(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 082 854 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.07.2009 Bulletin 2009/31

(21) Application number: **09001156.0**

(22) Date of filing: **28.01.2009**

(51) Int Cl.:
B26D 1/00 *(2006.01)* ***B26D 1/11*** *(2006.01)*
B26D 7/08 *(2006.01)* ***B26D 7/26*** *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA RS

(30) Priority: **28.01.2008 NL 1034959**

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(54) Separating device for food products

(57) The present invention relates to a separating device for food products, comprising a separating element with two outer blades which are attached together at an acute angle relative to each other along at least part of their circumferential edges so as to provide a cutting edge, whilst a spacer is provided between at least part of said outer blades, which spacer fills the space between the two outer blades only partially, and drive means for reciprocating the outer blades along the cutting edge at a frequency in the 150 - 10,000 Hz range. The invention further relates to a separating element for use in such a separating device and to a method for cutting a food product by means of such a separating device.

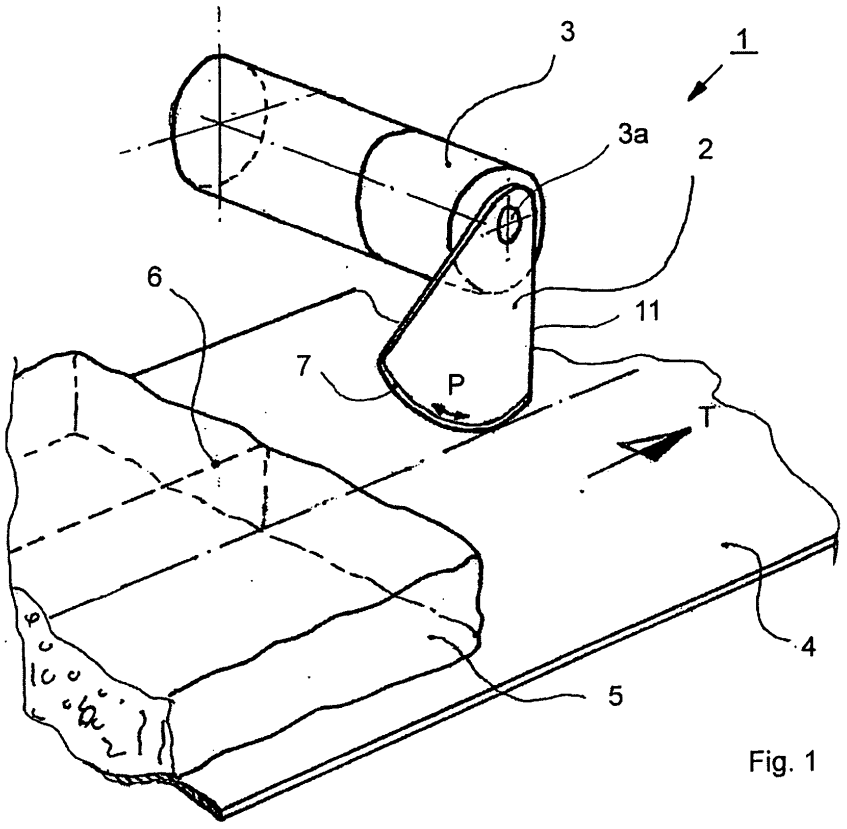

Fig. 1

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Description

[0001] The present invention, according to a first aspect thereof, relates to a separating device for food products of the type comprising a reciprocable separating element.

[0002] FR 2 666 534 describes a cutting device for slicing pieces of meat, such as a turkey breast. The known cutting device includes a series of knives in the form of elongated cutting blades, which are arranged in pairs between two frames, wherein pairs of cutting blades move reciprocatingly in opposition to each other at a frequency of 10 - 100 Hz.

[0003] The known cutting device has a number of drawbacks, however. One of said drawbacks is the fact that cutting blades adhere to the outer sides of the meat while moving forward and backward when cutting a piece of meat. As a result, at least the cut parts of the meat are pushed in opposite directions as cutting proceeds on account of the reciprocating motion of the cutting blades abutting one another. Because of this, the meat is not only cut but also torn, as it were, so that a neat cut surface is not obtained. In the case of less solid substances, such as dough, pastry, ice-cream, etc, said adhesion effect becomes more pronounced, because the product itself is less solid and can be pulled apart more easily. If cutting such a product by means of the known cutting device would be possible at all, there would even be a chance that the structure of halves of the cut part of the food product would be disturbed to such an extent that the cut product would no longer look appetizing. From a commercial point of view this is disadvantageous, of course, because the way food products look is a major factor in a consumer's decision to buy a product.

[0004] The object of the present invention is to provide a separating device which makes it possible to cut various kinds of food products, among which less solid substances, in such a manner that a clean cut is made, and wherein the orientation and the structure of products having a none too solid structure are at least substantially retained during said cutting. This object is accomplished by the present invention in that it provides a separating device for food products which comprises a separating element with two outer blades which are attached together at an acute angle relative to each other along at least part of their circumferential edges so as to provide a cutting edge, whilst a spacer is provided between at least part of said outer blades, which spacer fills the space between the two outer blades only partially, and drive means for reciprocating the outer blades along the cutting edge at a frequency in the 150 - 10,000 Hz range. Since the separating element reciprocates at a relatively high frequency of 150 - 10,000 Hz, preferably 250 - 5,000 Hz, developing a comparatively high speed relative to the product to be cut, of course, the risk of the food product adhering to the separating element is eliminated, or at least significantly reduced. In order to make it possible for the separating element to reciprocate at such a frequency, the separating element must be as light as possible. The separating element is therefore formed by attaching two outer blades together along the cutting edge, and having said outer blades diverge slightly conically from said cutting edge, with the spacer holding the outer blades spaced apart at a location some distance away from the cutting edge. To keep the weight relatively low, the spacer fills only part of the space between the two outer blades. The blades of the separating element are preferably made of a metal. Furthermore, said blades preferably have a thickness in the 100-150 μm range. Because the outer blades are preferably designed for minimum weight, the spacer can impart the required stiffness to the separating element. The object aimed at can thus be accomplished with a separating device according to the present invention.

[0005] In a preferred embodiment of the present invention, the outer blades are arranged with their circumferential edges staggered relative to each other. The circumferential edge of one of the two outer blades lies within the circumferential edge of the other outer blade, for example at a distance of 0.5-3 mm from said circumferential edge. The cutting edge of the separating element is thus formed by the circumferential edge of the outer blade that extends furthest and thus projects beyond the other outer blade. Said further extending outer blade can thus form a cutting means which is thinner at the cutting edge. In addition, such an embodiment makes it possible to weld the outer blades together in a reliable manner near the circumferential edges, for example by laser welding.

[0006] A cutting element may furthermore be provided between the two circumferential edges, which cutting element forms the actual cutting edge. The material of the outer blades and the material of the cutting edge may be selected with a view to optimising the function of the element in question. The cutting edge may form part of the spacer or be connected thereto.

[0007] With a view to forming a sharp cutting edge it is preferable if the outer blades are attached together at least near the cutting edge.

[0008] A very good cutting result is obtained if the separating element is arranged for reciprocation about an axis of rotation. The separating element thus makes a reciprocating movement about the axis of rotation, with the cutting edge provided on the side remote from the axis of rotation.

[0009] In order to have such a cutting device move smoothly through a food product, it is preferable if the cutting edge has a curved shape. Said curved shape may extend substantially along a circular arc, with the axis of rotation as its centre, at least in the case of a separating element that reciprocates about an axis of rotation. A very good cutting result is obtained if the side of the cutting edge that forms the leading edge during a cutting movement is located closer to the axis of rotation than a trailing part of the cutting edge. In the case of a cutting element which is capable of two-sided cutting, the op-

posing ends of the cutting edge form a leading end, whilst the central portion of the cutting edge forms the trailing part of the cutting edge.

[0010] In order to be able to adapt the separating device for use with various products to be cut, it is preferable if control means are provided for controlling the frequency at which the separating element can be reciprocated.

[0011] In order to further reduce the resistance experienced by the outer blades during a cutting movement, and thus the risk of the food products adhering to the outer blades of the separating element during said cutting, at least one of the outer blades may be provided with a textured surface on the side remote from the spacer. Said textured surface may be a hydrophilic or a hydrophobic surface, depending on the products to be cut.

[0012] The cutting result can be improved even further if the separating element is provided with a fluid inlet for supplying fluid to the interior of the separating element and with fluid outlets. In this way it is possible to supply a fluid between the cut surfaces of the product being cut during a cutting operation by the separating element. In the following paragraphs it will become clear how this can lead to a better cutting result.

[0013] If the fluid discharge means are at least partially provided in at least one of the two outer blades, a fluid film can be applied between said at least one outer blade and the cut surface of a cut part of a food product to be cut. It is possible, of course, to provide both outer blades with fluid discharge means, so that fluid can be supplied during the cutting operation between the separating element and the two cut surfaces of cut parts of the food product to be cut. The fluid may have several functions. Thus it is for example possible to have moisture, for example water, trickle from the separating element in small quantities during the cutting operation, so that a film of liquid, for example water, is provided between an outer blade and the corresponding cut surface of the product to be cut. It is known, for example, that bread dough will not adhere to a surface, in this case an outer blade, when a film of water is present between said surface and the dough. Moreover, the two cut surfaces of a dough product will not adhere together again after being cut, on account of the film of water that is present therebetween, for example because said film of water was left behind between two opposing cut surfaces by the separating element. Furthermore, a comparatively hot or cold fluid may flow through the separating element for or heating or cooling, as the case may be, the separating element. Heating, for example, can facilitate cutting through ice cream. Cooling the separating element may result in condensate precipitating on the separating element, which has the same effect as having water trickle through the outer blades.

[0014] With a view to transporting fluid to the fluid discharge means, the spacer may be provided with at least one channel for carrying fluid from the fluid inlet to the fluid outlet openings.

[0015] Alternatively, or in addition thereto, said fluid discharge means may at least partially be provided at a circumferential edge of the separating element remote from the cutting edge of the separating element. Thus, a fluid can be left behind at a so-called trailing end between the separated parts of a (partially) cut product during a cutting movement.

[0016] The device preferably comprises a counterweight, which reciprocates in opposition to the separating element. The object of the counterweight is to keep the separating device as stable as possible in use. As a result, the frequency of the reciprocating motion can be further increased, whilst the risk of the separating device being exposed to substantial vibration as a result of reaching an eigenfrequency is strongly reduced in comparison with devices that are not provided with a counterweight.

[0017] In a preferred embodiment of the present invention, heating means are provided for heating at least the outer blades of the separating element. Heating means may be used to facilitate cutting by means of the separating element, for example when the separating element can also cause the products to melt, as is for example the case with ice cream and other dairy products. Because the product (partially) melts along the cut surface, it is possible to realise an even neater finish of the cut surface with certain products.

[0018] The heating means preferably comprise an electrical heating element. Electrical heating elements are easy to install and they are not very prone to malfunction.

[0019] The length of the cutting edge preferably ranges between 15 and 150 mm, more preferably between 25 and 100 mm. A separating element having such a cutting edge has the right dimensions for easily cutting most food products.

[0020] To provide a separating device in which the cutting operation is aided by the movement relative to each other of the outer blades of the separating element, the outer blades of the separating element may be provided in such a manner in the separating device that they can be reciprocated in opposition to each other along the cutting edge.

[0021] The separating device according to the present invention preferably comprises a support surface for a product to be separated, above which support surface the separating element is mounted for reciprocating motion. This makes it possible to adjust the positions of the separating element and a product present on the support surface relative to each other by means of the device. A correct position of a product to be cut relative to the separating element (or conversely) makes it possible to optimise the cutting process.

[0022] It is preferable in that regard if the support surface forms part of a conveyor. This makes it possible for the conveyor to move a product to be cut in the direction of and past the operative separating element.

[0023] According to the second aspect, the present invention relates to a separating element for use in a separating device according to the first aspect of the inven-

tion, comprising two outer blades, which are attached together at an acute angle relative to each other along at least part of their circumferential edges so as to provide a cutting edge, whilst a spacer is provided between at least part of said outer blades, which spacer fills the space between the two outer blades only partially. The advantages of such a method correspond to the advantages of the separating device according to the first aspect of the present invention.

[0024] The present invention will be explained in more detail hereinafter by means of a description of an exemplary embodiment of the present invention, in which reference is made to the appended drawings, in which:

Figure 1 is a perspective view of a cutting device according to the present invention;
Figure 2 is a side view of a part of the separating device of figure 1;
Figure 3 shows an alternative embodiment of a separating element for use in the present invention;
Figure 4 shows an embodiment of yet another separating element for use in the present invention;
Figure 4a is a cross-sectional view of the separating element along the line A-A in figure 4;
Figure 4b is a sectional view of the separating element of figure 4, along the line B-B in figure 4a;
Figure 4c is a cross-sectional view of an alternative embodiment of a separating element along the line A-A in figure 4;
Figure 5a is a side view of a separating element having a perforated outer blade;
Figure 5b is a sectional view of the separating element of figure 5a along the line A-A; and
Figure 6 shows the separating element provided with fluid outlet openings in a trailing edge.

[0025] Referring to figure 1, a part of a cutting device 1 according to the present invention is shown. A wedge-shaped connecting element 11 comprising two outer blades 2 (only one of which is shown in figure 1) is mounted for reciprocating motion according to the double arrow P from a driving device 3 having an axis of rotation 3a for the cutting blade 2. A conveyor belt 4 supplies a piece of pastry 5 having a hard upper crust to a cutting edge 7 of the cutting element 11 in the direction indicated by the arrow T for cutting said crusty pastry along the separation plane 6, which is illustrated in dotted lines in the figure. As long as the product has not been cut, there will be no separation plane, of course, so that an imaginary plane is meant along which the product is to be cut.

[0026] Figure 2 is a side view of the cutting element 11 and the driving device 3 above a conveyor belt 4 shown in figure 1. The cutting element 11 is mounted for reciprocating motion according to the double arrow P, with the cutting edge 7 reciprocating just above the conveyor belt 4 (see the double arrow P).

[0027] Figure 3 is a side view of an alternative embodiment of a cutting element 15 comprising a cutting blade 12 having a serrated cutting edge 17, which is mounted for reciprocating motion according to the double arrow P from a driving device 13.

[0028] Figure 4 is a side view of a cutting element 21 having a cutting blade 22 and a cutting edge 27. Figure 4a is a sectional view along the line A-A in figure 4 of the cutting element 21 comprising two cutting blades 22a, 22b, between which a central element 28 is provided, and in which the cutting blades 22a, 22b are provided in such a manner as to define a wedge shape extending from the bottom edge 27 of the central element 28 on either side of the central element 28, with the bottom edge 27 of said central element forming the cutting edge. The cutting element 21 is mounted for reciprocating motion about the axis of rotation 23a.

[0029] Figure 4b is a sectional view of the cutting element 21, along the line B-B in figure 4a. The cutting element 21 extends from the cutting edge formed by the cutting blades, of which only the cutting blade 22b is shown in figure 4b, to the upper edge of the cutting blades 22 of the cutting element 21. The central element 28 of the cutting element 21 thus imparts rigidity to the construction with the outer blades 22a, 22b.

[0030] Figure 4c is a side view of a cutting element 61, which is in large measure comparable to the cutting element 21, with a cutting blade 62 and an alternative cutting edge 67, along the line A-A in figure 4. The cutting element 61 has two cutting blades 62a, 62b, between which a central element 68 is provided, on either side of which central element 68 the cutting blades 62a, 62b are provided. At the end 65 of the cutting blade 62b, the cutting blade 62b is connected to the cutting blade 62a by means of a welded joint, which cutting blade extends slightly further and whose end 67 forms the cutting edge.

[0031] Figure 5a is a side view of a cutting element 31 with a cutting edge 37 and outer blades 32a, 32b (which latter cutting blade is not shown in figure 5a) and a central element provided with channels 39 between the outer blades 32a, 32b, which are illustrated in dotted lines in figure 5a and which lead to areas provided with perforations 40 on the surface 32a.

[0032] Figure 5b is a cross-sectional view along the line A-A in figure 5a, showing two outer blades 32a, 32b which extend upwards in the shape of a wedge from the cutting edge 37, and a central element 38, through which the channels of figure 5a extend from an inlet connection 41 to the areas provided with the perforations 40 (see figure 5a) for delivering a fluid to a cut surface as indicated by the arrows F.

[0033] Figure 6, to conclude, shows an alternative embodiment of a cutting element 51 in exploded view, in which an insert 62 provided with an inlet opening 61, channels 59 and outlet openings 60 is provided between the cutting blades 52a, 52b in the trailing end of the cutting element 51.

[0034] Now referring to figure 1, there is shown a cutting device 1 according to the present invention in which, in use, a driving device 3 drives the cutting element 11

to reciprocate about the axis 3a in the directions indicated by the double arrow P, whilst a piece of crusty pastry 5 is being transported in the direction of the cutting element 11 on the conveyor belt 4. When the cutting element 11 comes into contact with the crusty pastry 5, it will cut the crusty pastry 5 along the separation plane 6. This takes place because the sharp cutting edge 7 is reciprocated at a frequency of about 500 Hz and with an amplitude in the 0.25 - 4 mm range. Furthermore preferably, said range has a lower limit of 1.0 mm. Also further preferably, said range has an upper limit of 1.5 mm. Said lower limit is determined by, among other factors, a desired minimum distance along which the cutting element is to reciprocate through the product to be cut. The upper limit is determined by, among other factors, the lower reciprocating frequency and the weight of the cutting element. As a result of the high frequency at which the cutting element 11 comprising the cutting blades 2 and the cutting edge 7 cuts through the crusty pastry 5, the pastry will not adhere to the cutting blades 2 of the cutting element 11 on either side of the separation plane 6, resulting in neatly cut pastry 5.

[0035] Figure 2 is a side view of the cutting element 11 reciprocating in the direction indicated by the arrow P above the conveyor belt 4. From the shape of the cutting edge 7 of the double-sided cutting element 11 it can be derived that this cutting element is suitable for cutting a food product from two sides.

[0036] Figure 3 shows a cutting element 15, which is driven for reciprocating motion in the direction indicated by the double arrow P by a driving device 13, the cutting edge 17 of the cutting blades 12 of which cutting element being serrated. Because of this, the cutting element is in particular suitable for food products which easily dull the knife, for example poultry containing bones.

[0037] Figure 4 shows another cutting element 21, which is suitable for cutting food products with the cutting edge 27 thereof. Said cutting element 21 has a-symmetrical cutting blades 22, with the distance d1 from the axis of rotation 23 to the leading end of the cutting edge 27 being smaller than the distance d2 from the axis of rotation to a central part of the cutting edge 27. As a result, the cutting element 21 will penetrate further and further into a product, also in the case of a stationary product, upon moving in clockwise direction, seen in figure 4, about the axis of rotation 23a. The cutting edge 27 in fact slides through the products in such an embodiment, with the cutting edge 27 withdrawing from the cut surface during its return movement (in anti-clockwise direction) and making an adequate cutting movement again upon moving in clockwise direction again.

[0038] Figure 4a is a sectional view of the cutting element 21 of figure 4, along the line A-A therein. As said sectional view shows, a central element 28 functions as a spacer and as a support element for the two cutting blades 22a, 22b of the cutting element 21. At the bottom side of the cutting element 21, the blades 22a, 22b make direct contact with the bottom edge 27 of the central element 28 so as to form a very sharp, wedge-shaped cutting edge 27.

[0039] Figure 4b, to conclude, is a sectional view along the line B-B in figure 4a, which shows the shape of the central element 28 between the cutting blades 22a, 22b. The recesses in the central element 28, through which the cutting blade 22b is visible, serve to reduce the weight of the cutting element 21 with a view to realising a maximum reciprocating frequency. At the bottom side, the cutting blade 22b extends beyond the central element 28, where the cutting blade 22b will make contact with the cutting blade 22a (not shown in this figure).

[0040] Figure 4c shows an alternative cross-sectional view along the line A-A in figure 4 of a cutting element 61 which is comparable to the cutting element 21 of figure 4. In this embodiment, too, two cutting blades 62a, 62b are held spaced apart by a central element 68. In contrast to the situation in figure 4a, however, in which a bottom edge of the central element 28 forms the cutting edge 27, both cutting blades 62a, 62b extend beyond the spacer 68, joining one another at the bottom edge 65 of the cutting blades and 62b. The cutting blade 62a extends further than the cutting blade 62b, which is welded to the cutting blade 62a with its end 65. Thus, the cutting edge 67 is in fact only formed by the circumferential edge of the cutting blade 62.

[0041] Figures 5a and 5b show a cutting element 31 in side view and in sectional view, respectively, in which perforations 40 are present in the cutting blades 32a and 32b on either side of the cutting element 31. In figure 5, dotted lines indicate channels for transporting fluid from a fluid inlet connection 41 (see figure 5b) to the perforations 40. The perforations 40 are arranged in such a manner that they are ideally located for a specific product to be cut. The perforations may be provided at different locations for different products. The channels 39 extend through the central element 38, which is not shown as such in the drawings for the sake of clarity. As figure 5b shows, fluid flows from the two cutting blades 32a, 32b as indicated by the arrows F for being delivered to the cut surfaces of a food product on either side of the cutting element 31.

[0042] In figure 6, an alternative embodiment of a cutting element 51 provided with fluid outlet openings 60 is shown in exploded view. In the assembled condition, the insert 62 is disposed between the cutting blades 52a and 52b, with the perforations or outlet openings 60 terminating at the rear side of the cutting element 51. As such, fluid can be passed from the inlet connection 61, through the channels 59 in the insert 62 and through the outlet openings 60 in the direction indicated by the arrows F. In this embodiment, the fluid will not be introduced between the cut surfaces of a partially cut product until the cutting element 51 has passed that part of the food product. Consequently, this embodiment is suitable only for applying a film between the cut surfaces while being less suitable for reducing the amount of friction between the cutting blades 52a, 52b and the food product.

[0043] Only a few embodiments of a cutting device or cutting element according to the present invention have been shown and discussed in the figures and the description. It will be understood, however, that various modifications to these embodiments may be conceived by those skilled in the art, which modifications all fall within the scope of the present patent application, which is defined by the appended claims. The figures and the description herein are only meant by way of illustration. Thus it is possible, for example, to provide the separating device with coupling means, for example quick-action coupling means, for (rapidly) exchanging a cutting element in adaptation to different kinds of products to be cut.

Claims

1. A separating device for food products, comprising a separating element with two outer blades which are attached together at an acute angle relative to each other along at least part of their circumferential edges so as to provide a cutting edge, whilst a spacer is provided between at least part of said outer blades, which spacer fills the space between the two outer blades only partially, and drive means for reciprocating the outer blades along the cutting edge at a frequency in the 150 - 10,000 Hz range.

2. A separating device according to claim 1, **characterised in that** the outer blades are arranged with their circumferential edges staggered relative to each other.

3. A separating device according to claim 1, **characterised in that** a cutting element is provided between the two circumferential edges, which cutting element forms the actual cutting edge.

4. A separating device according to claim 1 or 2, **characterised in that** the outer blades are attached together at least near the cutting edge.

5. A separating device according to one or more of the preceding claims, **characterised in that** the separating element is arranged for reciprocation about an axis of rotation.

6. A separating device according to one or more of the preceding claims, **characterised in that** at least one of the outer blades is provided with a textured surface on the side remote from the spacer.

7. A separating device according to one or more of the preceding claims, **characterised in that** the separating element is provided with a fluid inlet and with fluid outlets.

8. A separating device according to claim 7, **characterised in that** the fluid discharge means are at least partially provided in at least one of the two outer blades.

9. A separating device according to claim 7 or 8, **characterised in that** the spacer is provided with at least one channel for carrying fluid from the fluid inlet to the fluid outlet openings.

10. A separating device according to one or more of the preceding claims, **characterised in that** the device comprises a counterweight, which reciprocates in opposition to the separating element.

11. A separating device according to one or more of the preceding claims, **characterised in that** heating means are provided for heating at least the outer blades of the separating element.

12. A separating device according to one or more of claims 1-3 or 5-11, **characterised in that** the outer blades of the separating element are provided in such a manner in the separating device that they can be reciprocated in opposition to each other along the cutting edge.

13. A separating device according to one or more of the preceding claims, **characterised in that** the separating device comprises a support surface for a product to be separated, above which support surface the separating element is mounted for reciprocating motion.

14. A separating element for use in a separating device according to one or more of the preceding claims, comprising two outer blades, which are attached together at an acute angle relative to each other along at least part of their circumferential edges so as to provide a cutting edge, whilst a spacer is provided between at least part of said outer blades, which spacer fills the space between the two outer blades only partially.

15. A method for cutting a food product, wherein a separating device according to one or more of claims 1-19 causes a separating element to reciprocate at a frequency in the 150 - 10,000 Hz range.

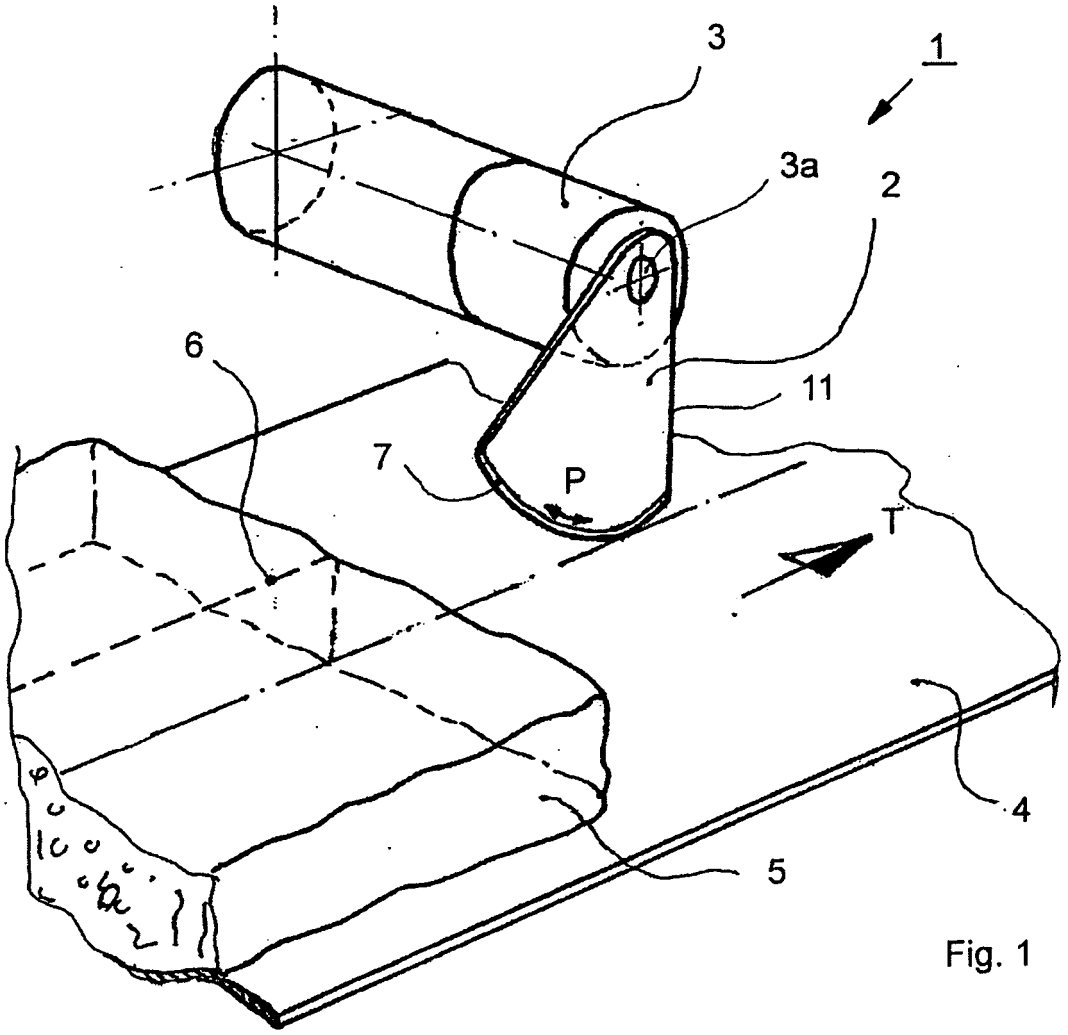

Fig. 1

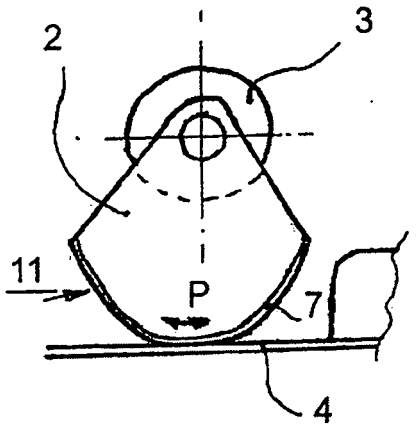

Fig. 2

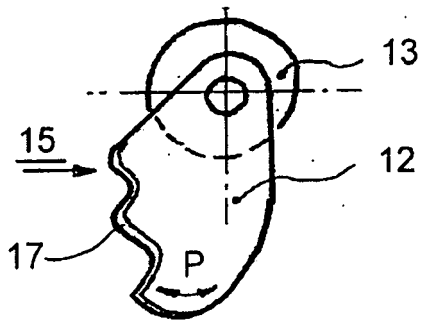

Fig. 3

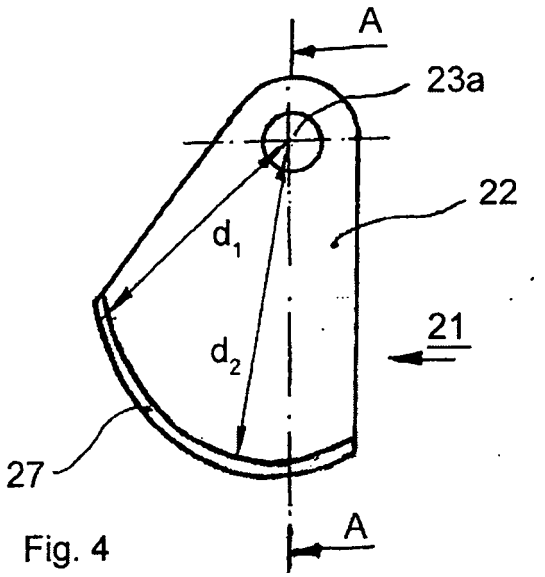

Fig. 4

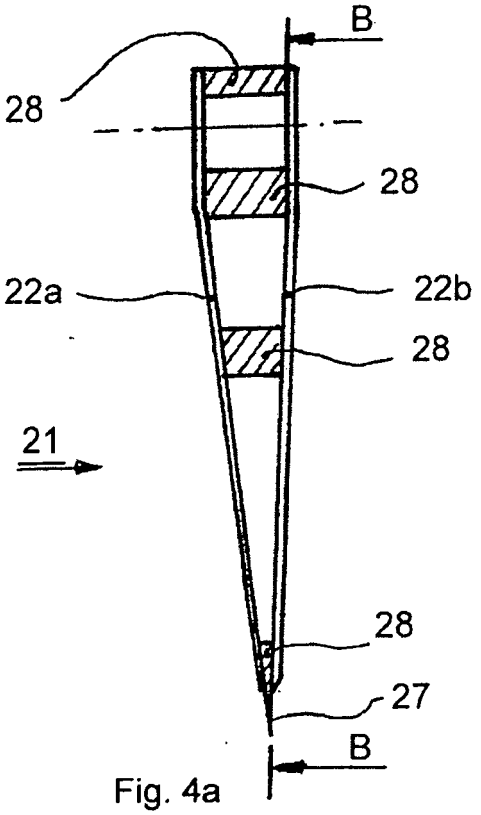

Fig. 4a

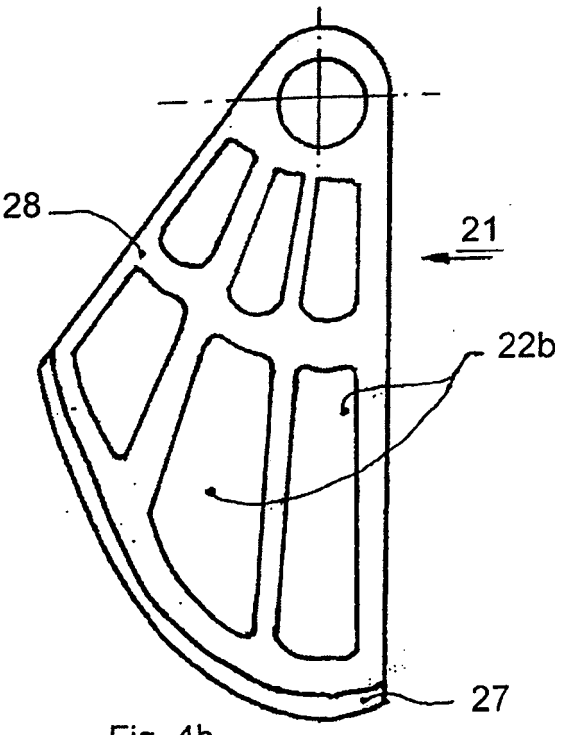

Fig. 4b

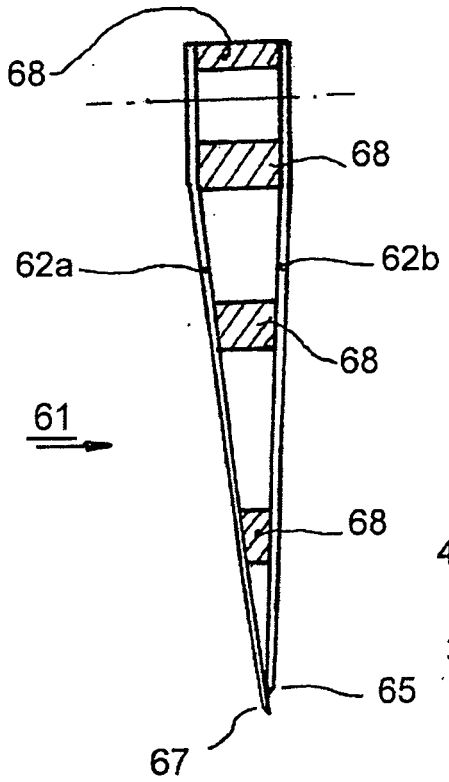

Fig. 4c

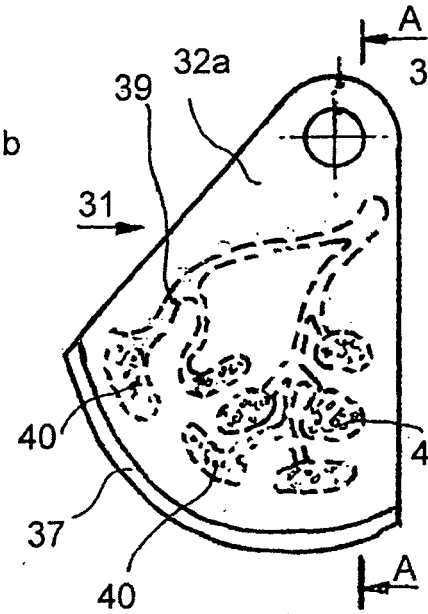

Fig. 5a

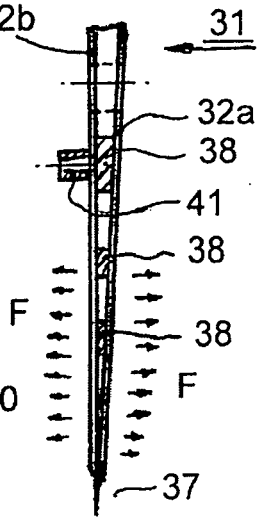

Fig. 5b

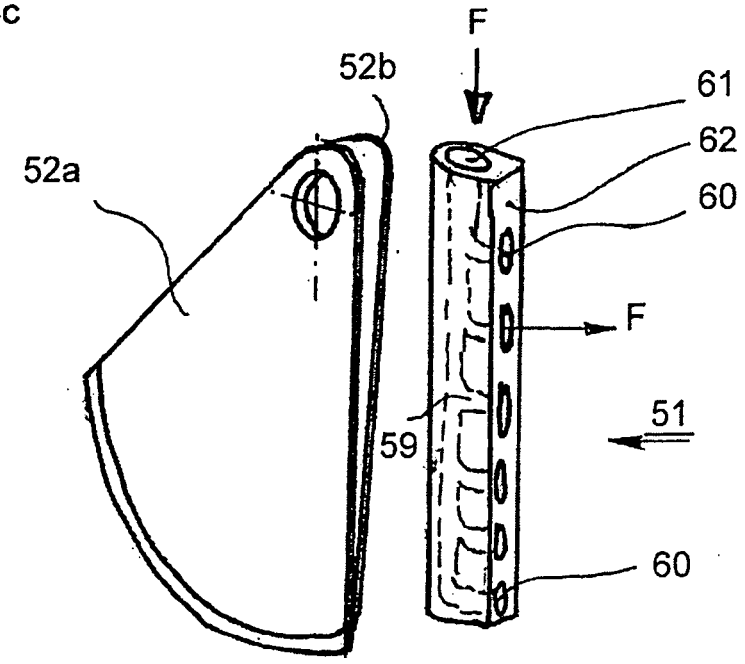

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 09 00 1156

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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