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(54) Titel: **Præ-rigor- og fersk fisk-nervebenudtagningsapparat**

(57) Sammendrag:
Pre-rigor and fresh fish pin bone removal apparatus, for removing pin bones in fish flesh, where the pre-rigor and fresh fish pin bone removal apparatus comprises at least a conveyor, a temperature manipulation unit and a pin bone removal unit, where the temperature manipulation unit is followed by the pin bone removal unit and where the temperature manipulation unit is configured to conduct a controlled heating of fish flesh where the temperature manipulation unit is further configured to conduct a controlled heating of at least one selective area of the fish flesh and where the controlled temperature manipulation unit comprises either a microwave unit or a laser unit, the advantage of which is adding individuality and targeted temperature manipulation to the process to bring the processing window from present up to 3 days maturing down to no maturing needed.

Fortsættes...

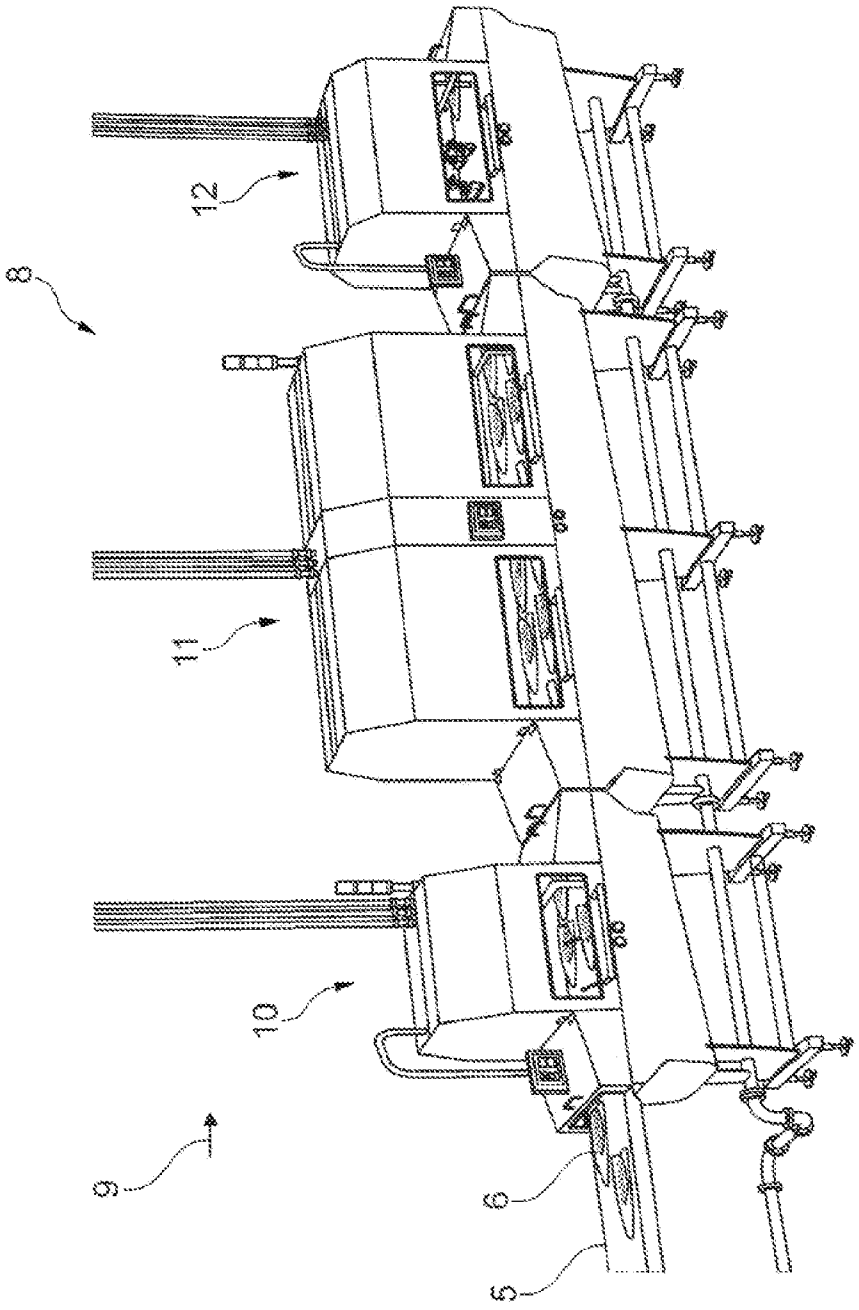

Fig. 4

Pre-rigor and fresh fish pin bone removal apparatus

Field of the Invention

The present invention relates to an pre-rigor and fresh fish pin bone removal apparatus, for removing pin bones in fish flesh, where the pre-rigor and fresh fish pin bone removal apparatus comprises at least a conveyor, a temperature manipulation unit and a pin bone removal unit, where the temperature manipulation unit is followed by the pin bone removal unit and where the temperature manipulation unit is configured to conduct a controlled heating of fish flesh.

Background of the Invention

The invention is targeting to solve a puzzle, which has until now remained unsolved. Conventional methods have over numerous attempts proven to be unsuccessful on especially fresh fish fillets, where bones and skin and flesh is firmer.

The removal of the pin bones is a critical part of processing fresh fish, where present technology has of yet not achieved noticeable success on pre-rigor fillets no matter the specie.

Before the development of the present invention, it has been known to remove pin bones in the following ways:

1) Manually, where operators have small tools to pick the bones from the flesh,
2) Semi-automatic, where a handheld rotating shredded drum is positioned to rip the bones from the flesh,
3) Automatic, where a conveyor takes the fish through one or more fixed rotating drums.

One of the disadvantages of these methods is that they have not worked properly on fresh (pre-rigor) fish fillets; where the firm flesh and bone fasten to the skin make this impossible without damaging the flesh.

Another one of the disadvantages of these methods is thus, that it is possible only to work properly with post rigor fish, where time and temperature have resulted in a maturing/softening process, which has made the flesh tender.

Object of the Invention

The object of this invention is to provide an pre-rigor and fresh fish pin bone removal apparatus of the type mentioned in the introduction which changes the prior art methods by adding both intelligence, individuality and targeted temperature manipulation to the process.

It is a further object of the invention to make it possible to provide a pin bone removal apparatus which is able to bring the processing window from present up to 3 days maturing down to no maturing needed. The method is also capable of improving skinning process.

It is another object of the invention to change the markets substantially, so that distribution chains and processing plants will change in order to finish the products as close to live state as possible. This again will bring fresh and firmer fish products to market, with significant impact on price and quality on white fish as well as salmonids + other species.

It is thus an object of the invention to significant improve todays fillet and further value added products.

In yet another object of the invention it is furthermore possible to add cold air during process of fillets, so outside the pre-rigor and fresh fish pin bone removal apparatus temperature can be higher without damaging the sensible fillet products.

Description of the Invention

According to a first aspect of the invention, the above object is achieved with an pre-rigor and fresh fish pin bone removal apparatus of the type mentioned in the introduction, where an pre-rigor and fresh fish pin bone removal apparatus, for removing pin bones in fish flesh, where the pre-rigor and fresh fish pin bone removal apparatus comprises at least a conveyor, a temperature manipulation unit and a pin bone removal unit, where the temperature manipulation unit is followed by the pin bone removal unit and where the temperature manipulation unit is configured to conduct an area controlled heating of fish flesh where the temperature manipulation unit is further con-

figured to conduct a controlled heating of at least one selective area of the fish flesh and where the controlled temperature manipulation unit comprises either a microwave unit or a laser unit.

This makes it possible to target the temperature manipulation to the process and to make it possible to provide a pin bone removal apparatus which is able to bring the processing window from present up to 3 days maturing down to no maturing needed.

It also makes it possible to finish the products as close to live state as possible, which includes pin bone removal and skinning.

The temperature manipulation unit is followed by the pin bone removal unit which could further be followed by a skinning machine or alternatively could a skinning machine follow after the temperature manipulation unit and before the pin bone removal unit. Both options are possible due to the fact that the skinning process becomes easier after the temperature manipulation unit.

The process that makes it possible can be summarized as a procedure, where:

1. The temperature manipulation unit conduct a tendering process through targeted heating of bone roots and
2. The pin bone removal unit adjust to the individual fillets

This can be done by letting the fillets pass through a controlled microwave tunnel either in step or in a flow. The flesh will heat up the fastest, where the fat layer is thick and bones are fastened to the skin. The temperature control ensures, that it will only allow the area to tender and not the fillet to cook, hence a controlled heating of at least one selective area of the fish.

With laser technology is it also possible to heat up the flesh, where the fat layer is thick and bones are fastened to the skin area, thus a controlled heating of at least one selective area.

By an pre-rigor and fresh fish pin bone removal apparatus is meant a single unit machine or a combination of units working together one after another in a line, thus in-

line. The conveyor is preferably a single conveyor that transports the fish through the entire pre-rigor and fresh fish pin bone apparatus such that the fish do not change its position between the units of the pre-rigor and fresh fish pin bone apparatus. Alternatively it could be a number of conveyors as long as the fish do not change its position.

The conveyor is able to move the fillets forward in a flow, where it is understood that a flow is both considered to be controllable steps or forward continuous movement, where the fillets are in motion at both steps/movement.

The temperature manipulation unit is able to work from any side of the fish, whether that may be from above, below, front, back or from the sides. Furthermore is it able to work from at least one angle, where it by angle is meant angle in relation to the surface of the fish.

For the pre-rigor and fresh fish pin bone removal apparatus to be able to work at all it is preferably driven by electricity.

In a second aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where at least the laser unit further comprises a laser tool arranged at a robotic arm.

This makes it possible to precisely pinpoint the position, distance and angle of the laser in relation to the fillet. In a preferred embodiment is the robotic arm part of a flexpicker robot. In an alternative embodiment could another type of robot be used. It is also possible to have the laser perform a certain system of movements, whether that is in a tilted angle, zigzag, from side to side or other patterns or movements.

In a preferred embodiment are servo motors as rotary or linear actuators used due to their ability to conduct precise control of positions, angularly or linearly. Servo motors also have the ability to control velocity as well as acceleration.

In a third aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where the pin bone removal apparatus further comprising a

combination scanner at least in front of the pin bone removal unit, where the combination scanner comprises at least a positioning unit and a bone detection unit.

This makes it further possible to provide a pin bone removal apparatus with intelligence and individuality. The fillets will pass through the combination scanner, which can measure the individual fillets as they pass through.

This makes it further possible to follow a procedure, where:

1. The combination scanner conduct a position, surface and bone detection by combining scanning methods
2. The temperature manipulation unit conduct a tendering process through targeted heating of bone roots and
3. The pin bone removal unit adjust to the individual fillets

Where a microwave tunnel is the temperature manipulation unit, the following procedure is also possible:

1. The temperature manipulation unit conduct a tendering process through targeted heating of bone roots,
2. The combination scanner conduct a position and bone detection by combining scanning methods, and
3. The pin bone removal unit adjust to the individual fillets

The latter is due to the fact that the microwave unit also is able to operate without the scanner.

When using the scanner the fillets are then detected in terms of their location on the conveyor and the bones detected, where after tendering process is activated. This is done by manipulating the temperature, where especially the bones are fastened.

This can be done by letting the fillets pass through a controlled microwave chamber either in step or in a flow. The flesh will heat up the fastest, where the fat layer is thick and bones are fastened to the skin. The temperature control ensures, that it will only allow the area to tender and not the fillet to cook.

This can also be done by letting the fillets pass through a laser unit, where laser technology makes it possible by using the information from the scanner to heat up specific area and depth according to the fillets surface with laser precision.

The pre-rigor and fresh fish pin bone removal apparatus could be three individual machines, but functions could be within one machine frame as well.

In a fourth aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where the positioning unit is a 3D surface scan unit and that the bone detection unit is an x-ray unit.

This makes it possible to measure the individual fillets as they pass through the combination scanner by means of a 3D surface scan unit to detect the shape of the fillets and an x-ray unit to detect inside bone position and the angle of the bones within the fillets.

In a fifth aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where the positioning unit is a 3D surface scan unit and that the bone detection unit is a MR- scanning unit.

This makes it possible to measure the individual fillets as they pass through the combination scanner by means of a 3D surface scan unit to detect the shape of the fillets and an MR- scanning unit to detect inside bone position and the angle of the bones within the fillets.

In a sixth aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where the pin bone removal unit comprises at least one pull mechanism arranged on at least one arm, where the at least one arm has a number of flexibly positioning means.

This makes it possible to pull the bones after the tendering process, since the bones have now lost their grip and can then be pulled with less or no damage to the flesh. In order to improve the result, intelligent pin bone pulling is used, where:

a. The position of individual fish and its bones + surface structure is tracked through to the pulling area
b. The pull mechanism, which is arranged on at least one arm, where the at least one arm has a number of flexibly positioning means, which then optimizes the picking angle.
c. Each fillet is unique and the pull mechanism adapts all angles, speed accordingly, which will secure "straight" pulling from optimized angles.

The pin bones are exposed from the vertebra after filleting but piece of cartilage fastens this to the skin.

By the expression a number of positioning means is meant at least one of a linear movement of the arm, a rotating movement around the axes of the arm or around a swivel at the end of the arm where the axis of the swivel is at least parallel to the axis of the arm. It could likewise be a rotating movement around a swivel at the end of the arm where the axis of the swivel is different from parallel to the axis of the arm, preferably perpendicular to the axis of the arm.

Preferably telescopic coaxial axis are used as well as swivels, however other construction means could just as well be used to conduct the same kind of movements.

In a seventh aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where the pull mechanism comprises at least one rotating head.

This makes it possible to remove pin bones through flexible and maneuverable rotator heads adjusted to the individual fillets.

In a preferred embodiment is the rotating head a rotating drum which is intended to roll over the fillets where the pin bones are placed.

After the tendering process the bones have lost their grip and can then be pulled with less or no damage to the flesh. In order to improve the result intelligent pin bone pulling is used, where:

a. The position of individual fish and its bones + surface structure is tracked through to the pulling area
b. The rotating drums have servo motors and have full arm wrist flexibility, so that the rotator drum optimizes the picking angle.
c. Each fillet is unique and the pull mechanism adapts all angles, speed accordingly, which will secure "straight" pulling from optimized angles.

The pin bones are exposed from the vertebra after filleting but piece of cartilage fastens this to the skin.

In an eight aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where at least one of the temperature manipulation units, the pin bone removal unit or the combination scanner comprises cabinets with self-cleaning means.

This makes it possible to conduct a completely automatized inside cleaning of a single unit machine or the combination of several or all the individual machines connected and working together, where the machines comprises cabinets.

The uniqueness continues as a solution, where movable and fixed spray bars combined with a sloped bottom section is making it possible to make a complete internal wash down, which include a 360 degree belt and cabinet wash.

In a ninth aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where the automated inside cleaning cabinets comprises moveable and/or fixed spray bars.

This makes it possible to choose the most optimal solution, whether that is moveable or fixed spray bars. It also makes it possible to choose a combination of movable or fixed spray bars. One cabinet might require one solution, another cabinet another. Though preferably, all cabinets comprise the same solution.

In a tenth aspect, the present invention also relates to an pre-rigor and fresh fish pin bone removal apparatus, where the automated inside cleaning cabinets further comprise a sloped bottom section.

This makes it possible to get the water and other liquids used for cleaning out of the cabinets. In one embodiment is the bottom sloped to one end of the cabinet, in another embodiment to the other end or in a third embodiment at the bottom centre of the cabinet.

The invention could be a single unit machine or a combination from three individual machines working together. The machine frames and cabinets are made to connect with each other and allow for completely automatized inside cleaning. Movable and fixed spray bars combined with a sloped bottom section is making it possible to make a complete internal wash down.

The invention also includes or at least could include a system for control- and regulating the apparatus comprising different technical items, such as for example microprocessors, sensors, timers, motors and actuators, which are not all described in the specification, but as one of ordinary skill will recognize necessary to the invention, to make it function properly.

Description of the Drawing

The invention will be described in further detail below by means of non-limiting embodiments with reference to the drawing, in which:

Figure 1 shows a manually method of prior art

Figure 2 shows a semi-automatic method of prior art

Figure 3 shows an automatic method of prior art

Figure 4 shows an pre-rigor and fresh fish pin bone removal apparatus, in closed position

Figure 5 shows an pre-rigor and fresh fish pin bone removal apparatus comprising a microwave unit, in

open position

Figure 6 shows an pre-rigor and fresh fish pin bone removal apparatus comprising a laser unit, in open
position

Figure 7 shows a combination scanner

Figure 8a-8c shows surface and bone scanning

Figure 9 shows a microwave unit

Figure 10 shows microwaves

Figure 11 shows the "Thermal mode" with depth impact shown as "sinus heat curves"

Figure 12 shows a laser

Figure 13 shows a laser beam from tool

Figure 14 shows the "Thermal mode" sinus heat curves

Figure 15 shows a pin bone removal unit

Figure 16a-16c shows a salmon fillet with bone structure

Figure 17a-17c shows the flexibly positioning means of the pull mechanism of the pin bone removal unit

Figure 18a-18c shows that the pull mechanism matches the fillet structure

Figure 19 shows an pre-rigor and fresh fish pin bone removal apparatus, in open position where the means for easy cleaning is shown

The figures shown illustrates salmon, however the invention can be handling other kinds of individual fish as well.

In the description of the figures, identical or corresponding elements will be designated by the same reference numerals in the various figures. Thus, there will not be given an explanation of all details in connection with each figure / embodiment.

In the drawing, the following reference numerals have been used for the designations used in the detailed part of the description:

1	Tool
2	Bone
3	Fish flesh
4	Handheld rotating shredded drum
5	Conveyor

6	Fish fillet
7	Automatic rotating drum
8	Pre-rigor and fresh fish pin bone removal apparatus
9	Direction of processing
10	Combination scanner
11	Temperature manipulation unit
12	Pin bone removal unit
13	Microwave unit
14	Laser unit
15	Cabinet
16	Hatch
17	Positioning unit
17a	3D surface scan unit
18	Bone detection unit
18a	X-ray unit
18b	MR scanning unit
19	Microwave
20	Laser tool
21	Flex picker robot
22	Laser beam
23	Salmon
24	Backbone
25	Skin
26	Pull mechanism
27	Arm
28	Rotating drum
29	Linear movement
30	First rotating movement
31	First swivel
32	Second rotating movement
33	Second swivel
34	Automated inside cleaning cabinets
35	Spray bars
36	Sloped bottom section

37 Air, water, electricity connections

38 Water drain pipe

Detailed Description of the Invention

Figure 1 shows a manually method of prior art, where operators have small tools 1 to pick the bones 2 from the fish flesh 3. Figure 2 shows a semi-automatic method of prior art, where a handheld rotating shredded drum 4 is positioned to rip the pin bones 2 from the fish flesh 3. Figure 3 shows an automatic method of prior art, where a conveyor 5 takes the fish fillet 6 through one or more automatic rotating drums 7.

Figure 4 shows an pre-rigor and fresh fish pin bone removal apparatus 8, in closed position, where a conveyor 5 is transporting fish fillets 6 in the direction of processing 9. In the shown embodiment is a combination scanner 10 placed in front of a temperature manipulation unit 11 followed by a pin bone removal unit 12.

Figure 5 shows an pre-rigor and fresh fish pin bone removal apparatus 8 comprising a microwave unit 13, in open position. Figure 6 shows an pre-rigor and fresh fish pin bone removal apparatus 8 comprising a laser unit 14, in open position. By open position is meant that the cabinet 15 has a hatch 16, a door or a similar device which can be opened and closed.

Figure 7 shows a combination scanner 10. Figure 8a shows a 3D surface scanning of a fish fillet conducted by a positioning unit 17 in terms of a 3D surface scan unit 17a; figure 8b shows a bone scanning conducted by a bone detection unit 18 either in terms of an x-ray unit 18a or a MR scanning unit 18b. Figure 8c shows a fish fillet 6 with pin bones 2.

Figure 9 shows a microwave unit 13, in open position. Figure 10 shows microwaves 19 (just one wave is shown as a sinus heat curve for illustration) from the microwave unit 13 that hit the fish fillet 6 whereby the tendering process is then activated. This is done by manipulating the temperature, where especially the bones are fastened. Fat is more aqueous than flesh or meat, which means that the fat becomes warmer before the meat when exposed for microwaves. Since the bones are fastened to the fat which

again is fastened to the skin the coherence becomes weaker and the bones becomes thus easier to pull without damaging the flesh of the fish. Figure 11 shows the "Thermal mode" with depth impact.

Figure 12 shows a laser unit 14, in open position where a laser tool 20 is mounted on a flex picker robot 21. Figure 13 shows a laser beam 22 from the laser unit 14, where the laser beam 22 hit the fish fillet 6 whereby the tendering process is then activated by manipulating the temperature, where especially the bones are fastened. With laser technology this can be done very precisely. Figure 14 shows the "Thermal mode".

Figure 15 shows a pin bone removal unit 12.

Figure 16a shows a salmon 23 in cross section with its bone structure comprising backbone 24 and pin bones 2. Figure 16b shows a fillet 6 with pin bones 2 in the lengthwise direction of the fish fillet 6 and figure 16c shows a fillet 6 with pin bones 2 in a cross section of the fish fillet 6. The pin bones 2 are exposed from the backbone 24 after filleting but piece of cartilage fastens the pin bones 2 to the skin 25.

Figure 17a-c shows the flexibly positioning means of the pull mechanism 26 arranged on at least one arm 27 of the pin bone removal unit 12, which allows the pull mechanism 26 shown as a rotating drum 28 flexibly positioning means to optimize the picking angle. Figure 17a shows an example of a linear movement 29 of the arm 27, figure 17b an example of a first rotating movement 30 around a first swivel 31 at the end of the arm where the axis of the first swivel is at least parallel to the axis of the arm 27, figure 17c shows a second rotating movement 32 around a second swivel 33 at the end of the arm 27 where the axis of the second swivel 33 is different from parallel to the axis of the arm 27, preferably perpendicular to the axis of the arm 27. Figure 18a-c shows that the pull mechanism 26 matches the structure of the fillet 6.

Figure 19 shows an pre-rigor and fresh fish pin bone removal apparatus 8, in open position where the means for easy cleaning is shown. This comprises automated inside cleaning cabinets 34 with moveable and/or fixed spray bars 35 as well as a sloped bottom section 36. Further are shown air, water and electricity connections 37 as well as the water drain pipe 38.

PATENTKRAV

1. Præ-rigor- og fersk fisk-nervebenudtagningsapparat, til fjernelse af nerveben i fiskekød, hvor præ-rigor og fersk fisk-nervebenudtagningsapparatet omfatter mindst en transportør, en temperaturmanipuleringsenhed og en nervebensfjerneenhed, hvor temperaturmanipuleringsenheden efterfølges af nervebensfjerneenheden, og hvor temperaturmanipuleringsenheden er konfigureret til at udføre en kontrolleret opvarmning af fiskekød, **kendetegnet ved** at temperaturmanipuleringsenheden yderligere er konfigureret til at udføre en kontrolleret opvarmning af mindst et udvalgt område af fiskekødet, og hvor den kontrollerede temperaturmanipuleringsenhed enten omfatter en mikrobølgeovn eller en laserenhed.

2. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge krav 1, **kendetegnet ved** at i det mindste laserenheden yderligere omfatter et laserværktøj arrangeret på en robotarm.

3. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge krav 1 eller 2, **kendetegnet ved,** at nervebenudtagningsapparatet yderligere omfatter en kombineret skanner i det mindste foran nervebensfjerneenheden, hvor den kombinerede scanner omfatter mindst en positionsdetektionsenhed og en benregistreringsenhed.

4. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge krav 3, **kendetegnet ved** at positionsdetektionsenheden er en 3D-overfladeskanningsenhed, og at benregistreringsenheden er en røntgenenhed.

5. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge krav 3, **kendetegnet ved** at positionsdetektionsenheden er en 3D-overfladeskanningsenhed, og at benregistreringsenheden er en MR-skanningsenhed.

6. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge ethvert af krav 1 til 5, **kendetegnet ved** at nervebensfjerneenheden omfatter mindst en trækmekanisme arrangeret på mindst en arm, hvor den mindst ene arm har et antal fleksible positioneringsorganer.

7. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge krav 6, **kendetegnet ved** at trækmekanismen omfatter mindst et roterende hoved.

8. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge ethvert af krav 1 til 7, **kendetegnet ved** at mindst en af temperaturmanipuleringsenheden, nervebensfjerne-enheden og den kombinerede skanner omfatter kabinetter med selvrensende midler.

9. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge krav 8, **kendetegnet ved** den automatiserede indvendige rensning af kabinetter omfatter bevægelige og/eller faste sprøjtestænger.

10. Præ-rigor- og fersk fisk-nervebenudtagningsapparat ifølge 8 eller 9, **kendetegnet ved** den automatiserede indvendige rengøring af kabinetter yderligere omfatter en skrånende bundsektion.

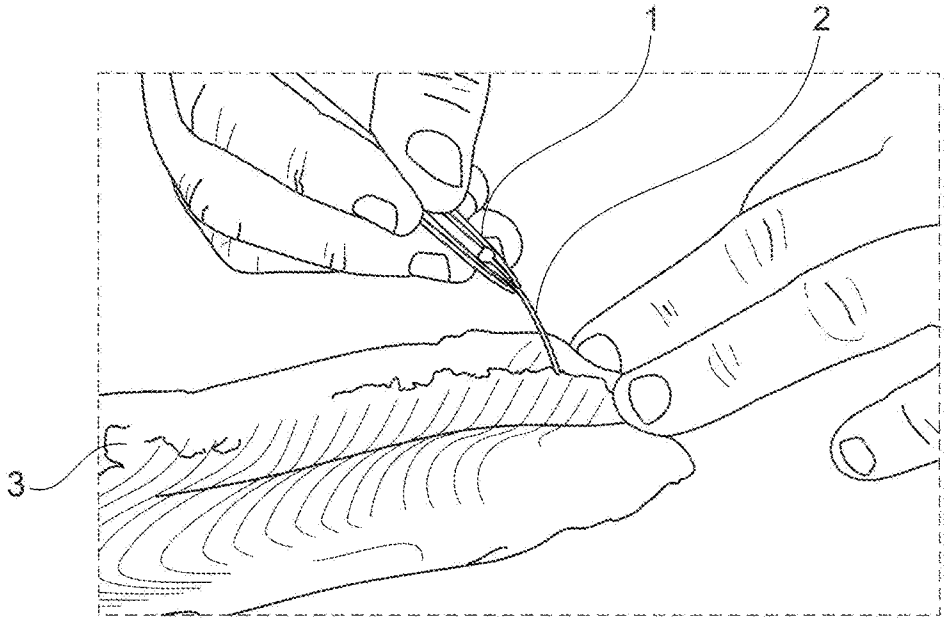

Fig. 1
Prior art

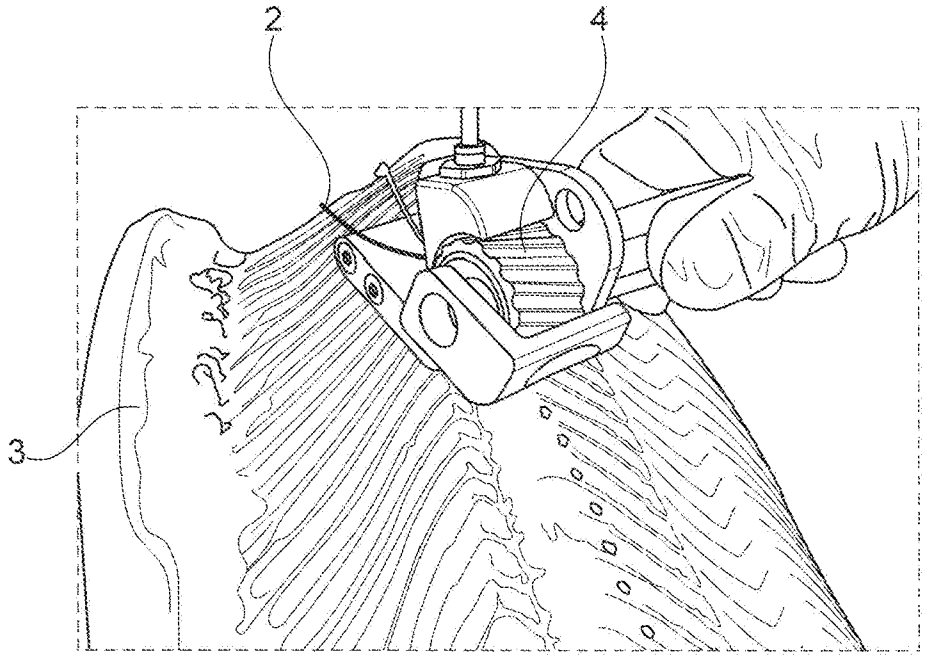

Fig. 2
Prior art

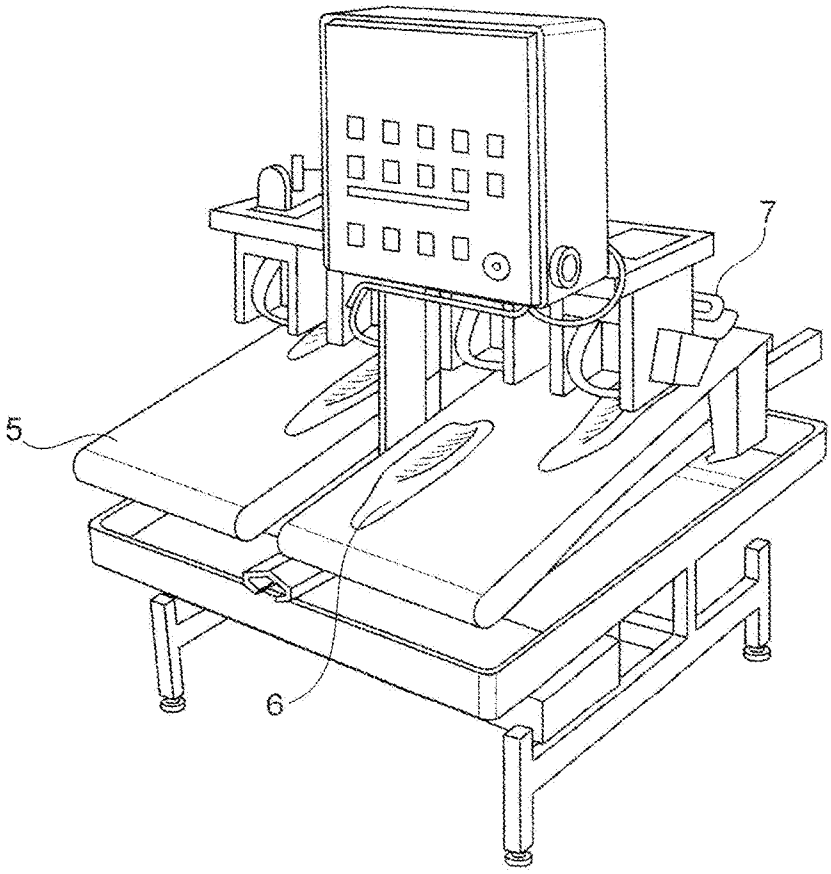

Fig. 3
Prior art

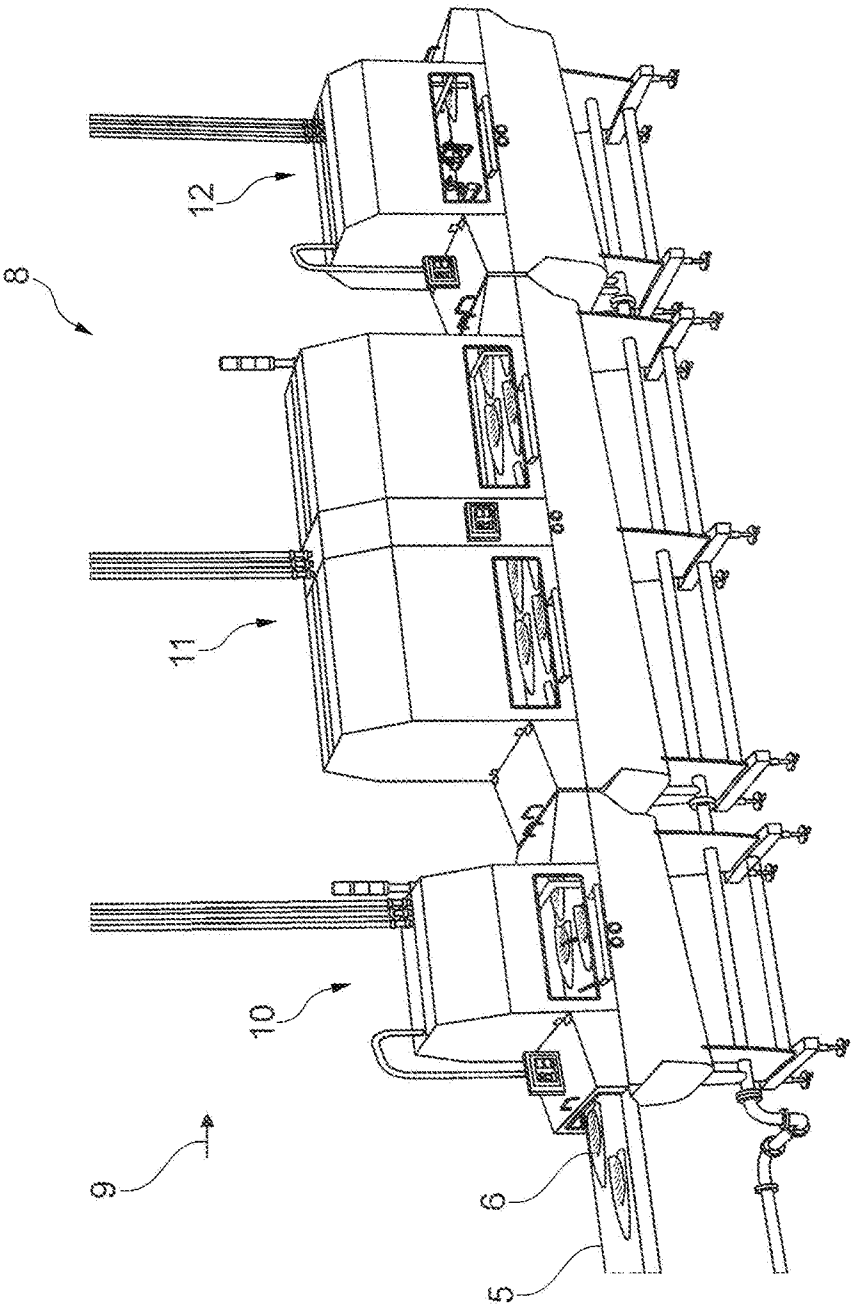

Fig. 4

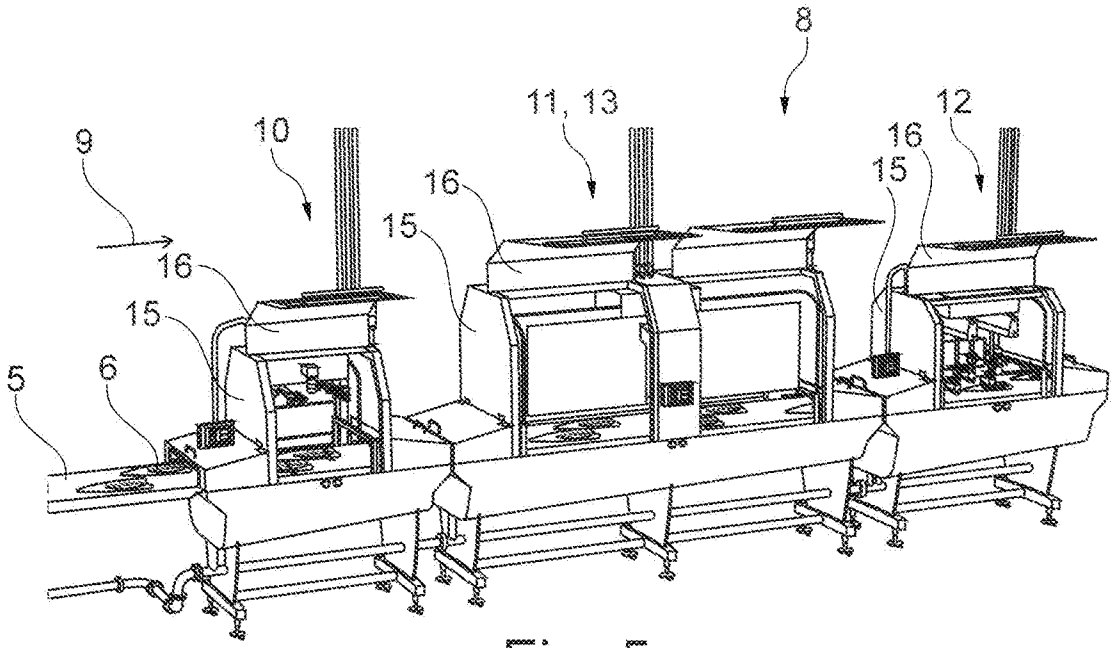

Fig. 5

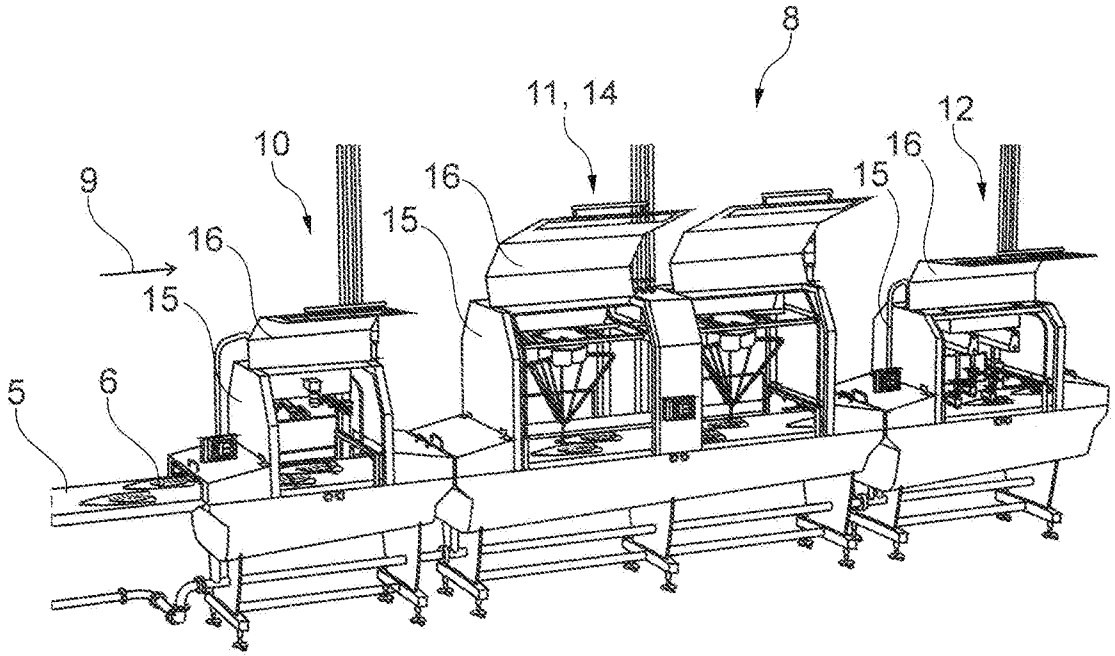

Fig. 6

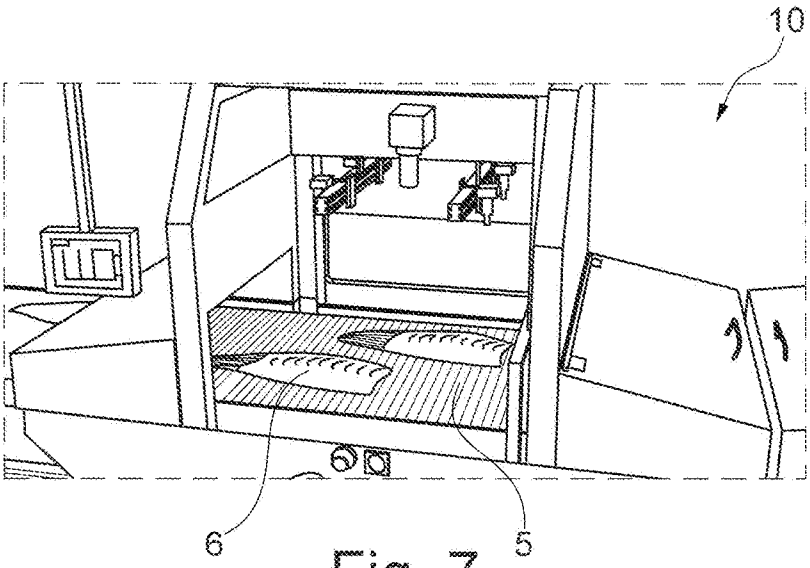

Fig. 7

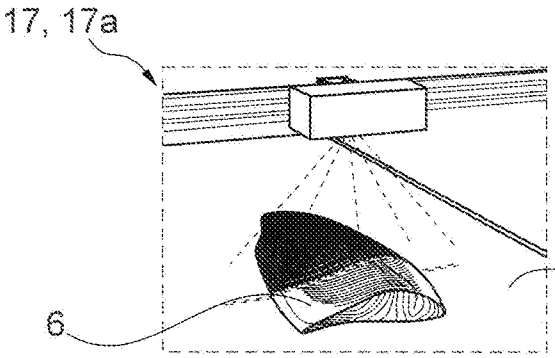

Fig. 8a

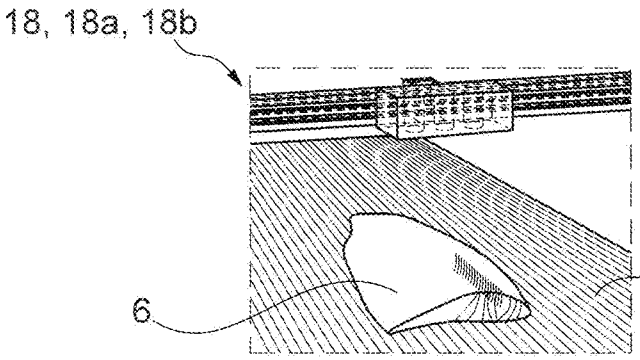

Fig. 8b

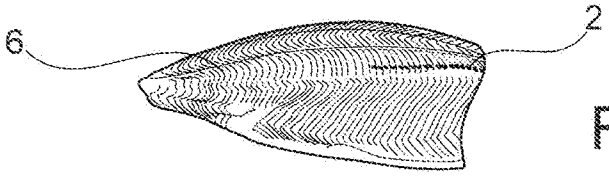

Fig. 8c

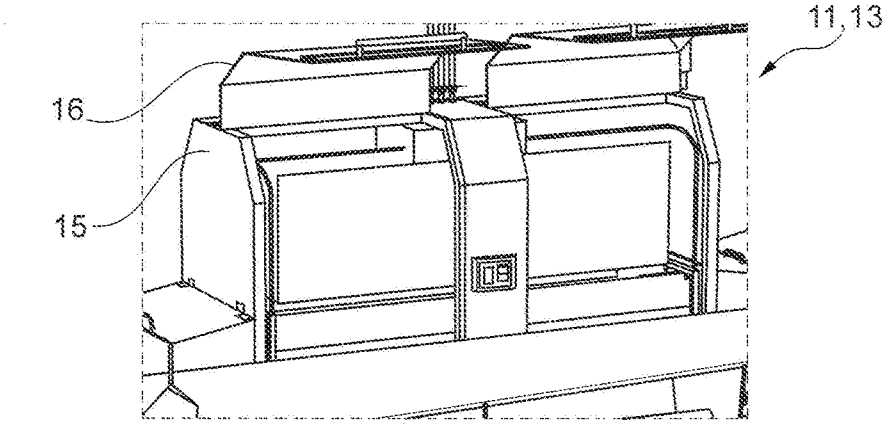

Fig. 9

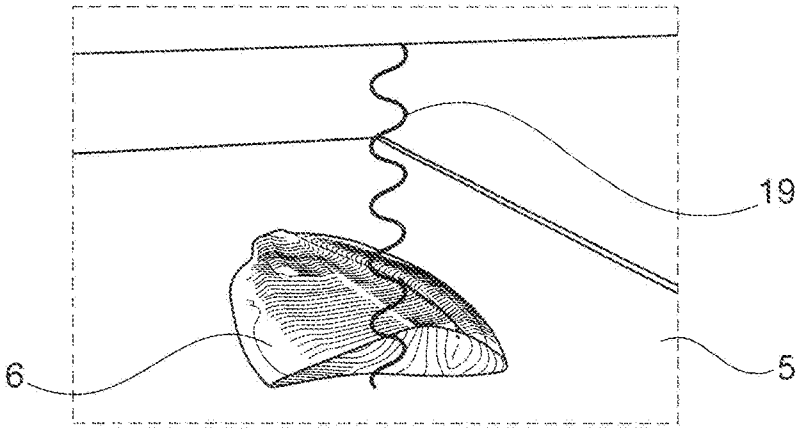

Fig. 10

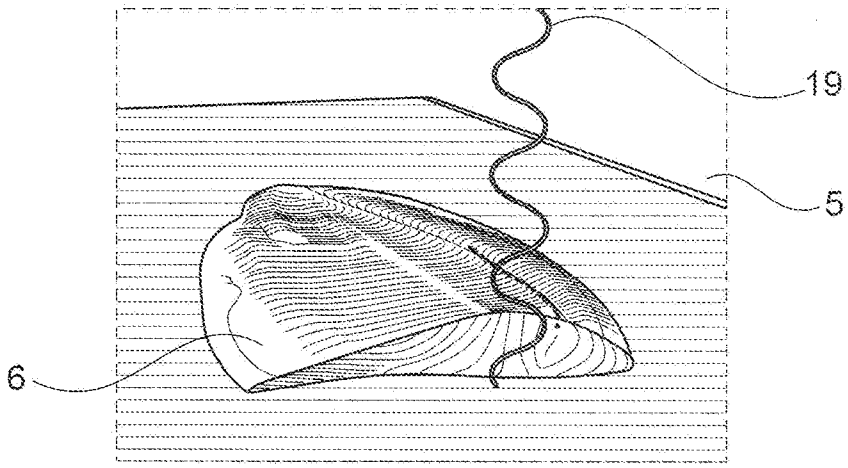

Fig. 11

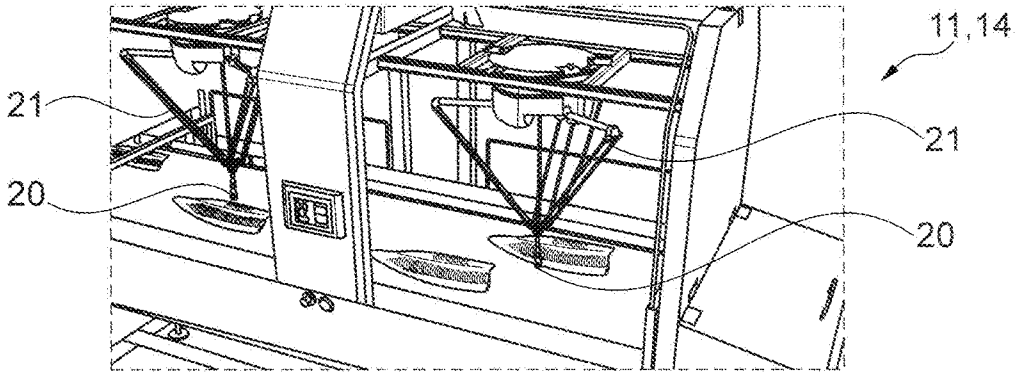

Fig. 12

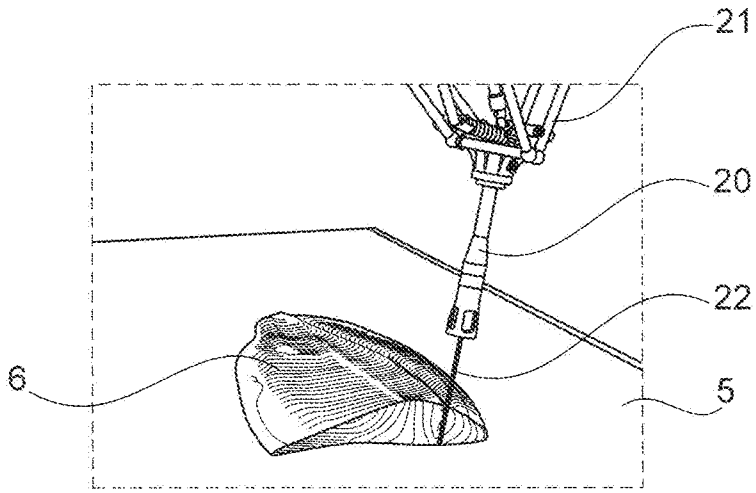

Fig. 13

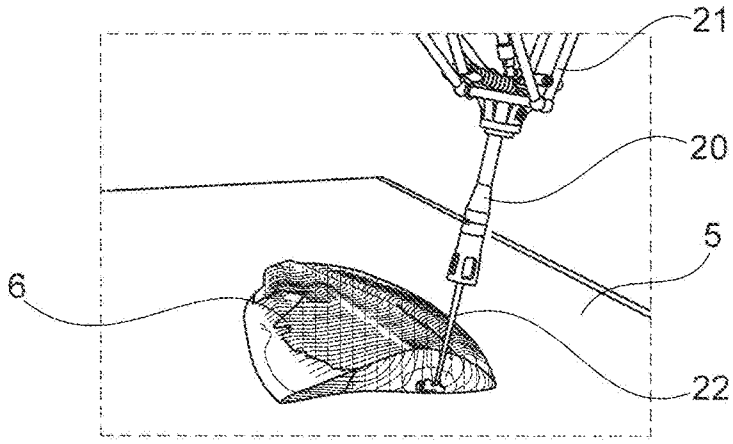

Fig. 14

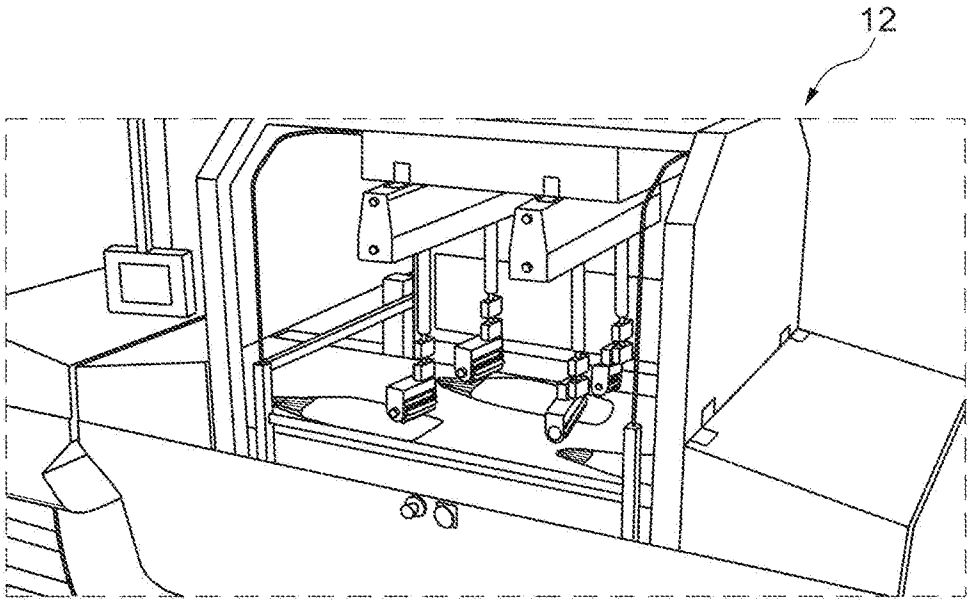

Fig. 15

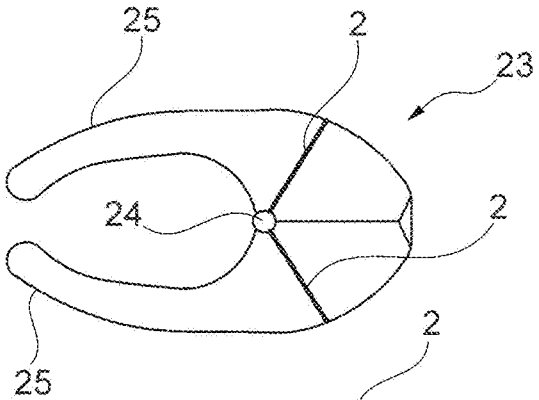

Fig. 16a

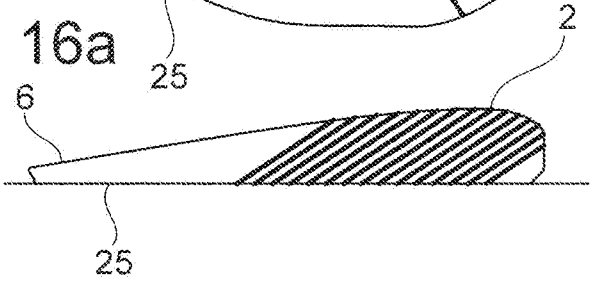

Fig. 16b

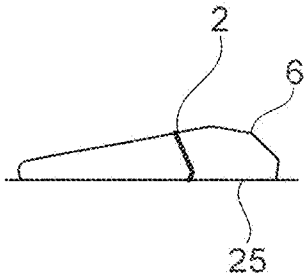

Fig. 16c

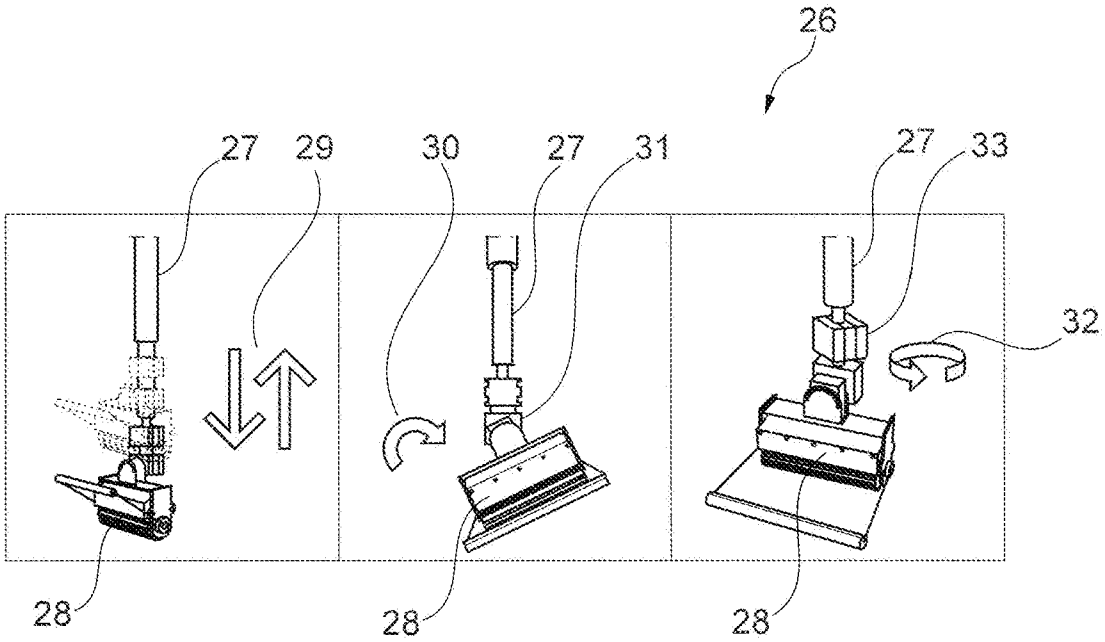

Fig. 17a Fig. 17b Fig. 17c

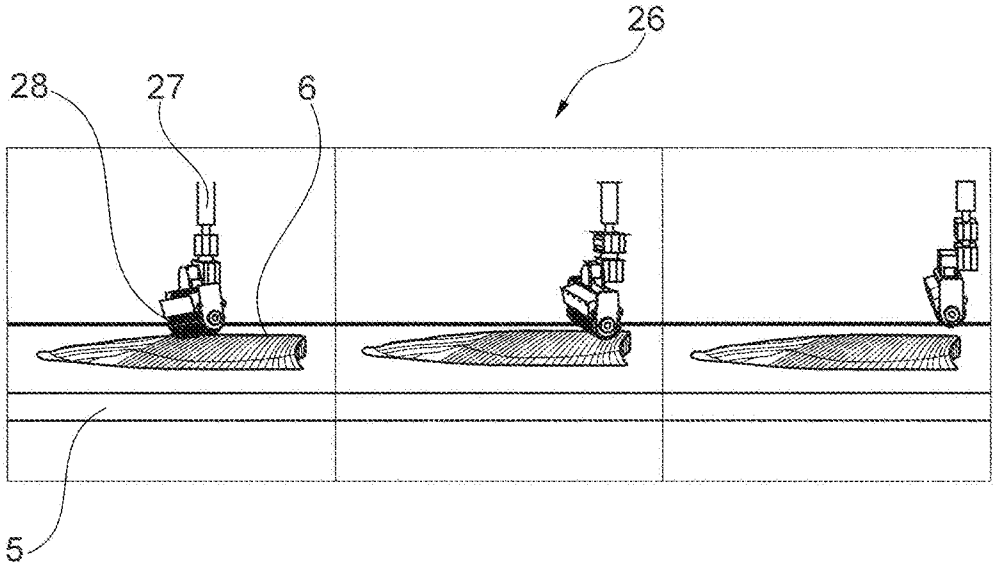

Fig. 18a Fig. 18b Fig. 18c

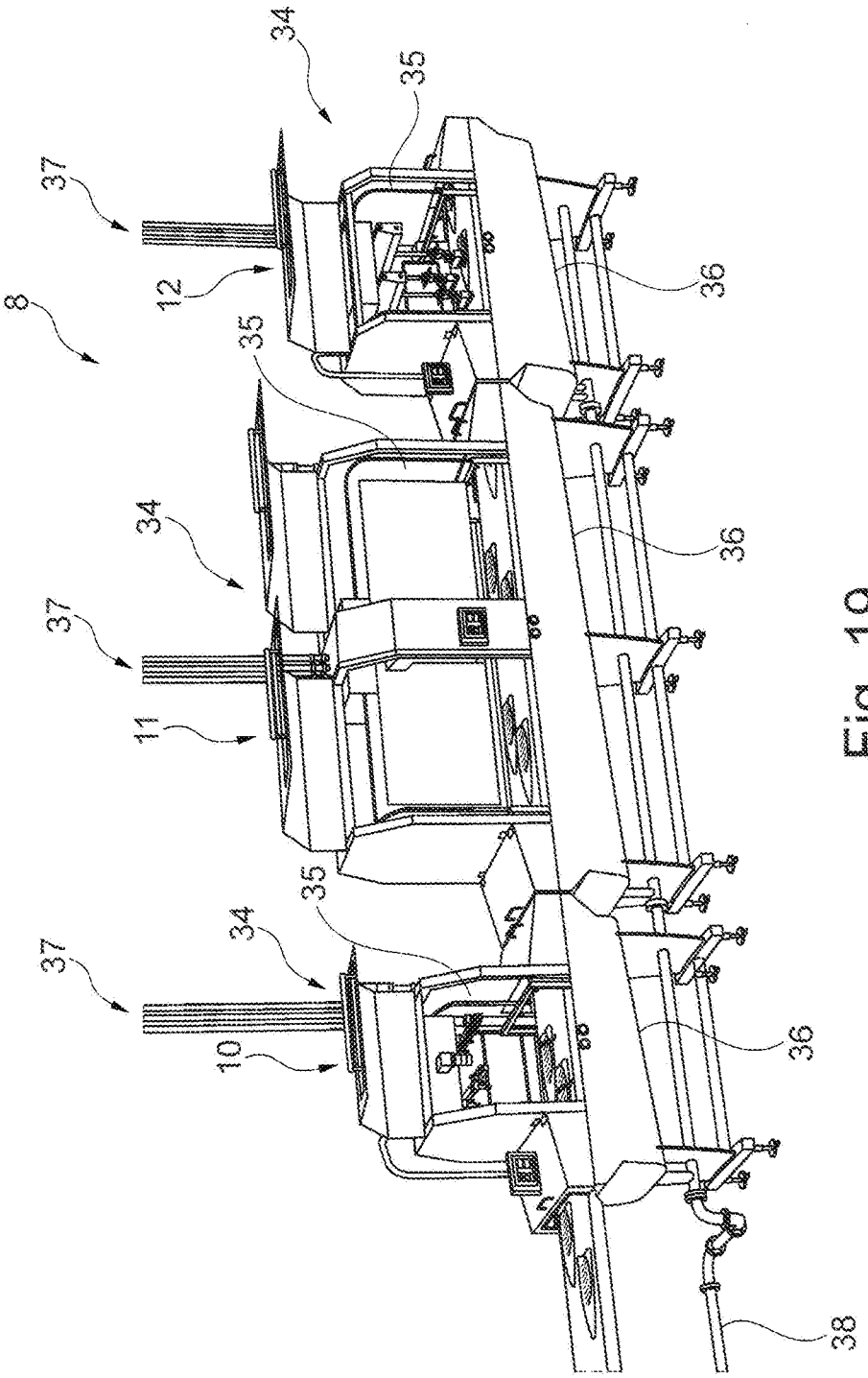

Fig. 19