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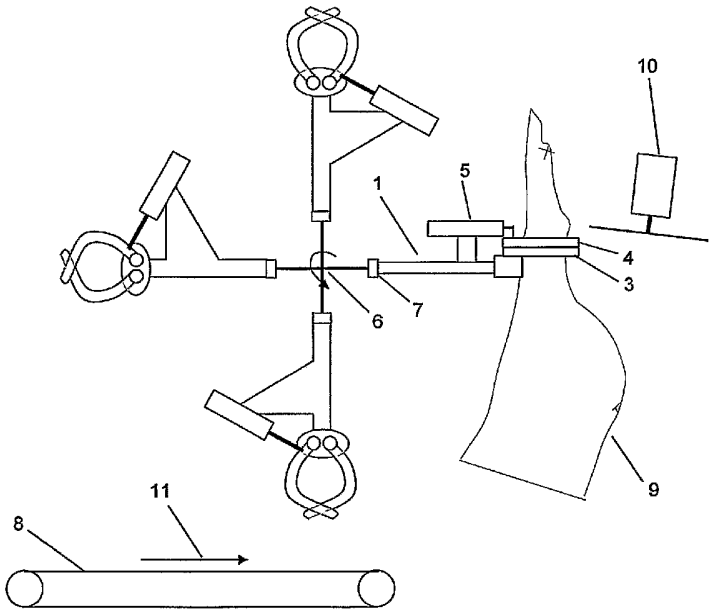
(54) **Title:** A METHOD AND A DEVICE FOR PROCESSING A BACK END PART OF A CARCASE



(57) **Abstract:** A device for processing at least a back end part of a carcase having a thickened heel joint as well as a hind toe part and a ham part. The device comprises a gripping and retaining mechanism (2) adapted to grip the back end part (9) of the ham side of the thickened heel joint while the back end part is in a lying position. The back end part may be lifted for further processing, e.g. automatic cutting off the hind toe or loop tying.

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A METHOD AND A DEVICE FOR PROCESSING A BACK END PART OF A CARCASE

FIELD OF THE INVENTION

The present invention relates to a method, a device and a system for processing at least a back end part of an animal carcase, as well as a system for primary cutting and further subsequent processing of a carcase. The processing in particular comprises fixed gripping or retaining of the back end part and possible further processing. The carcase can for example be a hog, cattle or sheep carcase having a heel joint constituting a thickening relatively to a ham or a hind toe part, extending in separate directions from the heel joint.

BACKGROUND OF THE INVENTION

At the present time slaughterhouses pose increasing demands of automatic and individual processing of parts of a carcase in order to obtain optimal yield with minimal costs.

In slaughterhouses carcases are often conveyed hanging vertically from hooks along an overhead conveyor. The hooks may, e.g., be gambrels or hooks according to German standard DIN 5047, also known as "Euro Haken". The carcases can either be conveyed as carcase sides or as complete carcases. The carcases are conveyed in single file or in pairs to a primary cutting system, where the carcase sides are divided into front end parts, middle parts and back end parts, and from the primary cutting system they are conveyed lying on conveyor belts for further processing in the processing line.

Subsequent processing of the parts may be of various kind, and the slaughterhouses normally also desire the possibility of individually processing the parts. Thus, it may be desired that a back end part is conveyed further on in the processing line with or without hind toe, loop tying, i.e. with a string through the hind leg, or it may be desired that the back end part is conveyed further on, lying on a conveyor belt, or that the part is transferred to a vertical position to a conveyor system where the parts are conveyed vertically hanging or suspended from, e.g., a string. The back end parts may be conveyed hanging vertically separately or in batches on vertical rods with hook, i.e. on so-called "christmas trees".

At the present time the processes mentioned above are performed at different times relatively to the primary cutting of the carcase. As described in DK 174515 and in DK/EP 0607744 cutting the hind toe away from the back end part may be performed automatically in connection with putting down of the carcases from a vertically hanging transport to a horizontally lying transport, or manually after putting down the carcases to the horizontally lying transport. Loop tying the parts and/or hanging the parts on christmas trees is

performed manually or semi-automatically after the parts have been conveyed away from the primary cutting system.

DK 174515 describes a system for processing carcase sides, where a carcase side is conveyed suspended from its hind toe in a gambrel. The hind toe is automatically cut off after a gripping mechanism has gripped between the knee joint and the heel joint and lifted the hind toe and the ham out of the gambrel, in such a way that the ham of the carcase side is suspended in the gripping mechanism. After cutting off the hind toe, the ham falls upon a conveyor belt by means of which the carcase side may be conveyed to a position of primary cutting.

In US 4,662,029 is disclosed a system for cutting carcases being put down on a conveyor belt, and subsequently an optical scanning system determines a reference point on the lying carcases. The position of the reference point is communicated to a computer which adjusts the position of a hind toe saw according to the position of the reference point.

EP 1 053 684 discloses an automatic machine for deboning animal parts by means of a fluid jet. Hams with the hind toe and heel joint already cut off are conveyed to a pick-up station where the end of the shin bone is engaged by a gripper which grips and retains the ham. The gripper then moves the ham to a deboning station where the deboning takes place. During this movement the orientation of the ham is changed from a substantially horizontal orientation to a substantially vertical orientation. Since the hind toe and heel joint have already been cut off, it is not possible to let the gripping means rest on the heel joint during this movement. Accordingly, relatively strong gripping forces are needed in order to retain the ham. Furthermore, it is not possible to use the heel joint as an anatomical reference for the subsequent processing.

SUMMARY OF THE INVENTION

The system disclosed in US 4,622,029 is complicated since it requires an optical scanning system and corresponding control of the position of the hind toe saw. In addition, there is no clearly defined anatomical reference for the hind toe cutting, which may therefore be imprecise. Furthermore, the reference does not refer to means for alternatives kinds of processing of the carcases.

Even though the system disclosed in DK 174515 has turned out to function satisfactorily in praxis, it has turned out to be desirable to provide an alternative system in which the hind toe is not necessarily cut off simultaneously with putting down of the carcase on a conveyor

belt. It may, e.g., be desirable to delay the cutting off of the hind toe to a later time in the processing procedure, e.g. after the primary cutting.

It is an object of the present invention to provide a system which on the one hand makes an efficient cutting off of the hind toe possible, if this is desired, and on the other hand does not necessarily cut off the hind toe, thereby opening the possibility of other, alternative, kinds of processing of the carcase, e.g. loop tying.

It is a further object of the present invention to provide a system which requires minimal gripping forces for gripping and retaining the carcase.

It is an even further object of the present invention to provide a system which provides a clearly defined anatomical reference point for any desired further processing of the carcase.

According to the invention the above and other objects are fulfilled by providing a method and a device for processing, preferably including at least positioning and fixation of at least a back end part of a carcase having a thickened heel joint and a hind toe part extending from a first side of the heel joint, and a ham part extending from a second side of the heel joint, said second side being opposite to the first side. The method according to the invention is characterised in that the back end part in a lying position is gripped by means of a gripping and retaining mechanism at the ham side of the thickened heel joint. Thereby fixated gripping of back end parts, e.g. lying horizontally on a conveyor belt, is obtained. The parts may subsequently be processed in various manners. They may, e.g., be transferred to a hanging position for cutting off the hind toe, loop tying or another further processing.

In a preferred embodiment a lying back end part is gripped around the hind leg, e.g. immediately subsequently to cutting off the back end part in the primary cutting system. The gripping and retaining mechanism, which may have a closed and an open mode, may follow the back end part synchronously, and rotate it from a first to a second orientation, e.g. from a substantially horizontal to a substantially vertical orientation. The further processing will normally take place in the second, e.g. vertical, orientation.

The position and/or the orientation of the back end part may be detected using suitable means, e.g. a vision system, or the position/orientation may be transferred from the control system of the primary cutting system, thereby allowing gripping of the back end part in a predefined position, e.g. around the hind leg above the thickened heel joint. When the part is subsequently lifted and rotated, the thickened heel joint will engage an upper side of the gripping and retaining mechanism, thereby retaining and fixating the part relatively to the thickened heel joint. This fixation is appropriate for the further processing, since the

thickened heel joint may serve as an anatomical reference for, e.g., cutting off the hind toe or loop tying.

It is often attempted to obtain that cutting off the hind toe takes place in the middle of the thickened heel joint in a well defined angle relatively to the hind toe. This may be achieved with the method and the device according to the invention, since the distance from the upper side of the gripping and retaining mechanism is known. Control means for the cutting means, which cuts off the hind toe, may thereby use the upper side of the gripping and retaining mechanism, and thereby the thickened heel joint, as a reference for the cutting. This results in a precise and uniform cutting. In a preferred embodiment the cutting means is designed in such a way that the incision may be angularly adjusted. Thereby it may be taken into account whether the end part which is to be processed originates from the right or the left side of the carcase. Additionally, possible desires from the individual slaughterhouse in relation to the incision angle may also be taken into account.

For the purpose of automatic loop tying, it is normally desired that the position of the hind leg is known. Thereby the string used for loop tying may be drawn correctly through the hind leg between the bones and the sinews, in such a way that the further transport while suspended in the string can take place in a safe manner.

A weighting unit may form part of the system according to the invention. Thereby the weight of the individual back end part, or other parts of the carcase, may be determined, and may be included for the purpose of controlling the further processing of the back end part.

The gripping and retaining mechanism may be arranged at the end of a gripping arm which is rotatable about a first axis at one end of the gripping arm, the gripping and retaining mechanism being arranged at the other end of the gripping arm. In a preferred embodiment further gripping arms are provided, e.g. 2, 3, 4 or more, the number being chosen in accordance with the desired capacity of the system. The rotation of the gripping arm about the first axis may advantageously be synchronized with the movement of a conveyor belt on which the back end part is conveyed. In a preferred embodiment the first axis is at least substantially parallel to the conveyor belt, and at least substantially perpendicular to the conveying direction of the back end part on the conveyor belt.

The gripping and retaining mechanism may further be rotatable about a second axis arranged at least substantially parallel to the gripping arm. The rotation about the second axis may be provided by an actuator mounted on the gripping arm. Thereby, the gripping and retaining mechanism may grip a back end part about the hind leg above the heel joint, and the gripping arm with the retained back end part may subsequently be rotated about the first

axis, in such a way that the peripheral velocity of this movement corresponds to the conveying velocity of the lying back end part. The length of the gripping arm and the position where the gripping takes place may be determined in such a way that the back end part by rotation is moved over an end of the conveyor belt, and in such a way that the back end part is rotated about the second axis, due to the force of gravity, to a vertically hanging position.

The rotation of the gripping arm with the rotated gripping and retaining mechanism with the retained back end part may be stopped in a given position, in such a way that the back end part is hanging vertically, carried by the gripping mechanism with the upper side of the heel joint of the hind leg resting on the upper side of the gripping and retaining mechanism.

Subsequent processing may be performed with the back end part positioned in this known position and with the defined position of the heel joint of the hind leg by activating one or more processing units. For example, a hind toe cutting unit, a loop tying unit, or a transfer/hanging unit may be applied. After the further processing, the gripping and retaining mechanism may be opened, thereby releasing the back end part from the system. Subsequently the gripping and retaining mechanism is rotated back to its initial position relatively to the gripping arm, and the gripping arm with the gripping mechanism may be rotated in such a way that the next back end part may be processed.

The system may be provided with several processing units which may be automatically activated depending on the desired processing.

The gripping means may be provided with a weighting cell, in such a way that a vertically hanging back end part may be weighted, and in such a way that the weight may be taken into account when deciding the further processing of the back end part.

The invention further relates to a system for processing at least a back end part of a carcase, the system comprising a device as described above and a processing unit.

Finally, the invention relates to a system for primary cutting and further processing of a carcase, the system comprising:

- a primary cutting system comprising control means for controlling the primary cutting;

- a system as described above comprising control means for controlling the further processing performed by the system;

wherein the control means of the primary cutting system can communicate with or is integral with the control means for controlling the further processing.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described with reference to the accompanying drawings in which:

Fig. 1 shows the system with four gripping arms with gripping mechanisms in a closed position, and

Fig. 2 shows the system with four gripping arms with a back end part hanging vertically.

DETAILED DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a system with four gripping arms 1 with gripping and retaining mechanism 2 having gripping units or jaws 3 and 4, at least one of the jaws 3, 4 being adapted to be activated by actuator 5. The gripping arm(s) 1 is/are rotatable about an axis arranged in parallel with conveyor belt 8 and perpendicularly to the conveying direction 11 with centre of rotation 6. The gripping and retaining mechanism 2 can rotate in rotational bearing 7 about an axis arranged in parallel with gripping arm 1.

Fig. 2 shows the system with a vertically hanging back end part 9. Gripping arm 1 has been rotated about centre 6 after gripping of back end part 9 on conveyor belt 8 by gripping mechanism 2. By this rotation gripping mechanism 2 has been rotated in rotational bearing 7 due to the gravitational force acting on back end part 9. The vertically hanging back end part 9 is hanging with the upper side of its heel joint resting on the upper side of the closed gripping units 3 and 4, and cutting off the hind toe may be performed at a desired incision angle and decision position in the heel joint by cutting means 10, since the cutting means 10 may be angled, and/or moved horizontally and vertically.

CLAIMS

1. A method for processing at least a back end part of a carcase having a thickened heel joint and a hind toe part extending from a first side of the heel joint, and a ham part extending from a second side of the heel joint, said second side being opposite to the first side, characterised in that the back end part in a lying position is gripped by means of a gripping and retaining mechanism at the ham side of the thickened heel joint.

2. A method according to claim 1, wherein the back end part undergoes subsequent processing while it is retained and fixated by the gripping and retaining mechanism.

3. A method according to claim 2, wherein the heel joint is used as an anatomical reference for the subsequent processing.

4. A method according to claim 2 or 3, wherein the hind toe part is cut off by means of cutting means during the subsequent processing.

5. A method according to claim 4, wherein the hind toe part is cut off by an incision positioned at a predetermined position in the heel joint.

6. A method according to claim 4 or 5, wherein the cutting means is adjustable, the orientation of the incision relatively to the back end part thereby being adjustable.

7. A method according to claim 2 or 3, wherein the hind toe part of the back end part is loop tied by means of a string during the subsequent processing.

8. A method according to claim 7, wherein the string during loop tying is positioned in a predefined position relatively to the heel joint.

9. A method according to any of claims 1-8, wherein the back end part is conveyed lying on a conveyor belt, and wherein the gripping and retaining mechanism is movable synchronously with the conveyor belt.

10. A method according to any of claims 1-9, wherein the carcase has undergone primary cutting prior to the gripping.

11. A method according to any of claims 1-10, wherein the back end part is lifted by the gripping and retaining mechanism.

12. A method according to claim 11, wherein the back end part during the lifting is rotated from a first to a second orientation.

13. A method according to claim 11 or 12, wherein the back end part during the lifting slides downwards in the gripping and retaining mechanism, due to the force of gravity, the thickened heel joint thereby sliding to a position in which it rests on an upper edge of the gripping and retaining mechanism.

14. A method according to any of claims 1-13, wherein the back end part is weighted while it is fixated by the gripping and retaining mechanism.

15. A method according to any of claims 1-14, wherein the orientation and/or the position of the hind leg of the back end part is/are determined in such a way that the gripping and/or the subsequent processing is controlled depending on the orientation of the hind leg.

16. A device for processing at least a back end part of a carcase having a thickened heel joint and a hind toe part extending from a first side of the heel joint, and a ham part extending from a second side of the heel joint, said second side being opposite to the first side, characterised in that the device comprises a gripping and retaining mechanism adapted to grip the back end part at the ham side of the thickened heel joint while the back end part is in a lying position.

17. A device according to claim 16, wherein the gripping and retaining mechanism is adapted to lift the back end part.

18. A device according to claim 17, wherein the gripping and retaining mechanism is adapted to rotate the back end part from a first to a second orientation simultaneously with lifting the back end part.

19. A device according to any of claims 16-18, further comprising at least one gripping arm rotatable about a first axis at one end of the gripping arm, and wherein the gripping and retaining mechanism is arranged at the other end of the gripping arm.

20. A device according to claim 19, wherein the rotation of the gripping arm can be synchronised with the movement of a conveyor belt on which the back end part is conveyed.

21. A device according to claim 20, wherein the first axis is at least substantially parallel to the conveyor belt, and at least substantially perpendicular to the conveying direction of the back end part on the conveyor belt.

22. A device according to any of claims 19-21, wherein the gripping and retaining mechanism is rotatable about a second axis arranged at least substantially parallel to the gripping arm.

23. A device according to any of claims 16-22, wherein the gripping and retaining mechanism is designed in such a way that the thickened heel joint may rest on an upper side thereof when the back end part is completely or partly suspended from the gripping and retaining mechanism.

24. A device according to any of claims 16-23, wherein the gripping and retaining mechanism comprises at least one gripping unit with two mutually movable jaw parts adapted to pinch the back end part at the ham side of the heel joint.

25. A device according to any of claims 16-24, further comprising means for positioning the gripping and retaining mechanism relatively to a processing unit.

26. A system for processing at least a back end part of a carcase, the system comprising a device according to any of claims 16-25 and a processing unit.

27. A system according to claim 26, wherein the heel joint is used as an anatomical reference for the processing of the back end part by the processing unit.

28. A system according to claim 26 or 27, wherein the processing unit comprises cutting means for cutting the hind toe part away from the back end part.

29. A system according to claim 28, wherein the cutting means is adapted to position the incision for cutting the hind toe part at a predefined position in the heel joint.

30. A system according to claim 29, wherein the position of the cutting means is adjustable, the orientation of the incision relatively to the back end part thereby being adjustable.

31. A system according to claim 26 or 27, wherein the processing unit comprises means for loop tying the back end part.

32. A system according to any of claims 26-31, wherein the processing unit comprises means for weighting at least a part of the back end part.

33. A system for primary cutting and further processing of a carcase, the system comprising:

- a primary cutting system comprising control means for controlling the primary cutting;

- a system according to any of claims 26-32 comprising control means for controlling the further processing performed by the system;

wherein the control means of the primary cutting system can communicate with or is integral with the control means for controlling the further processing.

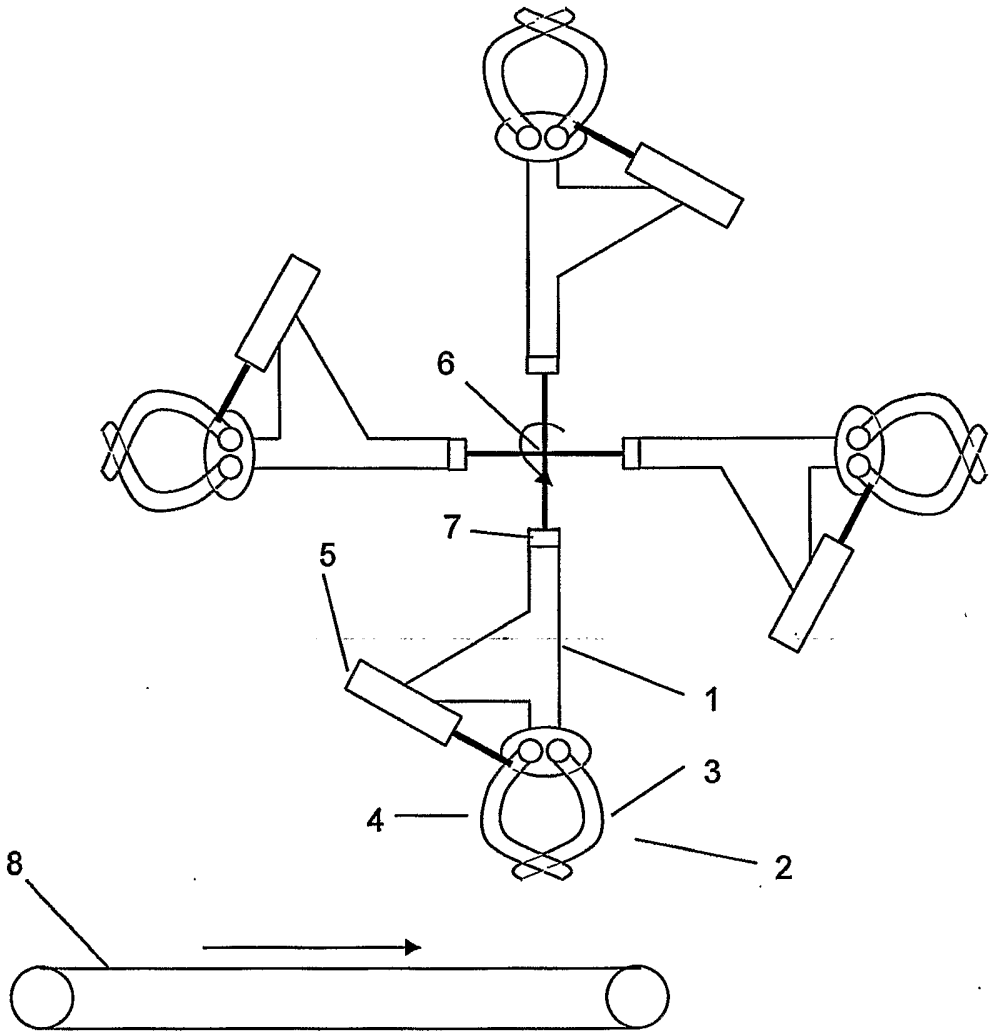

Fig. 1

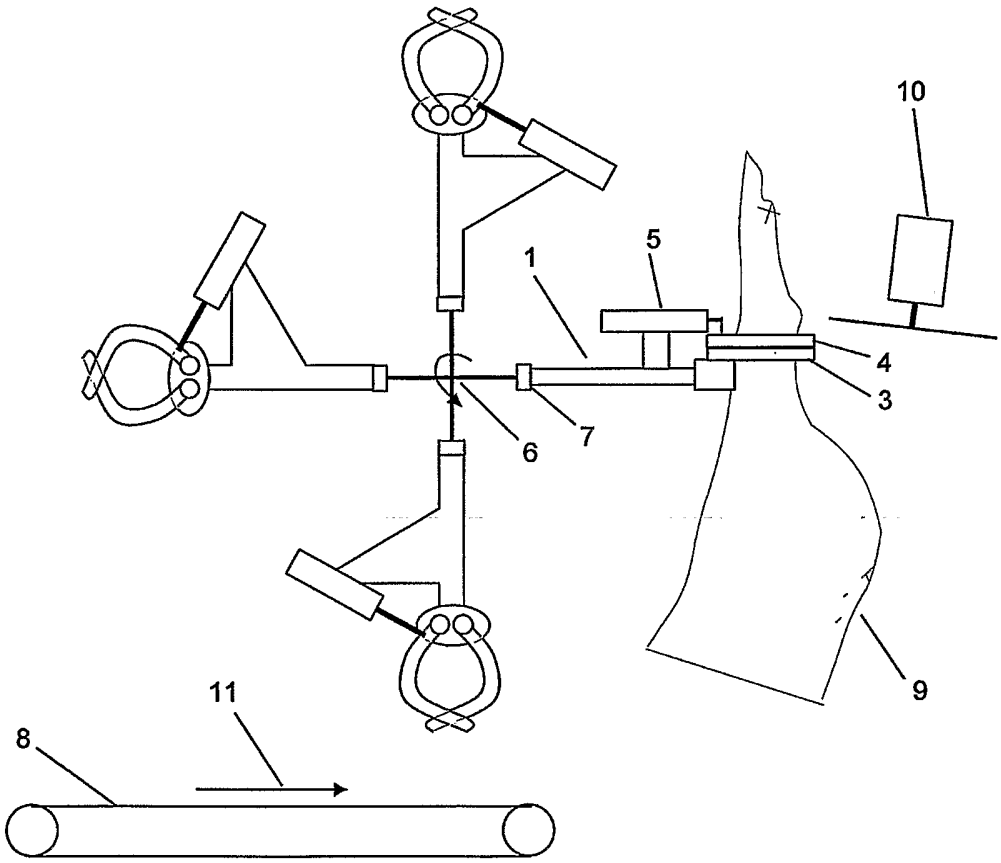

Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/DK2005/000313

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A22B5/00 A22B7/00

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)
IPC 7 A22B

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/062146 A (KJ MASKINFABRIKEN A/S; KRUEGER, PETER) 15 August 2002 (2002-08-15) abstract; claims 1-4,6; figures 1-3 page 2, lines 1-31	1-13, 16-21, 23-29,31
Y	page 3, lines 6-31 page 6, line 16 - page 8, line 24	14,32,33
Y	US 4 662 029 A (HELSENE ET AL) 5 May 1987 (1987-05-05) cited in the application abstract; figure 1 column 4, lines 62-65 column 6, lines 52-60	14,32,33

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/DK2005/000313

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 607 744 A (SLAGTERIERNES FORSKNINGSINSTITUT) 27 July 1994 (1994-07-27) cited in the application abstract; figures 1-6 column 3, line 4 - column 5, line 21	1-33
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