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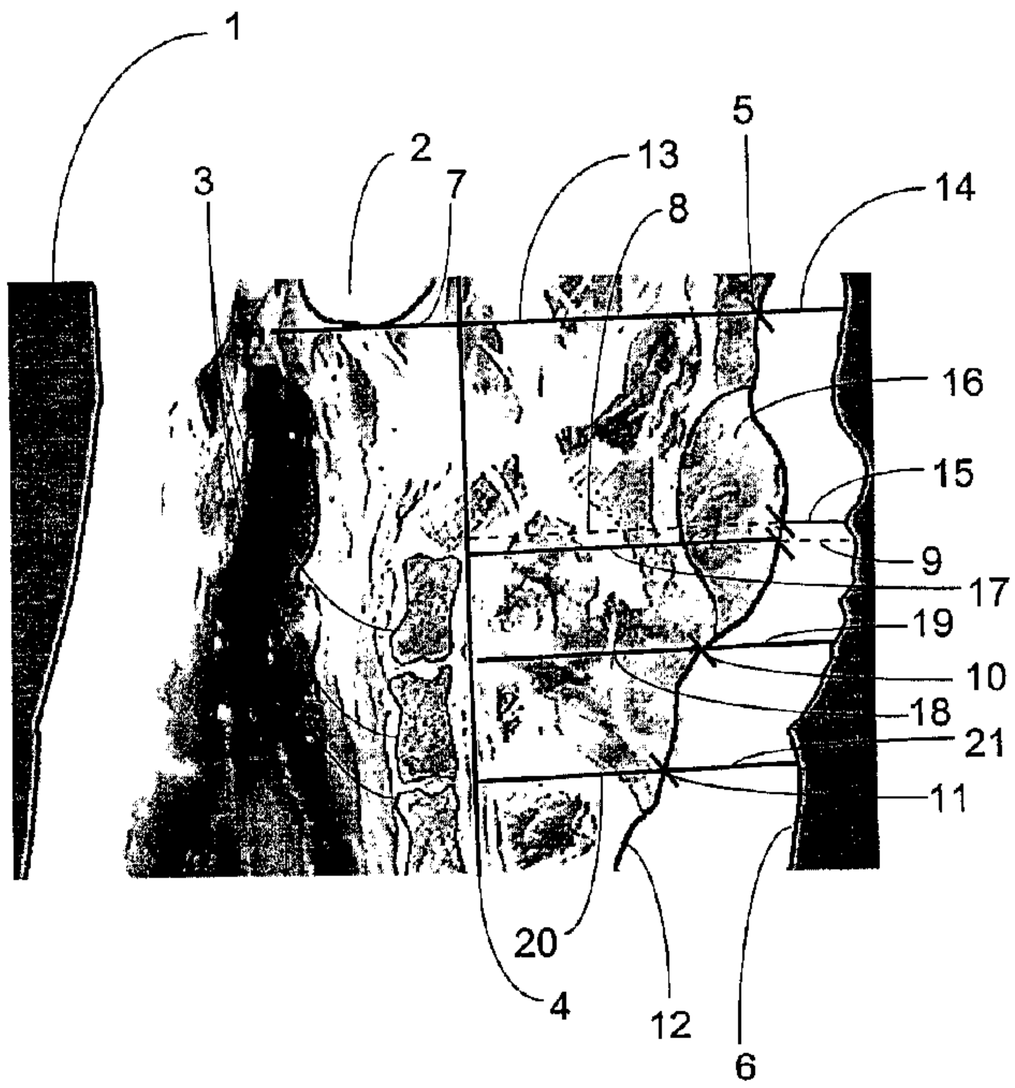
(54) Titre : DISPOSITIF POUR EVALUER LA QUALITE DE MOITIES DE CARCASSES ANIMALES
(54) Title: METHOD FOR ASSESSING THE QUALITY OF ANIMAL HALF-CARCASSES



(57) Abrégé/Abstract:
The invention relates to a method which, using optical image processing, ensures an automatic quality assessment of animal half-carcasses, in particular, of slaughtered pigs, whereby, compared to prior art methods, a higher reproducible estimation accuracy, which can not be significantly influenced by errors made during the cleaving process of the slaughtered animal, is attained by carrying out image acquisition in a manner that is not absolutely perpendicular in relation to the cleaving plane. To this end, the invention provides that an optical recorded image of the animal half-carcass is photogrammetrically evaluated in the cleaving plane, in the area of the ham-loin region. The vertebral column (3), the hinge bone (2), the thinnest fat thickness on the musculus gluteus medium (MGM) (16), and the contours of the fat back (6; 12) in the selected region are used as distinctive reference points. The portion of lean meat which leads to the assessment of quality is calculated by adding the partial lengths in the region of the meat and of the fat layer which are set in proportion to one another and which are perpendicular to the straight progression of the back marrow channel while taking into account a base constant as well as constants for each term, which are established from regression calculations.

Abstract

The invention describes a method which by means of optical image processing ensures the automatic evaluation of the quality of slaughtered animal halves, in particular of slaughtered pigs, wherein in contrast to the known methods, it is possible to achieve a higher reproducible accuracy of estimation which can only be influenced insignificantly by errors in the process of splitting the slaughtered animal and cannot be influenced by not absolutely perpendicular image recording with respect to the splitting plane. In accordance with the invention, the object is achieved by virtue of the fact that a recorded optical image of the slaughtered animal half in the splitting plane, in the region of the ham-loin region is evaluated photogrammetrically.

The significant reference points which are used are the spinal column (3), the pin bone (2), the thinnest layer of fat on the MGM (16) and the contours of the back fat (6; 12) in the selected region.

The lean flesh proportion which is crucial for the purpose of evaluating quality is calculated by the addition of partial sections, which are set in ratio with respect to each other and are perpendicular to the straight progression of the spinal cord channel, in the region of the flesh and the layer of fat, thus incorporating constants for each term, which are ascertained from regression calculations, and a basic constant.

(Figure 1)

Method for evaluating the quality of slaughtered animal halves

The invention relates to a method for evaluating the quality of slaughtered animal halves by optical image processing which can be used in particular for the purpose of classifying and determining the market value of halves of slaughtered pigs and also in principle of other large and small slaughtered animals.

Generally in slaughter houses and meat processing works the halves of slaughtered pigs are suspended on hooks, the halves are registered, weighed and evaluated according to an official trade classification by measuring the thickness of fat and flesh at locations which are specifically prescribed by law in each State. Furthermore, the market value is determined using a plurality of other specific parameters of the slaughtered animal carcass and these parameters are mainly not standardized.

In addition to manual methods for determining the thickness of fat and flesh on halves of slaughtered animals, different prior art classification methods are known which follow the principle of optical image processing.

The documents DD 298 310 A5 / DE 41 31 556 C2 and DE 41 09 345 C2 describe a method for determining or analysing halves of slaughtered animal carcasses by means of image processing, wherein the outer contour, layer of fat, flesh and back fat ratio are determined, whereby images are recorded of the halves of slaughtered animals including the backbone and all the intermediate vertebral layers. The sacrum of the spinal column is used as the fixing point for determining the parameters for splitting and classifying the carcass and the sacrum is also determined in the same way as the other vertebrae by means of object analysis. On the one hand, a disadvantage of this method is the high cost of computer technology required to analyse the object using pre-defined contour and object parameters, on the other hand owing to possible splitting errors during the actual processing, it is not always possible to select the sacrum in a sufficiently reliable manner as a fixing point.

The document DE 197 33 216 C1 describes a method for evaluating halves of slaughtered animals using optical image processing, which renders it possible based on the standard two-point method to classify a carcass using an optical image evaluation of the extended loin region whilst excluding subjective error sources. The accuracy of the estimation for evaluation purposes and thus for classification of the carcass has not thereby been improved in comparison to hitherto known evaluation methods.

A method of evaluating slaughtered animal halves by optical image processing is also known, wherein a photogrammetric method is used as a simulation of the conventional two-point evaluation method. In the loin and ham region, two significant points, of which the first point is the carcass-side end of the pin bone, the second point is the carcass-side end of the MGM (Musculus Gluteus Medium), and a straight line in the direction of the average progression of the back fat are recorded photogrammetrically. For actual evaluation purposes, the lengths of partial sections are used which are provided on a perpendicular on the straight line, which is displaced in parallel with the pin bone, at the level of the second significant point by means of the thickness of the back fat. Although in the case of this method the subjective measuring errors of the manually performed two-point method are eradicated, the accuracy of the estimation for evaluation purposes is not, however, increased.

It is the object of the invention to develop a method which by means of optical image processing ensures the automatic evaluation of quality of slaughtered animal halves, in particular of slaughtered pigs, wherein in contrast to the known methods it is possible to achieve a higher reproducible accuracy of estimation which can only be influenced insignificantly by errors in the processing of splitting the slaughtered animal and cannot be influenced by not absolutely perpendicular image recording with respect to the splitting plane.

The object is achieved by the features stated in claim 1. Preferred developments are stated in the subordinate claims.

The essence of the invention resides in the photogrammetric evaluation of a recorded optical image of the slaughtered animal half in the splitting plane, in the region of the ham-loin area.

In this region, the pin bone and the vertebrae can be identified optically, the Musculus Gluteus Medium and the back fat can always be selected optically by the colour and brightness differences with respect to other tissue parts, which means that they can be selected in a reliable manner with respect to computer technology. The significant reference points used for the purpose of the photogrammetric evaluation are the spinal column, the pin bone, the thinnest layer of fat on the MGM and the contours of the back fat in the selected region.

The lean flesh proportion which is crucial for evaluating quality is calculated by the sum of partial sections, which are set in ratio with respect to each other and are perpendicular to the straight progression of the spinal cord channel, in the region of the flesh and layer of fat, thus incorporating constants for each term, which are determined from regression calculations, and a basic constant.

The partial sections which are required for the calculation are determined in that a straight line in the direction of the last, straight portion of the spinal column is placed in the middle of the spinal cord channel, as the first starting line for the measurements. Placed on this straight line as the second starting line is a perpendicular section extending as far as the outer contour of fat, of which the inner extension tangentially contacts the lower point of the pin bone.

In parallel with the second starting line, further sections, whose lengths are defined by the first starting line and the outer contour of fat, calculated at the level of the tail-side end of the last vertebra, the thinnest layer of fat on the MGM, between the ultimate and penultimate vertebra and also between the penultimate and third from last vertebra. The length of the partial sections of the second starting line and the further sections in parallel therewith are determined by the point of intersection thereof with the fat inner contour line between fat and flesh.

It is also feasible to determine the market class by means of the cross-sectional area calculation, which is possible in the following step, from the partial sections and the associated sections on the first starting line by reference to characteristic proportional variables of fat-layer parts and of partial areas which are defined by means of the fat inner contour, the pin bone, the penultimate vertebra.

Alternatively, the ratios of the section lengths of the diagonals of partial areas with respect to each other can also be used for determination purposes.

By determining section ratios for the purpose of evaluating the quality of slaughtered animal halves, the advantages of the invention reside particularly in the elimination of sources of error by not absolutely perpendicular recorded images in the splitting plane which otherwise cause incorrect evaluations and incorrect classifications. Splitting errors in the slaughtering process scarcely influence the evaluation. The accuracy of the estimation is substantially increased, whereby it is possible to achieve a more precise, higher quality evaluation.

The invention is explained in detail as an exemplified embodiment with reference to Figure 1 as a recording region for the evaluation.

As shown in Figure 1, an image region 1 of the ham and loin region of a slaughtered animal half is evaluated photogrammetrically and said image region includes its entire width, the carcass-side end of the pin bone 2 and the lower end of the spinal column 3 including vertebrae.

A straight line 4 in the direction of the straight portion of the spinal column 3 is placed in the middle of the spinal cord channel as the first starting line for the measurements. Placed on this straight line 4 as the second starting line 5 is a perpendicular section extending as far as the outer fat contour 6, wherein an inner extension 7 of the second starting line 5 tangentially contacts the lower point of the pin bone 2.

In parallel with the second starting line 5, four further sections are calculated, whose lengths are likewise defined by the straight line 4 as the first starting line and the outer fat contour 6. A first parallel 8 is calculated at the level of the thinnest layer of fat on the MGM, a second parallel 9 is calculated on the tail-side end of the last vertebra of the spinal column 3, a third parallel 10 is calculated between the last and the penultimate vertebra of the spinal column 3 and the a fourth parallel 11 is calculated between the penultimate and third from last vertebra of the spinal column 3. The second starting line 5 and the parallels 8; 9; 10; 11 are bisected by the fat inner contour line 12, whereby partial sections are produced. As a consequence, partial sections st1 13 and st2 14 are determined on the second starting line 5. Furthermore, the points of intersection determine the length of the outer partial section stzp 15 of the first parallel 8, which corresponds to the thinnest layer of fat on the Musculus Gluteus Medium 16, the length of an inner partial section stk 17 on the second parallel 9, the lengths of the

partial sections st3 18 and st4 19 on the third parallel 10 and on the fourth parallel 11 the lengths of the partial sections st5 19 and st6 20.

The lean flesh proportion (mfa) is calculated e.g. according to the following formula:

$$mfa = p0 + p1\frac{st6}{st1} + p2\frac{st5}{st1} + p3\frac{st1}{stk} + p5\frac{st5}{stzp} + p8\frac{st6}{stzp} + p9\frac{st2}{stzp}$$

which is used directly for evaluation purposes and serves to classify market value classification.

The constants p0, p1, p2, p3, p8, p9 are calculated as reference variables by regression calculations by means of a standardised statistics program, such as e.g. Microsoft Excel, from the actual lean flesh proportion of slaughtered animal halves.

It is likewise possible to determine the market value by means of the ratio of areas or section lengths of the delimitation thereof. For this purpose, the variables of the area, which is defined by the straight line 4, the fat inner contour line 12, the partial sections st1 13 and st3 18, are calculated with respect to the area of the fat between the partial sections st2 14 and st4 19 and a coefficient is determined which corresponds to the market value. Alternatively, the market value can be determined by means of coefficients from the values of the diagonals of these areas.

List of reference numerals used

1	image region
2	pin bone
3	spinal column
4	straight line
5	second starting line
6	outer fat contour
7	inner extension of the second starting line 5
8	first parallel
9	second parallel
10	third parallel
11	fourth parallel
12	fat inner contour line
13	st1
14	st2
15	outer partial section (stzp)
16	Musculus Gluteus Medium - MGM
17	stk
18	st3
19	st4
20	st5
21	st6

Claims

1. Method of evaluating the quality of slaughtered animal halves by means of optical image processing, wherein by means of photogrammetric evaluation of a recorded optical image in the splitting plane of said slaughtered animal halves in the region of the ham-loin area, different tissue types are selected using computer technology and specific parameters for evaluation purposes are ascertained,
characterised in that
the significant reference points used are the spinal column (3) comprising the spinal cord channel, the carcass-side lower point of the pin bone (2), the thinnest layer of fat on the MGM (16) and the contours of the back fat (6; 12) in the selected region,
a straight line (4) in the direction of the last, straight portion of the spinal column (3) is placed in the middle of the spinal cord channel, as a first starting line for the measurements, and placed on this straight line (4) as a second starting line (5) is a perpendicular section extending as far as the outer fat contour (6), wherein an inner extension (7) of the second starting line (5) tangentially contacts the lower point of the pin bone (2), in parallel with the second starting line (5) further sections, whose lengths are defined by the first starting line and the outer fat contour (6), are calculated at the level of the tail-side end of the last vertebra of the spinal column (3), the thinnest layer of fat on the MGM (16), between the ultimate and penultimate vertebra of the spinal column (3) as well as between the penultimate and third from last vertebra of the spinal column (3), wherein the length of partial sections of the second starting line (5) and the further sections in parallel therewith is determined by the point of intersection thereof with the fat inner contour line (12), and
the lean flesh proportion, which is crucial for the purpose of the evaluation, is calculated by the addition of summands of partial sections, which are set in ratio with respect to each other and are perpendicular to the straight progression of the spinal cord channel, in the region of the flesh and the layer of fat, thus incorporating constants for each term, which are ascertained by means of regression calculations, and a basic constant.

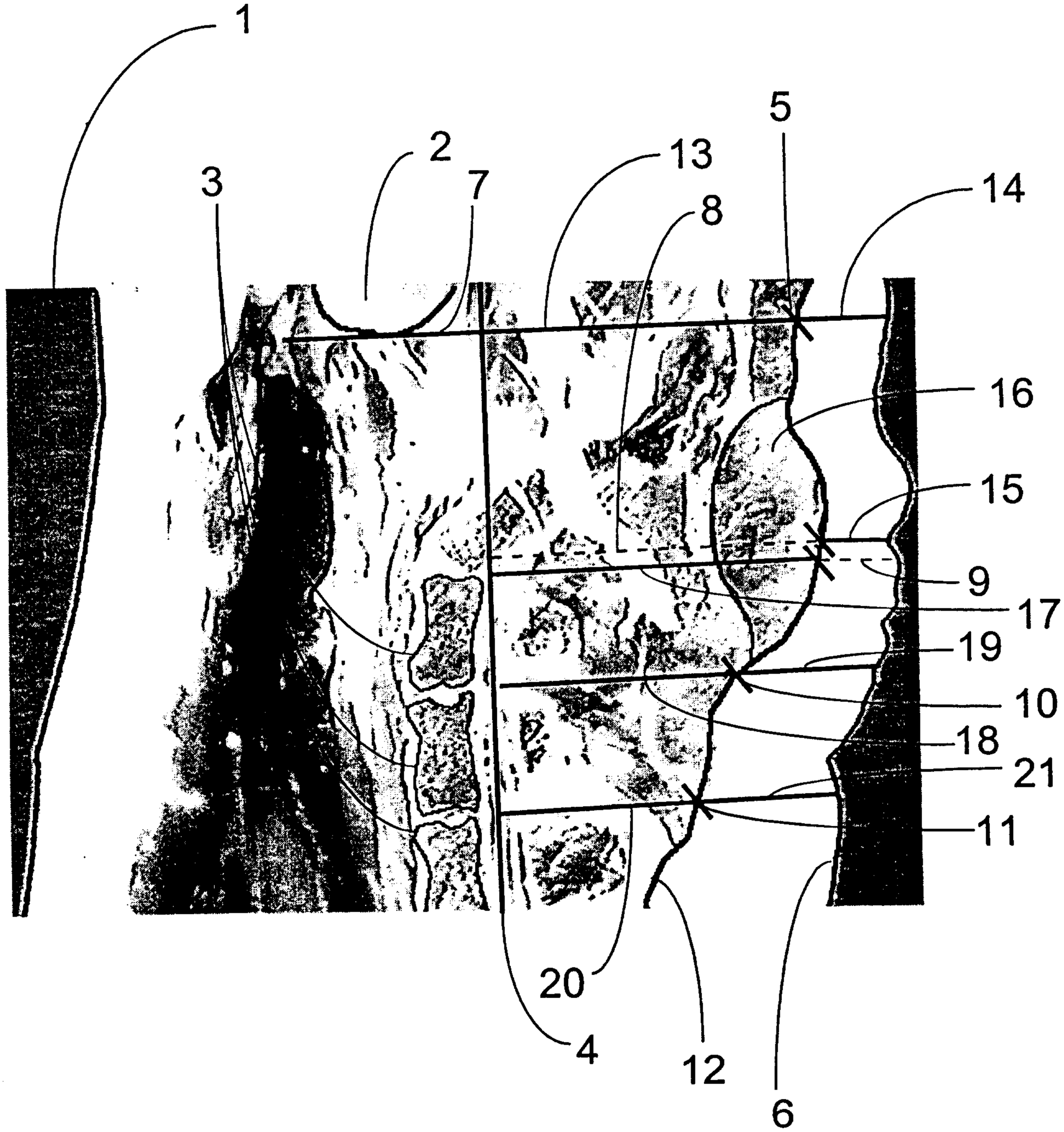
2. Method according to claim 1, characterised in that the market value is determined by calculating the area from partial sections and associated sections on the straight line (4) as a

first starting line by reference to characteristic ratio values of the area of fat layer parts and of partial areas which are defined by the fat inner contour line (12), the pin bone (2) and the penultimate vertebra of the spinal column (3).

3. Method according to claim 2, characterised in that ratio values of the lengths of the diagonals of partial areas in the flesh and fat region with respect to each other are used for the purpose of determining market value.

4. Method according to claim 2, characterised in that ratio values of the lengths of sections, which define the partial areas, in the flesh and fat region with respect to each other are used for the purpose of determining market value.

Fig. 1



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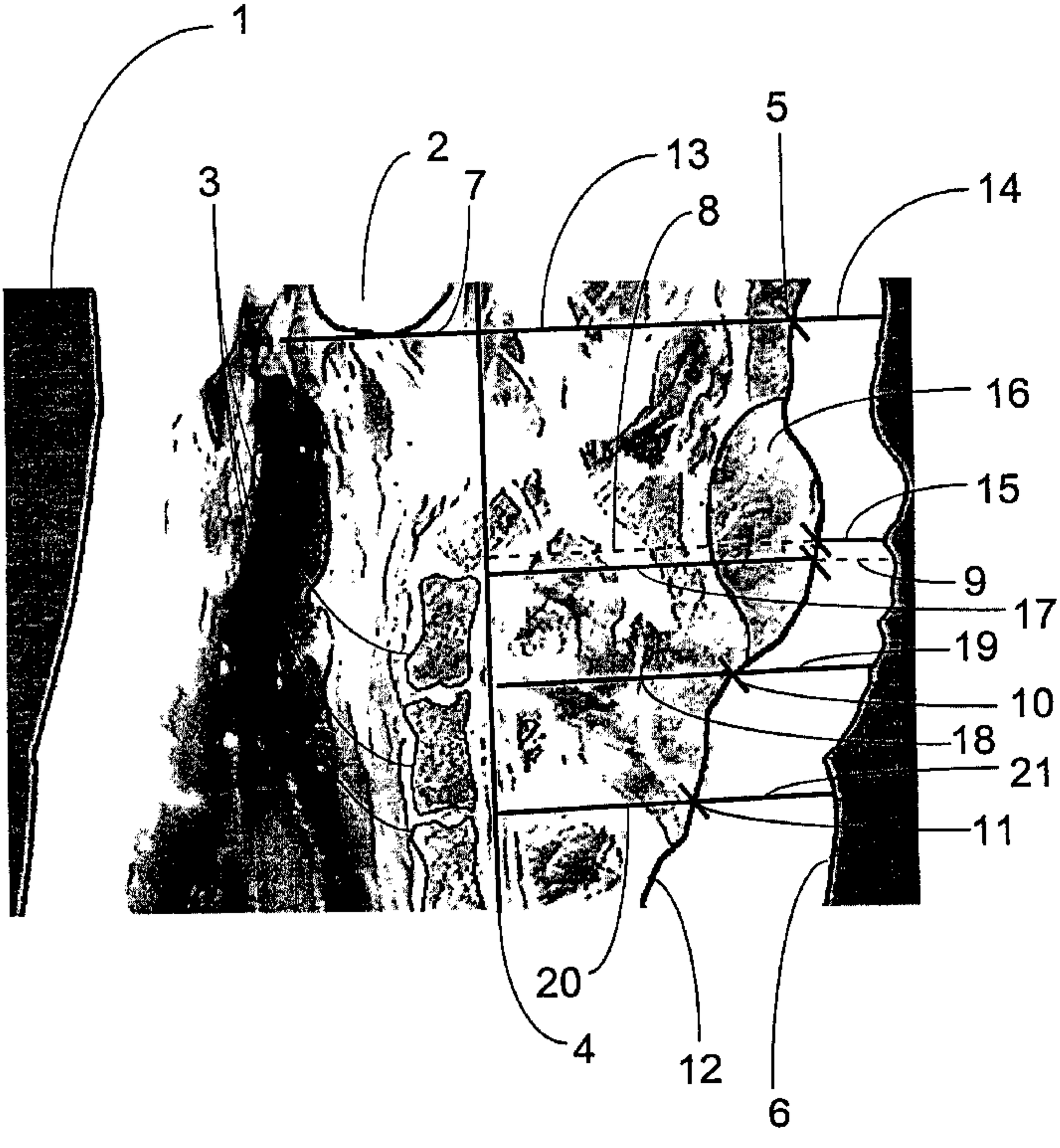
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