 10 - bestemmelse af et karakteristisk geometrisk element (15) på den midterskårne overflade (6) og/eller på bugsiden af den halve slagtekrop (1A, 1B), idet det karakteristiske geometriske element (15) omfatter:
    - o en placering på og/eller en spatial orientering af mindst en del af det eksponerede ribben eller rygsøjlen,
  - 15 - skæring langs en skærebane (13), idet skærebanen er defineret i forhold til den anatomiske struktur (7, 17) og det karakteristiske geometriske element (15) på den midterskårne overflade (6) og/eller på bugsiden af den halve slagtekrop, for at fjerne, mindst delvist, rygsøjlen fra den halve slagtekrop (1A, 1B).
- 20
2. Fremgangsmåde ifølge krav 1, hvor skærebanen (13) passerer gennem en position som er offset en forudbestemt første offset i forhold til det lokaliserede anatomiske element (7, 17) og en position i den halve slagtekrop (1A, 1B) som er offset en forudbestemt anden offset fra det karakteristiske geometriske element  
25 (15).
3. Fremgangsmåde ifølge krav 2, hvor det karakteristiske geometriske element er en spatial orientering, såsom den spatiale orientering af den midterskårne overflade (6), og hvor den anden offset er en forudbestemt vinkel  
30 (V) med det karakteristiske geometriske element.
4. Fremgangsmåde ifølge krav 2, hvor det karakteristiske geometriske element er en position og hvor den anden offset er en forudbestemt tilpasset afstand fra det karakteristiske geometriske element (15).

5. Fremgangsmåde ifølge et hvilket som helst af kravene 2-4, hvor den første og/eller den anden offset er lig med nul.
6. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor den
- 5 anatomiske struktur (7, 17) er
- en konkavitet defineret i forhold til leddet mellem ribbenshovederne og brysthvirvlen,
  - toppen af ribbenshovederne, eller
  - en konkavitet under ribbenshovedet(17).
- 10
7. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor det karakteristiske geometriske element (15) er:
- processus spinosus,
  - den spatiale orientering af den midterskårne overflade (6),
- 15
- rygmarvskanalen (5),
  - den øverste del af rygsøjlen (16), eller
  - tangenten til overfladen mellem den øverste position af rygsøjlen (16) og den anatomiske struktur (7, 17).
- 20
8. Fremgangsmåde ifølge krav 1, hvor den lokaliserede anatomiske struktur er en konkavitet (7, 17) defineret i forhold til leddene mellem ribbenshovederne og rygsøjlen (3) på den halve slagtekrop (1A, 1B),
- det bestemte karakteristiske geometriske element (15) er den spatiale orientering på den midterskårne overflade (6),
- 25
- skærebanelen (13) krydser konkaviteten (7, 17) eller krydser en forudbestemt første offset derfra og danner en forudbestemt vinkel (V) med den midterskårne overflade (6) for at fjerne, mindst delvist, rygsøjlen fra den halve slagtekrop (1A, 1B).
- 30
9. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor lokalisering af den anatomiske struktur udføres under anvendelse af optiske og/eller mekaniske metoder der giver data om et område af den halve slagtekrop, fortrinsvis herunder mindst konkaviteten (7, 17).

10. Fremgangsmåde ifølge et hvilket som helst af de foregående krav hvor det karakteristiske geometriske element (15) er bestemt under anvendelse af optiske og/eller mekaniske metoder.
- 5 11. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor det anatomiske element er lokaliseret under anvendelse af optiske og/eller mekaniske metoder.
12. Fremgangsmåde ifølge et hvilket som helst af de foregående krav
- 10 omfattende
- flytning af den halve slagtekrop, mens den bliver støttet på et transportbånd, langs længderetningen på rygsøjlen (3),
  - illuminering af bugsiden af den bevægende halve slagtekrop, og
  - opnå billeddata fra området af den halve slagtekrop, fortrinsvis omfattende
- 15 mindst konkaviteten (7).
13. Fremgangsmåde ifølge krav 12, hvor
- illuminering af bugsiden af den halve slagtekrop (1A, 1B) omfatter projicering af en lysstråle der definerer et plan af lys på tværs af
- 20 bevægelsesretningen, og
- modtagelse af projiceret lys reflekteret fra den halve slagtekrop (1A, 1B) med et kamera anbragt uden for lysplanen for at opnå profilinformation fra området af den halve slagtekrop, fortrinsvis omfattende mindst
- 25 konkaviteten.
14. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor den halve slagtekrop er anbragt på et transportbånd og hvor der er tilvejebragt midler til at stabilisere positionen af den halve slagtekrop på transportbåndet.
- 30 15. Fremgangsmåde ifølge et hvilket som helst af kravene 12-15 hvor den halve slagtekrop er arrangeret ophængt i en retning, idet fremgangsmåden endvidere omfatter
- illuminering af bugsiden af den halve slagtekrop (1A, 1B) ved at projicere en lysstråle der definerer et plan af lys på tværs af længderetningen på rygsøjlen,
- 35 og

- modtagelse af det projicerede lys reflekteret fra den halve slagtekrop (1A, 1B) med et kamera anbragt uden for lysplanen for at opnå profilinformation fra området af den halve slagtekrop omfattende mindst konkaviteten.
- 5 16. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor den halve slagtekrop er anbragt på et transportbånd, idet transportbåndet omfatter en indkoder der giver data om transportbåndets bevægelser og dermed om den halve slagtekrop.

1/4

Fig. 1

Fig. 2

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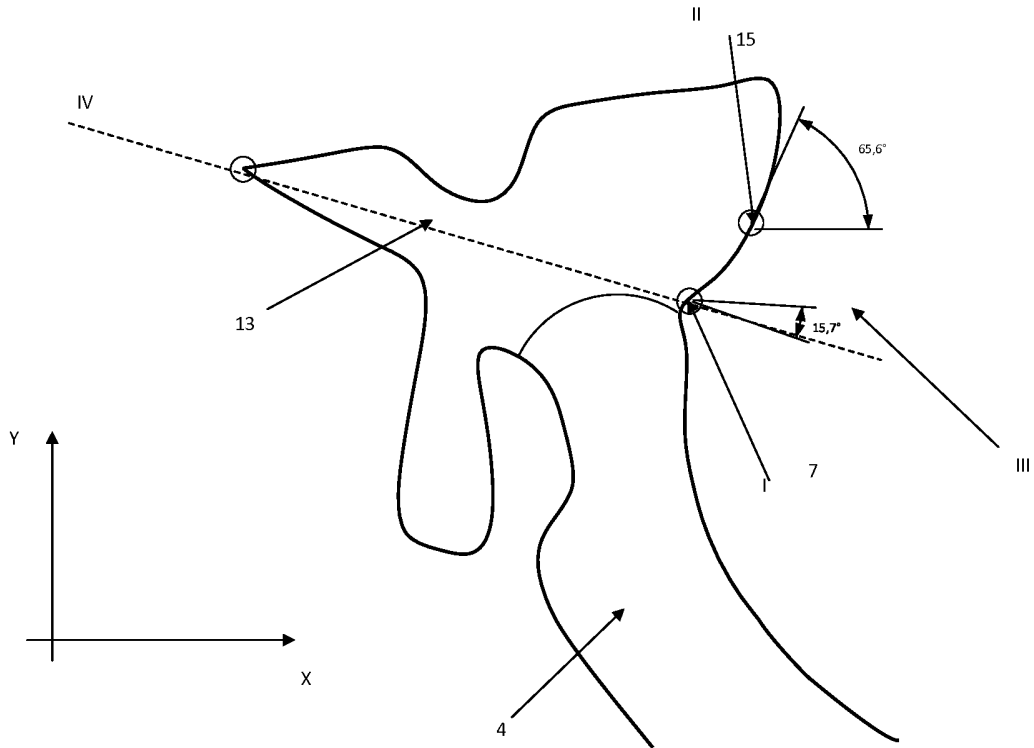


Fig. 3

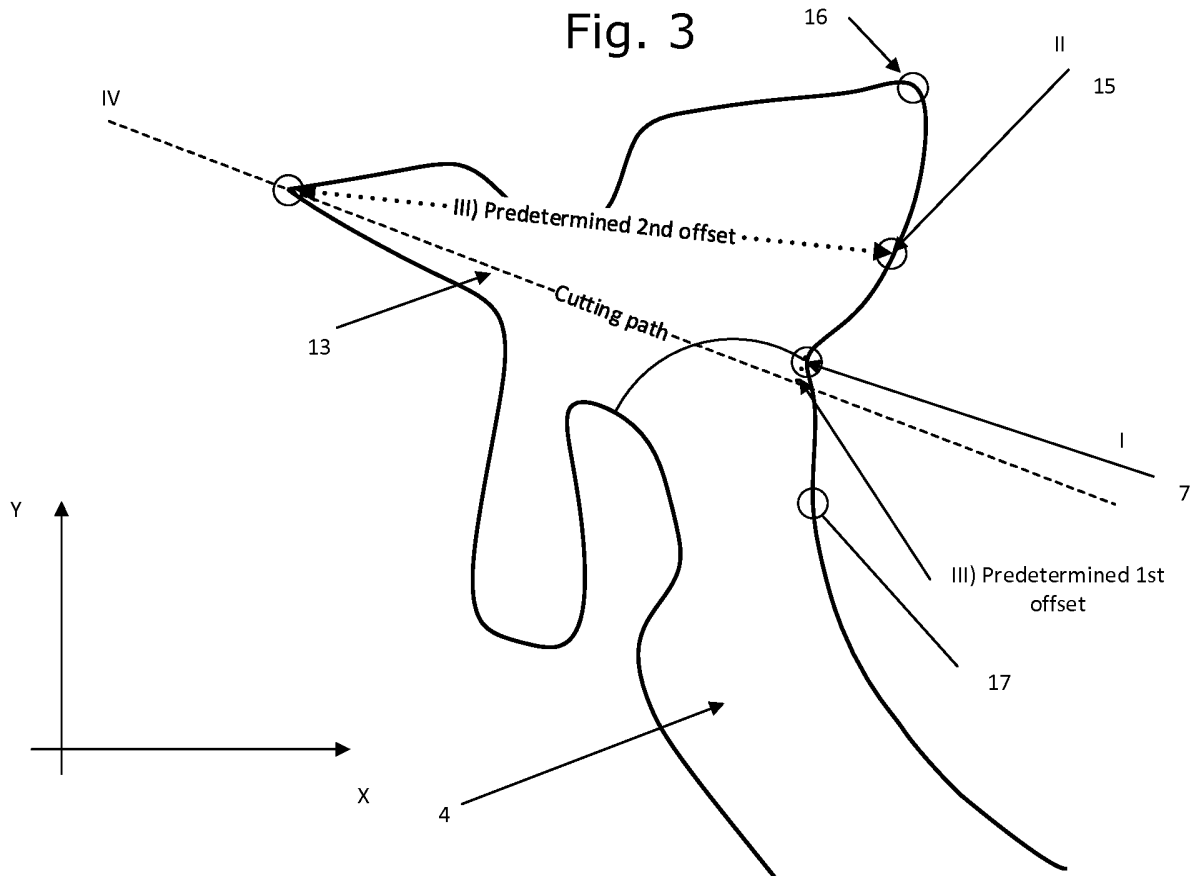


Fig. 4

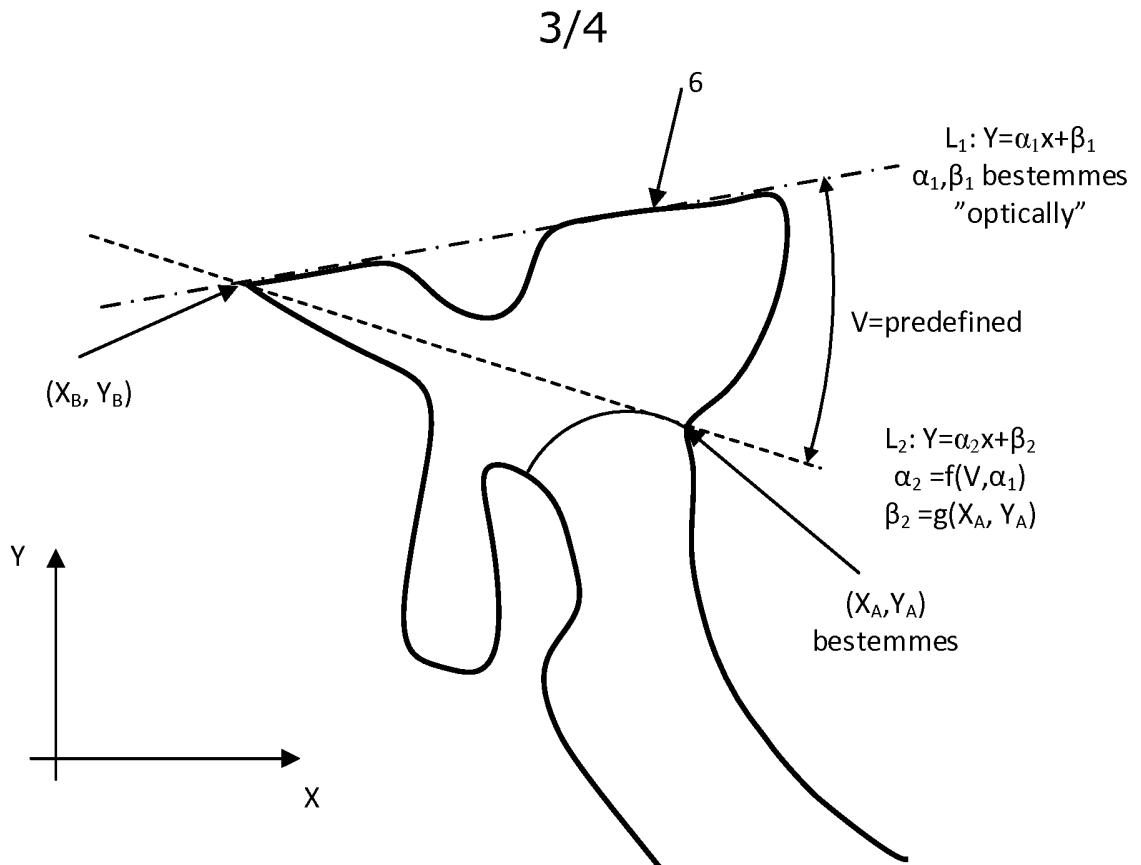


Fig. 5A

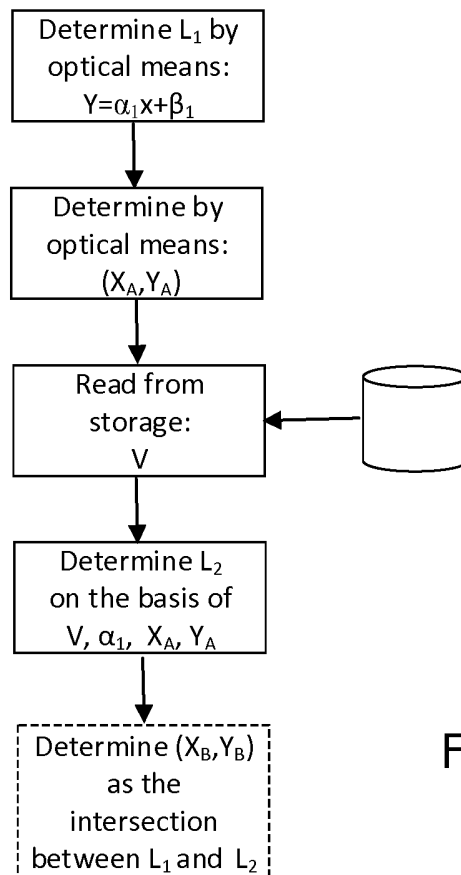


Fig. 5B

Fig. 6

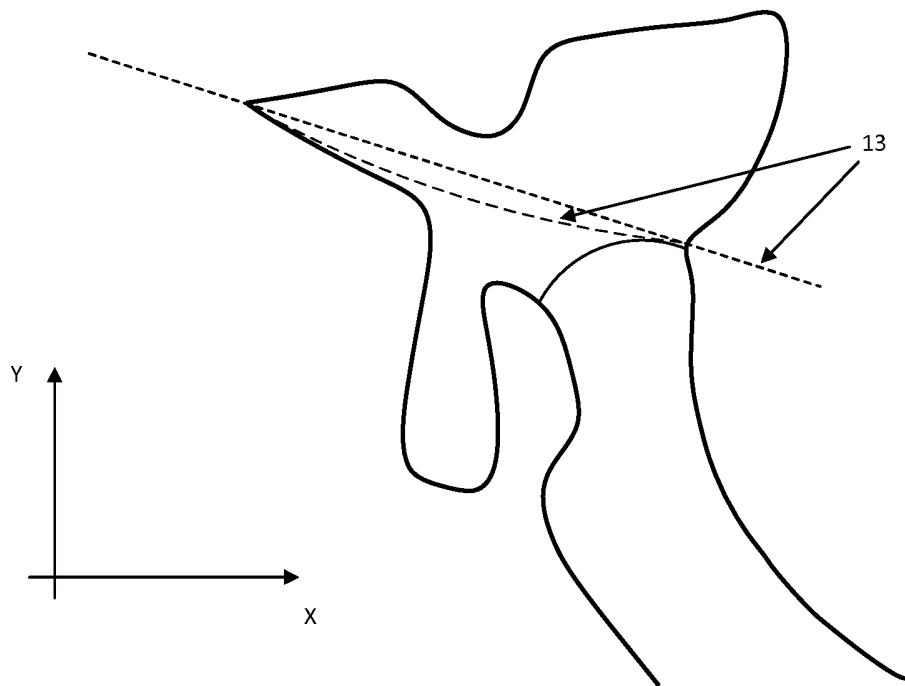


Fig. 7

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