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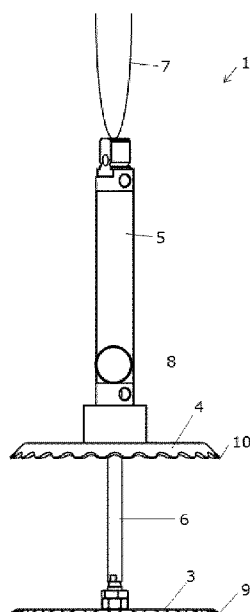


Fig. 1A

(57) Abstract: The present invention relates to a gripping device for handling workpieces, in particular workpieces under transport on a conveyor belt, such as for lifting meat pieces under transport at abattoirs. The workpiece in question may be positioned in a predetermined orientation after the lifting process. The device may in particular be an in-line device positioned at a conveyor belt, for assisting operators in turning meat pieces during transport on the conveyor.



A GRIPPING DEVICE FOR HANDLING WORKPIECES

The present invention relates to a gripping device for handling workpieces, in particular workpieces under transport on a conveyor belt, such as for lifting meat
5 pieces under transport at abattoirs. The workpiece in question may be positioned in a predetermined orientation after the lifting process. The device may in particular be an in-line device positioned at a conveyor belt, for assisting operators in turning meat pieces during transport on the conveyor.

10 Background of invention

At abattoir production lines, numerous operators work side by side with deboning and trimming cuttings, that are transported by the operators on a conveyor belt. Cuttings, e.g. pork loin pieces and pork belly pieces, are turned around or up-side-down manually, several times during the transport and
15 processing down the production line, as each operator positions the meat pieces on the conveyor belt for completing the process the operator is to perform. Pork loin and belly meat pieces often weight between 3 and 5 kg, and the repetitive movement, when an operator manually positions e.g. 300-500 meat pieces each hour, may result in physical disabilities of the arm and shoulder of the operator.
20 There is a need for reducing the load on the operators during the processing of the cuttings, and especially for reducing the load on the arms and shoulders of the operators during the lifting and turning of the meat pieces.

Prior art devices for turning meat pieces on conveyor belts often need excessive space, as such devices take up space corresponding to two to three times
25 the meat piece dimension measured along the transport direction performed by the conveyor belt. A pork loin or belly meat piece, transported on a conveyor belt with a long edge of about 60 cm along the edge of the conveyor belt, may thus require 120-180 cm in order to be turned and positioned by common prior art systems. At a production line, where the operators are manually handling the meat pieces, this
30 is far too much place occupied by the device for turning the meat pieces. A requirement for a compact turning device exists, which device can aid the operators lifting and positioning of the meat pieces.

EP 1755993 discloses a stationary system, placed in-line of a processing line, for inverting pieces of meat having an irregular shape, which system
35 comprises gripping means and rotation means.

US 6082797 discloses a gripping tool disposed to a robot manipulator for gripping and moving various objects between desired locations.

WO 2012/044157 discloses a product conveying device comprising a horizontally disposed conveying means for supplying a robot, a movable support and a lifting mechanism, mounted on the movable support for lifting the product from the conveying means.

5 However, the flexible and hand-operated device according to the present invention has not been described.

Summary of invention

10 In its first aspect, the present invention relates to a hand-operated device, for manually positioning and activating lifting and turning of a workpiece.

 The device of the invention comprises a gripper (1) having a gripper base (3), a gripper top (4), an actuator (5) connected to the gripper base (3) and to the gripper top (4), and which actuator is capable of pressing, or configured to press, the gripper base (3) and the gripper top (4) towards each other, thereby causing
15 closing of the gripper, or capable of pressing, or configured to press, the gripper base (3) and the gripper top (4) away from each other, thereby causing opening of the gripper, and the gripper is connected to elevating means (7) for elevating the gripper (1) when holding a workpiece (13).

 The trigger (8) may be located on the device (2) for initiating the actuator (5) to either close or open the gripper (2). The trigger (8) is preferably activated by
20 an operator (11). The trigger (8) may activate an elevating means (7) which elevates the gripper (2), thus lifting the workpiece (13) held by the gripper (2).

 An adjustable timer may be operably connected to the trigger (8), and may determine the time the actuator (5) is pressing the gripper base (3) and the gripper
25 top (4) towards each other, thus determining closing time of the gripper.

 Suspension means for suspending the device may be a part of the device (1). The device (1) can be hung directly in the ceiling, in a transport rail, or in a removable stand.

 The gripper base (3) and the gripper top (4) may have an overall lateral
30 dimension equivalent to each other, and the gripper base (3) and gripper top (4) should be substantially parallel to each other, at least when the gripper base (3) and gripper top (4) are not pressed towards each other (i.e. are in an open position). The inner part of the actuator (6) is operatively connecting the gripper top (4) and gripper base (3). The gripper top (4) may have an edge which is
35 bended towards the gripper base (3), and the gripper top (10) and/or gripper base (9) may have an edge line which is uneven, such as a bulged edge line (see Figs. 1A, 1B, 1C, 2A, 2B, 3A, 3B). The combination of a gripper base (3) and gripper top (4)

with equal lateral dimension, the gripper top (4) bending towards the gripper base (3), which is straight, and at least a gripper base (3) with a bulged edge line (see Figs. 1A, 1B, 2A, 2B), is preferred for lifting and positioning meat pieces (13).

In another aspect, the invention provides a method for lifting a workpiece, e.g. a meat piece (13) located on a support (12), by use of the device (1) described above, which method comprises the subsequent steps of:

a) holding the gripper (2) with a first-hand, so that a finger is positioned to activate the trigger;

b) pulling the device (2) towards the support (12);

c) positioning the gripper base (3) underneath the workpiece (13);

d) positioning the gripper top (4) above the workpiece (13); and

e) manually activating the trigger (8), whereby the workpiece (13) is lifted by the device (1).

In one embodiment, activating of the trigger (8) in step e) may, or may not, initiate the function of a timer.

An operator (11) may position the gripper (2) in front of a workpiece (13), activate the trigger (8), whereby the device closes the gripper (2) and lifts the workpiece (13) to a predetermined height for as long as the trigger (8) is activated or until the trigger is de-activated, alternatively for the time determined by a timer.

The method of the invention may further be used to position the lifted workpiece (13) on a support (12), by further guiding the workpiece (13) towards the support (12) with one hand, and de-activating the trigger (8), or when the timer stops counting, and the gripper base (3) and the gripper top (4) are directed away from each other, hereby opening the gripper (2) and positioning the workpiece (13) on the support (12).

The invention described herein is a manually positioned and activated, small, flexible and compact lifting device, that can be installed between two operators at a production line, without taking up excessive space between these operators. The device can be used to assist in the lifting and position process, when a meat piece, e.g. a pork loin or a pork belly piece, or other types of meat pieces, shall be turned around. When using the device, an operator reduces the load on the arm and shoulder, which otherwise is used to turn the meat piece, and in addition, the operator gets more time and energy to process more meat pieces and at an improved quality. When installing the device described herein at a production line it makes possible, that less muscular operators may perform the work, including turning meat pieces, and thus it becomes easier for the operators along a production line to change positions at the production line during a day, and thus

alternate the processes and the load performed on the body. The device described herein thus relieves the load on operators and reduces the repetitive strain injury (RSI) at these operators.

The invention described herein has a number of additional advantages, e.g. the device does not cause delay of the work at the production line; the device is flexible and having a mode of operation, which is intuitive for the operator; the device can be operated with one hand, and the operator can decide whether this is left or right hand; the device can be operated with a hand covered by a glove, such as a cutting glove or safety glove; the operator does not need to lift the operating hand to a height above shoulder level, though the workpiece may be lifted even higher; the device is capable of working under a meat production line conditions; no particular programming is required, and the device is easily switched between a bouquet of different products; the device is easy to clean; the device does not obstruct the view of the operator, even at locations with different and changing working processes; the device is easy to reorganize when different kinds of workpieces are to be processed at a conveyor belt; the device can easily be removed when not in use; when up in the air and in front of the operator, the operator may turn the workpiece, thus increasing the operator's influence on how to perform his operations.

Brief description of figures

The present invention is further illustrated by reference to the accompanying drawing, in which:

Figs. 1A-1C illustrate a gripping device of the invention in an open position;

Figs. 2A-2B illustrate a gripping device of the invention in a closed position;

Figs. 3A-3B illustrate a gripping device of the invention seen from below;

Fig. 4 illustrates different modes of turnings of meat pieces by the method of the invention; and

Figs. 5A-5B illustrate two operators at a conveyor belt, and indicate the replacing of a meat piece before and after arrival at a processing station.

Detailed description of the invention

The device of the invention

In its first aspect, the invention relates to a device for lifting a workpiece.

The device of this invention represents a hand-operated device, for manually positioning and activating lifting and turning of a workpiece.

The device of this invention comprises a gripper (1) having a gripper base (3), a gripper top (4), an actuator (5) connected to the gripper base (3) and to the gripper top (4), and which actuator is capable of pressing, or configured to press the gripper base (3) and the gripper top (4) towards each other, thereby causing closing of the gripper, or which actuator is capable of pressing, or configured to press, the gripper base (3) and the gripper top (4) away from each other, thereby causing opening of the gripper, and the gripper is connected to elevating means (7) for elevating the gripper (1) when holding a workpiece (13).

The actuator (5) may be a spring actuator, a servomotor, a pneumatic actuator, or a hydraulic actuator. In one embodiment, the actuator is a pneumatic actuator.

The device is preferably used for lifting a workpiece under transport, such as for lifting a workpiece under transport on a conveyor belt. The device may also be used for assisting in lifting and positioning a workpiece under transport, such as assisting an operator in lifting and positioning a meat piece under transport on a conveyor belt. The meat piece which is handled by the device described herein may be raw or frozen or in partly frozen.

The elevating means (7) may be automatically activated, e.g. when the gripper base (3) and the gripper top (4) are closing around a workpiece. Hereby the gripper may hold a workpiece firmly during the lifting performed by the elevating means. The elevating means may also be activated as soon as the trigger is activated.

The elevating means (7) may be any suitable means capable of elevating, or configured to elevate, the gripper (1) described herein, and may be a spring actuator, a servomotor, a pneumatic actuator, or a hydraulic actuator. In one embodiment, the elevating means is an electrically activated actuator, and the elevating means may be a linear actuator. The elevating means (7) may also comprise a pulley block with a wire rope drive.

The elevating means (7) preferably is capable of lifting, or configured to lift, a workpiece having a weight of up to 50 kg, such as up to 40 kg, e.g. up to 30 kg, such as up to 20 kg, e.g. up to 15 kg, such as up to 12 kg, e.g. up to 10 kg, such as up to 8 kg, e.g. up to 5 kg. Preferred the elevating means (7) is capable of lifting workpieces having a weight of up to 10 kg.

The elevating means (7) may be adjustable in respect of the lifting height, and may be adjusted in respect of the dimensions of the workpieces to be lifted. Lifting height is understood as the distance from the support, from where a workpiece is to be lifted, and to the lower side of an empty locked gripper

performing the lifting sequence. The lifting height is preferably at least 30 cm, such as at least 40 cm, e.g. at least 50 cm, such as at least 60 cm, e.g. at least 70 cm, such as at least 80 cm, e.g. at least 90 cm, such as at least 100 cm, e.g. at least 110 cm, such as at least 120 cm, e.g. at least 130 cm, such as at least 140 cm, e.g. at least 150 cm. For meat pieces having an average length of 60 cm the lifting height is preferably about 65-75 cm.

The device (2) may further comprise a trigger (8) for initiating the actuator (5). The trigger (8) may be a trigger suitable for manual activation by an operator (11). The trigger (8) preferably has a dimension and form making it easy for an operator (11), wearing a cutting glove or safety glove on the hand holding the device, to activate the trigger.

Activating the trigger (8) a second time may cause the gripper (2) to direct the gripper base and gripper top away from each other, thereby turning into an open position. This double-activation or de-activation of the trigger may thus be a safety function capable of opening the gripper, e.g. if a finger gets caught between the gripper base (3) and gripper top (4), and perhaps with a workpiece in between too.

The device of the invention may also comprise trigger adjusting means, so that an operator can decide if the trigger should activate a timer or not. If the timer is not activated, opening of the gripper may be performed by no longer activating of the trigger, or opening of the gripper may be performed by pressing the trigger twice to de-activate the actuator.

The device of the invention may further comprise an adjustable timer for determining the time the actuator is holding the gripper base (3) and gripper top (4) in a closed position. The timer may be activated when the trigger is activated, or at a predetermined time following the activation of the trigger, or when the gripper base and the gripper top are moved towards each other, and meet a predetermined resistance, e.g. corresponding to a predetermined resistance, necessary to make the gripper firmly hold the workpiece to be lifted. Preferably the timer is activated when the trigger (8) is activated.

The timer may be part of a control unit, in which the period in which the timer should be activated may be adjusted according to the process to be performed with the device, or according to the time the operator using the device need to perform the operation. The control unit may also control the actuator, such as by air or electricity used to activate and deactivate the actuator, to either lock or open the gripper.

The period during which the timer should be activated may be adjustable. An operator may hereby adjust the time to a predetermined time, e.g. correlated to the process to be performed, the type and/or size of workpieces to handle, the speed of the process, and/or the speed of a conveyor belt, by which the workpiece is conveyed. The timer may be set for any length of time, e.g. of from 1 to 10 seconds, or anything in between. For handling a pork middle part, a pork loin part or a pork belly part from a pig the time of the timer may be e.g. between 1 sec and 2 sec.

The control unit for use according to the invention may thus be connecting the trigger, the timer, the activator and the elevating means. Such connections may be wired or wireless.

In another embodiment, the device (1) of the invention comprises a "garage device", which allows for the gripper (2) to re-position itself into a holding means, i.e. an idle position, from which position the gripper (2) can be reached by the operator when needed for initiating the next turn.

The device of the invention may further comprise suspension means for suspending the device. The suspension means may suspend the device (1) to a ceiling, a frame or any suitable mounting located above the position, where the device is to be used, such as above an operator's working station at a production line. The suspension means may also be connected to a robotic arm, which may handle the workpiece, and which handling may be initiated by a signal from the device and sent to a controller which controls the robot arm. Such a signal may be from the trigger, that sends a signal to the controller when the trigger is activated. The suspension means may e.g. be a hoist or a pulley block.

The gripper base (3) and the gripper top (4) of the device of the invention may have an overall lateral dimension corresponding to each other. Such overall lateral dimension may be of any share, and may e.g. be round or cornered, to resemble an overall dimension of round, pentagonal, squared, triangular. The gripper base (3) and/or gripper top (4) may consist of a number of smaller units making up the overall lateral dimension. In one embodiment, the gripper base (3) and/or gripper top (4) each are composed of one non-split unit, i.e. made in one intact unit. Preferably the gripper base and/or gripper top each resemble a disc with one of the overall dimension, as indicated above. In one embodiment, the main part of the gripper base and/or of the gripper top resemble a circular or squared disc.

The gripper base (3) and gripper top (4) are preferably substantially parallel to each other, at least when the gripper base and gripper top are not

pressed towards each other, i.e. are in an open position. The gripper base and gripper top is connected by the inner part of the actuator (5), which may connect the gripper top (4) and gripper base (3) in the middle part of the gripper top and gripper base, such that the gripper can easily be positioned at an edge of a workpiece, as there is space between the gripper base and gripper top all around the inner part of the actuator connecting the gripper base and gripper top.

The gripper top may (10) have an edge which is bended towards the workpiece to be lifted. The edge of the gripper top (10) may hereby bend downward, when the gripper is in a position ready to grip a workpiece. The bending downward may be at an angle of from 10° to 90° in relation to the overall dimension of the gripper top. Preferable the bending downward of the gripper top is at an angle of from 20° to 80° , e.g. of from 30° to 70° , of from 40° to 60° , or of from 30° to 50° .

The gripper top may have an edge line (10) which is even or uneven. This edge line may be on an edge which is bended downwards. An uneven edge line may be corrugated with smooth roundings, or may be more crude, with incisions giving sharper teeth.

The gripper base may have an edge (9) which is not bended. Preferably the edge of the gripper base is straight. Hereby the gripper base can easily be positioned below a workpiece to be lifted, especially if the workpiece is flexible, e.g. like meat pieces. Though the edge of the gripper base may be straight, this edge may be bevelled, such that the edge may easier enter beneath the workpiece to be handled. The pointed part to the bevel may be the edge part, which is in contact with, or is closest to, the support holding the workpiece when the workpiece is to be gripped. Hereby the gripper base (3) may easily be slipped under the edge of a workpiece to be lifted.

The edge line of the gripper top and of the gripper base may correspond to each other, i.e. they may both be straight or uneven.

The edge line of the gripper base and/or of the gripper top may be constructed in relation to the workpiece to be handled. Preferably the edge line of the gripper top is such that the gripper is capable of holding a workpiece to be lifted, but without damaging the workpieces. If raw meat pieces are to be handled, the edge line of the gripper base and/or of the gripper top may be straight, or may be corrugated with smooth roundings, i.e. each having a bulged edge line, whereas if frozen meat is to be handled, the edge line of the gripper base and/or of the gripper top may have sharp teeth.

The gripper top and the gripper base preferably are made of a strong material, which will not brake during handling of the workpieces. Such material may be a metal, e.g. steel, such as stainless steel. For devices, which should be used for handling food or feed, such as meat pieces, the material is preferably strong and easy to clean or wash, and such a material may be stainless steel.

The actuator (5) may press the gripper top and gripper base towards each other with a pressure that secures grasping the workpieces to be lifted. Such pressure may be of any magnitude, e.g. of from 5 kg to 100 kg, or anything in between, e.g. 10 kg to 50 kg, less than 20 kg, less than 18 kg, than 15 kg, than 13 kg, or less than 10 kg. Preferably the pressure is about or less than 15 kg, when an operator is controlling the device and using it for lifting workpieces from a conveyor belt at a processing line. A pressure of about or less than 15 kg is suitable for holding e.g. a meat piece, and will preferably not harm an operator, if the operator gets a finger between the gripper top and gripper base when the actuator is activated. A pressure of about 15 kg or less is preferred for a gripper top and gripper base with straight or rounded edge line, which is to be used to lift meat piece, as this will not damage the meat pieces, i.e. the rounded edge line will not cut into the meat piece. A high pressure, e.g. of above 50 kg, may be used for gripping workpieces of non-compressible materials or of non-compressible materials of the workpieces, such as for gripping around bones in a meat piece.

The overall dimension of the gripper base and the gripper top may be determined in respect to the size of the workpiece to handle. An example of meat pieces to be handled are middle parts from a pork with a length of about 60-80 cm, a width of about 40-60 cm, and a thickness varying in one end of between about 4 and 10 cm, and in the other end of between 3 and 5 mm. Pork loin pieces and pork belly pieces can be obtained by cutting the middle part of a pig substantially in the middle along the length thus giving loin and belly pieces with a width of about 20-30 cm. For these meat pieces, the gripper base and the gripper top may be made of stainless steel, be dish formed with a diameter of about 15 cm and a thickness of about 2.5 mm. The edge lines of the gripper base and the gripper top may be corrugate and the edge of the gripper top may be bended slightly towards the gripper base. The stroke length may be about 10-12 cm making it possible to use the device for handling middle parts, loin parts or belly parts with the dimensions described above. The actuator preferably press the gripper top and gripper base towards each other with a pressure less than 20 kg, more preferably of less than 15 kg.

The width of the device may be less than about 40 cm, e.g. less than about 30 cm, less than about 25 cm, or less than about 20 cm. Preferred is a width of less than about 25 cm. More preferred is a width of less than about 20 cm. The width of the device is preferably represented by the diameter of the gripper base or gripper top whichever is the largest.

The depth of the device measured from the back of the device to the front of the gripper is preferably less than 100 cm, such as less than 80 cm, e.g. less than 60 cm, e.g. less than 50 cm, such as less than 40 cm. Preferably the depth of the device is about or less than the width of the support onto which workpieces to be handled are positioned. Thus, if the device is installed at a conveyor belt with at width of 50 cm, the depth of the device is preferably about 50 cm or less than 50 cm.

The device may be designed such that the gripper of the device when not in function will revert to a garage position and where the device is ready to be used. The garage position is preferably a position which is close to the location where an operator handling the device has a free hand which should be used to handle the device. The device should preferably be installed such that the moving length of the operator's free hand is as short as possible from the time the operator ends a part of a process just before the operator is to grip the handle of the device and locate the device to lift a workpiece.

Activating the trigger may initiate the activator pressing the gripper base and gripper top towards each other, lock the gripper base and gripper top holding the workpiece which is to be lifted, optionally initiate the timer, and initiate the lifting process performed by the elevating means. If the timer is not initiated, the gripper may be opened by no longer activating the trigger or the gripper may be opened by pressing the trigger again such as when the workpiece is lifted to a height useful for performing the desired operation with the workpiece and/or when the workpiece is positioned above a support onto which the workpiece is to be placed. If the timer is initiated and when the timer time ends the gripper base and gripper top are directed away from each other, the timer is reset and the elevating means direct the device back to the garage location making the device ready to be handled again.

The device is preferably relocatable i.e. easy to install and take down, and thus easy to reinstall at a different location and thus being flexible due to the location of the device, hereby the device may easily be moved from one location to another location to make the processing of workpieces e.g. meat pieces flexible e.g. if one kind of meat pieces should be handled differently e.g. due to requirements

from a customer, or if another kind of workpieces are to be handled e.g. at a conveyor belt and which requires one or more gripping devices along a conveyor belt to be located differently than when processing the previous type of workpiece.

5 The device of the invention may be used for lifting a workpiece, e.g. a piece of meat, e.g. pork loin, pork belly, breast of pork or backs of pork, which may be under transport by a conveyor belt in an abattoir.

The method of the invention

10 In another aspect, the invention relates to a method for grabbing and lifting a workpiece, which workpiece may in particular be a meat piece located on a support, and which method is controlled by an operator (11) using the device (1) of the invention.

The method of the invention comprises the subsequent steps of:

- 15 a) the operator grabs and holds the device (2) with a first-hand, so that a finger is in a position suitable for activating a trigger (8);
- b) the operator (11) pulls or moves the device (2) towards a support (12);
- c) the operator positions the gripper base (3) underneath the workpiece (13), thereby simultaneously positioning the gripper top (4) above the workpiece (13); and
- 20 d) the operator activates the trigger (8) to activate grabbing the workpiece (13) and initiate lifting of the gripper (2) holding the workpiece.

In one embodiment, the method of the invention comprises an additional step for re-positioning of the workpiece:

- 25 e) de-activating or re-activating the trigger (8) to open the gripper (2) for unloading and re-positioning the workpiece (13) on the support (12).

In another embodiment, activation of the trigger (8) in step d) may initiate the function of a timer, which timer determines for how long the gripper (2) is in its closed position for holding the workpiece.

The method of the invention may also comprise the subsequent steps of:

- 30 a) the operator holds the device (2) in one hand, so that at least one finger is positioned and capable of activating the trigger (8);
- b) the operator pulls or moves the device (2) towards said support (12);
- c) the operator positions the gripper base (3) underneath the workpiece (13), thereby simultaneously positioning the gripper top (4) above the workpiece (13), making the gripper ready to start grabbing the workpiece;
- 35 d) the operator activates the trigger (8) to initiate the function of a timer;

e) the operator removes his hand from the device (8), where after the workpiece (13) is automatically lifted by the device (2).

In a further embodiment, the device (1) of the invention comprises a "garage device", which allows for the gripper (2) to re-position itself into a holding means, i.e. an idle position, from which position the gripper (2) can be reached by the operator when needed for initiating the next turn.

The person holding the device of the invention preferably is an operator capable of handling the device described herein, and capable of handling the workpieces to be lifted. Such an operator may be an operator at an abattoir, performing a cutting or trimming process on a meat piece at a production line.

The elevating means (7) of the device preferably is a flexible system, making the device capable of being pulled by an operator or robot arm from a resting position, or from a garage position, towards a support, and so that the elevating means may lift the device together with a workpiece, when the gripper (2) is holding the workpiece. The lifting process may be initiated when the trigger (8) is activated, or when the device is released from an operator's first hand. In one embodiment, the lifting process is performed by the elevating means when the trigger is activated.

The method of the invention may further be used for re-positioning the workpiece on a support, and the method may thus comprise the additional step of:

f) guiding the workpiece (13) towards a support (12) with one hand, when the timer stops counting and the gripper is entering open position (i.e. the gripper base (3) and the gripper top (4) are directed away from the other, hereby opening the gripper (2) and releasing the workpiece (13)).

The method of the invention may be used for lifting a workpiece from a support, e.g. from a conveyor belt (12) where a meat piece (13) is under transport, by use of the device (1) described herein, and the method may comprise the steps of:

b) the operator (11) pulls the device (2) towards the support (12), i.e. a conveyor belt where a meat piece is under transport towards the location of the operator;

c) the operator (11) positions the gripper base (3) under an edge of the workpiece (13), thereby simultaneously positioning the gripper top (4) above the workpiece (13);

e) the operator (11) activates the trigger (8) to initiate the function of the actuator (5), whereby the workpiece is automatically lifted by the device (2);

f) the operator (11) releases his hand from the device (2) when the workpiece has been grabbed, and is being lifted; and

g) the operator (11) guides the workpiece towards the support (12) with his hand when the gripper is in its open position, and the operator positions the workpiece (13) on the support (12);

wherein the operator in step e) continues to activate the trigger until the device has lifted the workpiece to a desired height and/or location; or

wherein the operator in step e) re-activate the trigger when the device has been lifted the workpiece to a desired height and/or location.

In another embodiment, the method of the invention may be used for grapping, lifting and re-positioning a workpiece, e.g. a meat piece under transport on a conveyor belt, by use of the device (2) described herein, and the method may comprise the steps of:

a) an operator (11) is holding the device (2) with his hand, such that a finger is capable of activating the trigger (8);

b) the operator (11) pulls or moves the device (2) towards the conveyor belt (12), where a meat piece is being conveyed towards the location of the operator;

c) the operator (11) positions the gripper base (3) under an edge of the approaching meat piece (13), and simultaneously positions the gripper top (4) above an edge of the meat piece (13);

d) the operator (11) activates the trigger (8) of the device (2) to initiate the function of a timer (8) in operation with the actuator (5), whereby the meat piece (13) is lifted by the device (2);

e) the operator (11) releases his hand from the device (2); and

f) the operator (11) guides the meat piece (13) towards the conveyor belt (12) with his hand when the timing expires, and the gripper (2) passes into its open position, and re-positions the meat piece (13) on the conveyor belt (12).

The operator (11) handling a meat piece (13) using the device according to the invention may also perform a processing step with the meat piece, such as cutting and/or trimming the meat piece. The operator may thus hold a tool, e.g. a knife, in one hand, leaving the other hand free to handle the meat piece. With the free hand the operator controls (11) the device (2) as described herein, pulls or moves the device (2) towards the support (12) with a meat piece (13), locates the device (2) such that the gripping parts, i.e. the gripper top (4) and the gripper base (3), can catch hold of an edge of the meat piece (13), presses the trigger (8) to lock the position of the gripper base and gripper top, which may also initiate a

timer determining the time the gripper base and gripper top is locked, releases the his hand from the device if a timer is initiated and when the trigger is activated, and with his hand guide the meat piece, especially when the gripper base and gripper top is unlocked, and the meat piece (13) falls towards the support (12),
5 where this guiding his hand results in that the meat piece (13) will be located in a predetermined position on the support (12). If a timer is not initiated when the trigger is activated, the operator may continue to activate the trigger until it is time to deactivate the actuator and open the gripper. If activation and de-activation of the trigger is needed, a (first) operator, or another (second) operator, may de-
10 activate the trigger when the workpiece is in a correct position to be positioned onto a support.

The lifting and position method may be used to rotate and/or reverse the workpiece from any position to any predetermined other position. A few turning positions are shown in the figures.

15 Lifting with the device according to the invention may also be performed with the device connected to a conveyor or slide bar located above the device. The operator may guide the device holding a workpiece from a first location to a second location following a conveyor or slide bar. This process may be performed with a device where the trigger is to be activated during the guiding process, or with a
20 device where the trigger is first activated, and must be de-activated, before the gripper is opened. In the latter situation, a (first) operator need not to guide the device, as another (second) operator may de-activate the trigger when the device reaches the second location.

The workpiece to be handled by the device described herein, may be
25 located on a support in an unfolded position, i.e. without being folded up on itself. Also, the workpieces may be located with distance to each other on a support such as on a conveyor belt, making it easy for an operator to use the device described herein to handle a workpiece one at a time. The workpieces may be located on a support such that a workpiece is positioned with the largest surface towards the
30 support. In case the workpiece has more surfaces of substantially equal surface area, and these are larger than the rest of the surface areas, the workpiece is preferably located with one of these larger surface areas towards the support.

The workpiece may be a meat piece, however, a meat piece should be understood as a piece of meat of any size and with or without bones. Such meat
35 pieces may be from an animal such as a domesticated animal or a wild animal. Preferably the meat pieces to be handled by the device described herein is from an animal selected from the group of pigs, cattle/cows, sheep, goats, games, camels,

ostriches, emus, canards, rabbits. More preferably the meat pieces are from pigs, cattle/cows, sheep or goats. Most preferably the meat pieces are from pig or cattle/cows.

5 A further aspect of the invention relates to use of the device described herein for lifting a workpiece. The lifting process may be performed on workpieces under transport or which are not under transport. Especially the use may be for lifting a meat piece being transported by a conveyor belt.

10 The use of the device described herein may be at conveyor belts where the distance between the shoulders of two successive operators may be about 1 m or more. Where the distance between two successive operators is about 1 m, the width of the device is preferably less than about 25 cm, such as less than about 20 cm. Preferably the depth of the device is about or less than the width of the support onto which workpieces to be handled are positioned. Thus if the device is installed at a conveyor belt with at width of 50 cm, the depth of the device is preferably
15 about 50 cm or less than 50 cm.

The device of this invention is by its nature very flexible, allowing the device to be moved from one location to another location to make the processing of workpieces flexible, e.g. if one kind of meat pieces should be handled differently, e.g. due to requirements from a customer.

20 However, the device may also be used for lifting away meat pieces with or without bones, e.g. when cutting cows/cattle. The device described herein may be gripping and holding a piece of a carcass which is being cut into smaller parts, or the device may be gripping a piece already cut from a carcass. The gripped part of the carcass may then be lifted and moved by the device described herein. The
25 movement may be performed as the elevating means may be connected to a mounting above the location, to where the carcass part should be moved, or the elevating means may be connected to a conveyor such that the device is conveyed while it is lifting the carcass part. The elevating means may also be connected to a robot arm capable of moving, or configured to move, the carcass part or meat piece
30 to a predetermined end location. In such situations, the timer (8) may be adjusted to lock the gripper top (4) and gripper base (3) until the carcass part or meat piece (13) is expected to have reached the predetermined end location, or the timer (8) may be reset, and the gripper top (4) and gripper base (3) may become unlocked by an operator at the predetermined end location.

35 The use of the device may be for lifting workpieces having a weight of e.g. up to 50 kg, such as up to 40 kg, e.g. up to 30 kg, such as up to 20 kg, e.g. up to 15 kg, such as up to 12 kg, e.g. up to 10 kg, such as up to 8 kg, e.g. up to 5 kg.

Preferably the use is for lifting workpieces such as meat pieces having a weight of up to 10 kg. e.g. of 3-5 kg.

Use of the device of the invention is preferably for lifting meat pieces of any size, including entire carcasses or carcass parts. The use may be for lifting and moving the meat pieces, including entire carcasses or carcass parts, from a moving or non-moving support and to a predetermined location. The use may also be for lifting and position the meat pieces, including entire carcasses or carcass parts, on a moving support such as a conveyor belt transporting the meat pieces.

Especially the use is for lifting and positioning meat pieces transported by a conveyor belt at a processing line with a number of operators, where each operator is performing a small part of the overall process of the entire processing line, and where the meat pieces transported by the conveyor belt should be repositioned before an operator can perform the decided part of the process.

The use of the device may also be for placing a meat piece in a new position, e.g. before the meat piece is to enter a machine performing a specific operation, e.g. cutting off one or more bones, removing hide, removing fat, and/or cutting the meat pieces into smaller pieces.

Detailed description of the figures

The present invention is further illustrated by reference to the accompanying drawing.

Figs. 1A, 1B and 1C illustrate a gripper device (1) in an open or unlocked position. The gripper device (1) comprises a gripper base (3) with an edge (9), a gripper top (4) with and edge (10), an actuator with an outer part (5) and an inner part (6). A trigger (8) is located at the outer part (5) of the actuator. An elevating means (7) is located above the gripper device (1). The outer part (5) of the actuator also functions as a handle for an operator handling the gripping device (1):

Fig. 1A shows a side view of the gripper device (1);

Fig. 1B shows a perspective view of the gripper device (1) where the gripper base (3) and gripper top (4) are disc formed and circular; and

Fig. 1C shows a perspective view of the gripper device (1) where the gripper base (3) and gripper top (4) are disc formed and squared.

Figs. 2A and 2B illustrate a gripper (2) in a closed or locked position without a workpiece located in the gripper (2). The gripper (2) comprises a gripper base (3) with an edge (9), a gripper top (4) with and edge (10), an outer part (5) of an actuator. A trigger (8) is located at the outer part (5) of the actuator. The

outer part (5) of the actuator also functions as a handle for an operator handling the device:

Fig. 2A shows a side view of the gripper (2); and

Fig. 2B shows a perspective view of the gripper (2).

5 Figs. 3A and 3B illustrate a gripper (2) seen from below. The gripper (2) comprises a gripper base (3) with an edge (9), a gripper top (4) with and edge (10):

Fig. 3A illustrates a gripper (2) with a circular gripper base (3) and gripper top (4).

10 Fig. 3B illustrates a gripper (2) with a squared gripper base (3) and gripper top (4).

Fig. 4 illustrates some different turnings of meat pieces. The illustrated meat piece is a pork belly piece where the location of ribs is illustrated by the angled dark lines and the quarter of an ellipse in the upper left part of the meat pieces in the left half of each situation. Where the ribs are illustrated with entire lines this illustrates the ribs or the meat side from where the ribs may have been removed is the upper side of the meat piece. Where the ribs are illustrated with dotted lines this illustrates the ribs or the meat side from where the ribs may have been removed is facing the support:

20 Situation 1) illustrates a rotation in the plane, i.e. the meat piece is rotated 180° and still having the rib-side upward;

Situation 2) illustrates a meat piece reversed or mirrored along the longitudinal direction of the meat, i.e. turning the meat piece upside down, and applying a 180° rotation in the plane, hereby the rib part of the meat piece originally being at the upper side of the meat piece is after the process facing the support and the end originally being located at the right side is after the process located at the left side;

30 Situation 3) illustrates a meat piece reversed or mirrored along the transverse direction of the meat i.e. turning the meat piece upside down along the width of the meat piece hereby the rib part of the meat piece originally being at the upper side of the meat piece is facing the support after the process and no plane rotation has occurred i.e. the end originally being at the right side is still at the right side after the turning process; and

35 Situation 4) illustrates a 90° rotation in the plane such that the side of the meat piece originally facing the support still faces the support after the turning, and the end originally located at the left side of the meat piece is located at the top after the turning process.

Figs. 5A and 5B illustrate two operators (11a and 11b) at a conveyor belt (12) which conveyor belt (12) is transporting meat pieces (13) in the direction indicated by the arrows (14). Indicated is two operations performed each by an operator (11) relocating meat pieces (13) by the use of a gripper device (1) before and after the location of a processing machine (15), which may be a derinder machine and where the meat pieces (13) may be pork belly pieces as indicated by the angled dark lines and the quarter of an ellipse illustrating ribs or where ribs have been located. A derinder machine, like the processing machine (15), may perform the derinding process at a higher quality, i.e. remove more rind from a meat piece (13), if the meat piece (13) is fed into the machine (15) with a longest side of the meat piece (13) as the leading side;

Fig. 5A illustrates a situation where the operator (11) being located before the machine (15) i.e. in the left part of the figure may e.g. vacuum-clean the meat piece (13) before or after he rotates the meat piece (13) by the use of the gripper device (1) (A vacuum-cleaner is not indicated in the figure). With the location of the gripper device (1) in the left part of the figure it is possible that the meat piece (13) is rotated before the operator (11) vacuum-clean the meat piece (13), whereas the gripper device (1) may be located closer to the machine (15) if the operator vacuum-clean the meat piece (13) before the meat piece (13) is rotated by the use of the gripper device (1). The operator (11) being located after the machine (15) i.e. in the right part of the figure may e.g. reverse or mirror the meat piece (13) along the longitudinal direction of the meat and also make a 90° rotation in the plane hereby the rib part of the meat piece originally being at the upper side of the meat piece is after the lifting process facing the support and the fat originally being located below the rind is located towards the operator (11). After the relocation of the meat piece (13) the operator may cut away possible rind residual fractions which the derinding machine (15) did not cut away; and

Fig. 5B illustrates a situation with pork belly pieces where the ribs are removed before the illustrated situation and where each of the operators (11) may cut away soft bones from every second pork belly piece. Hereby the operator (11) in the left part of the figure cuts away soft bones before turning the meat piece (13) and the operator (11) in the right part of the figure turns the meat piece (13) before cutting away the soft bones.

List of reference signs

In the figures, identical structures, elements or parts that appear in more than one figure are generally labeled with the same numeral in all the figures in which they appear.

- 5 1. Gripper device;
- 2. Gripper;
- 3. Gripper base;
- 4. Gripper top;
- 5. Outer part of actuator;
- 6. Inner part of actuator;
- 10 7. Elevating means;
- 8. Trigger;
- 9. Edge of gripper base;
- 10. Edge of gripper top;
- 11. Operator;
- 15 12. Support (Conveyor belt);
- 13. Workpiece;
- 14. Transport direction;
- 15. Processing station for processing of the workpieces;

Claims

1. A hand-operated device for grabbing, holding and lifting a workpiece, which device comprises:

- 5 a) a gripper (2) having a gripper base (3) and a gripper top (4);
 b) an actuator (5) connected to said gripper (2), which actuator (5) is capable of pressing said gripper base (3) and said gripper top (4) towards each other, thereby causing closing of the gripper, while also being capable of pressing said gripper base (3) and said gripper top (4) away from each other, thereby
10 causing opening of the gripper; and
 c) elevating means (7) for elevating said gripper (2) when holding a workpiece (13).

15 2. The device according to claim 1, which device further comprises a trigger (8) for activating the actuator (5).

 3. The device according to either one of claims 1-2, which device further comprises an adjustable timer, which timer determines closing time of the gripper.

20 4. The device according to any one of claims 1-3, which device further comprises suspension means for suspending the device.

 5. The device according to any one of claims 1-4, wherein said gripper base (3) and said gripper top (4) both have an overall lateral dimension equivalent to
25 each other, and/or said gripper top has an edge (10) which is bended towards said gripper base (9), and/or said gripper top (10) and/or said gripper base (9) has an edge line which is uneven.

30 6. The device according to any one of claims 1-5, wherein said gripper base (9) and said gripper top (10) each has a bulged edge line.

 7. A method for lifting a workpiece (13) located on a support (12), which method is controlled by an operator (11) using the device (1) according to any one of claims 1-6, and which method comprises the subsequent steps of:

- 35 a) the operator holds the device (1) in one hand, with a finger positioned to activate the trigger (8);
 b) the operator pulls or moves said device (1) towards said support (12);

c) the operator positions said gripper base (3) underneath said workpiece (13), thereby simultaneously positioning said gripper top (4) above said workpiece (13); and

5 d) the operator activates said trigger (8), whereby said workpiece (13) is automatically lifted by said device (1).

8. The method according to claim 7, wherein activation of the trigger in step d) may, or may not, initiate the function of a timer.

10 9. The method according to either one of claims 7-8, for re-positioning said workpiece (13) on said support (12), which method comprises the additional step of:

e) with his hand, the operator de-activates the trigger (8), or, alternatively, when the timer function expires, the operator (11) guides said
15 workpiece (13) towards said support (12), hereby releasing said workpiece (13) from the gripper (2), and re-positioning said workpiece (13) on said support (12).

10. Use of the device according to any one of claims 1-6, for lifting a workpiece (13) being transported by a conveyor belt (12).

20

11. Use of the device according to claim 9, wherein the workpiece is a meat product being transported on a conveyor in an abattoir.

12. The use according to any one of claims 9-11, which use is performed
25 according to the method of either one of claims 7-8.

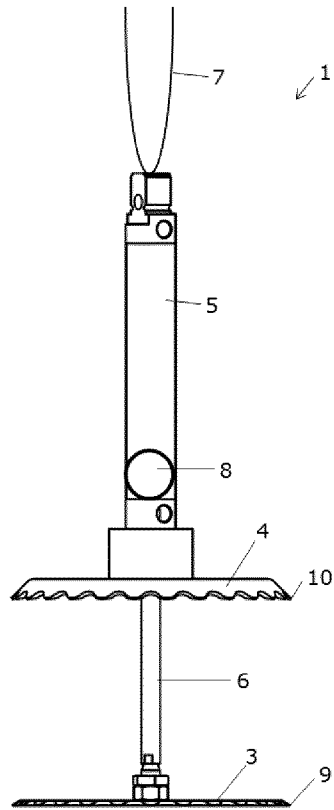


Fig. 1A

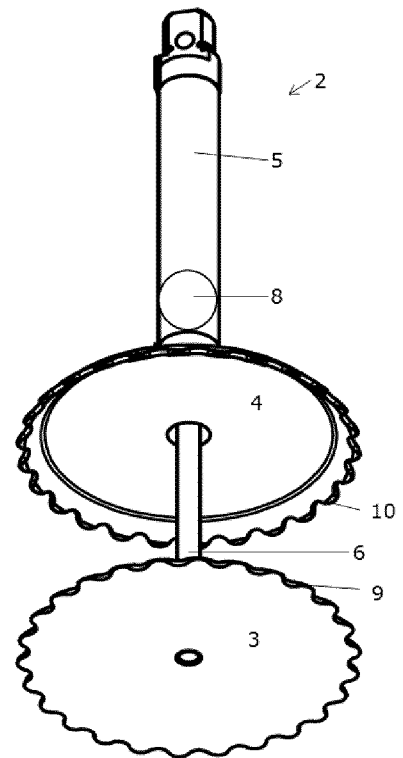


Fig. 1B

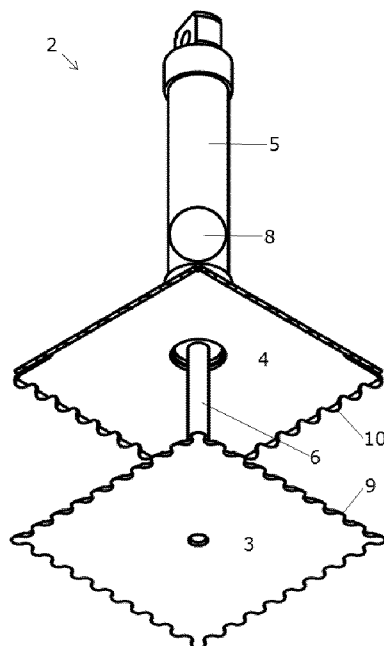


Fig. 1C

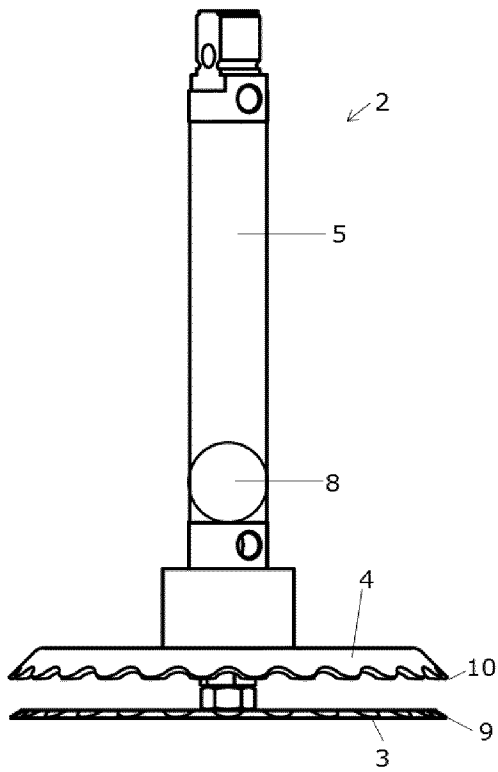


Fig. 2A

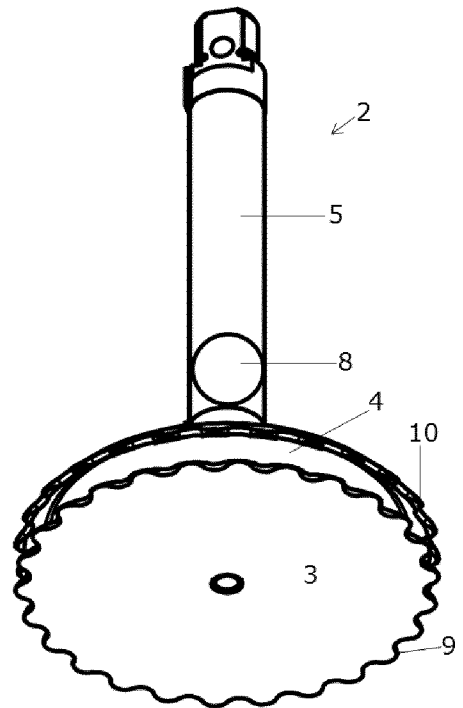


Fig. 2B

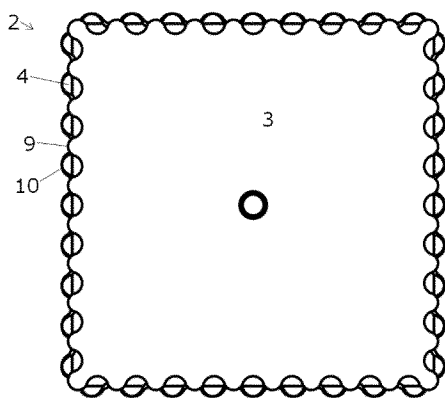


Fig. 3A

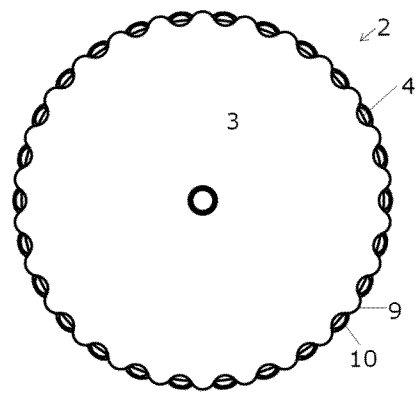
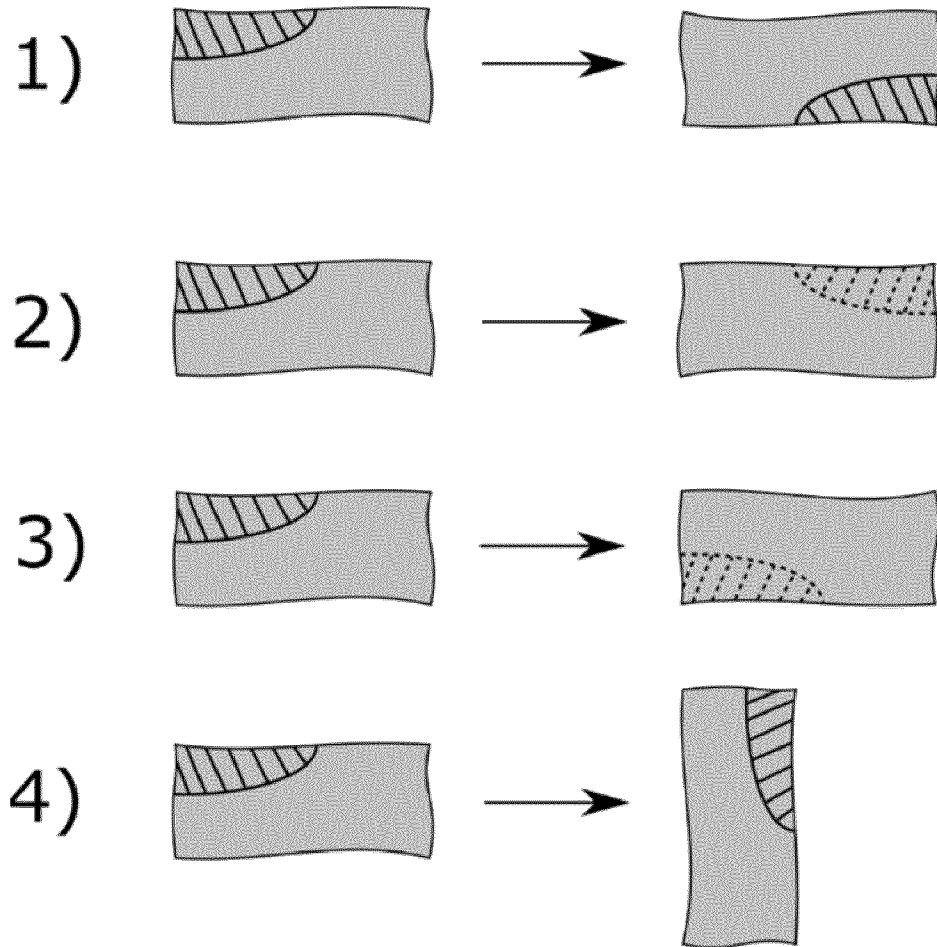


Fig. 3B

**Fig. 4**

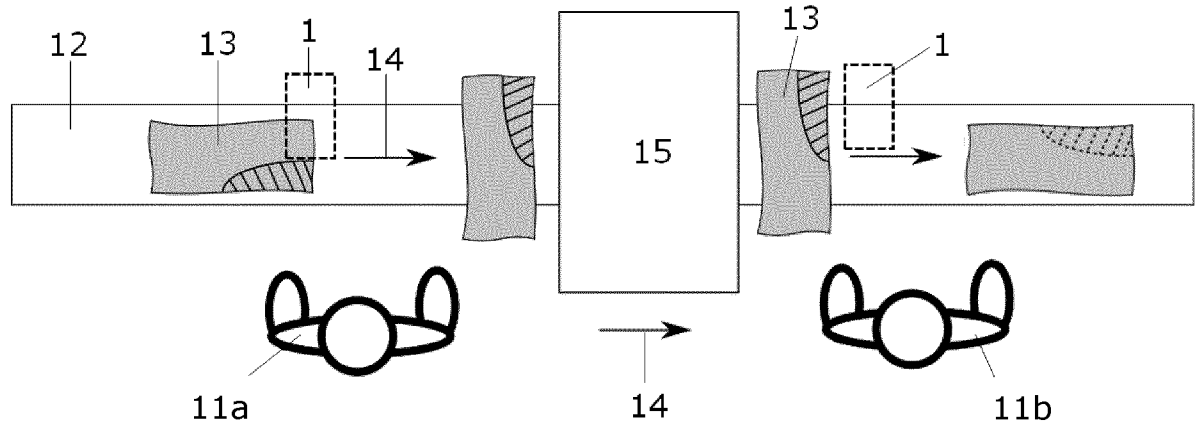


Fig. 5A

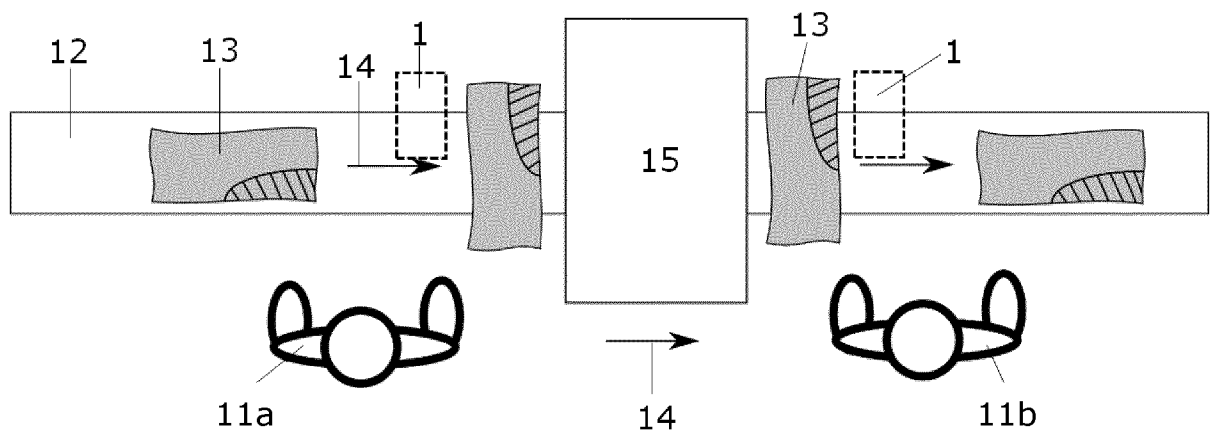


Fig. 5B

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/077587

A. CLASSIFICATION OF SUBJECT MATTER
INV. A22B7/00 B25J11/00 B65G47/90
ADD.

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)
A22B B65G B25J

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 practicable, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 755 993 A1 (K J MASKINFABRIKEN AS [DK]) 28 February 2007 (2007-02-28) cited in the application the whole document ----- -/--	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

27 March 2019

Date of mailing of the international search report

02/04/2019

Name and mailing address of the ISA/

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Authorized officer

Rojano, Borja

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/077587

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Saverio Santochi: "Development of an expert system for supporting the selection of robot grippers", 1 February 2014 (2014-02-01), XP055573059, Retrieved from the Internet: URL:https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwjG1YzDkKLhAhXMI1AKHavwAYsQFjAAegQIAhAC&url=https%3A%2F%2Fcore.ac.uk%2Fdownload%2Fpdf%2F19203703.pdf&usg=A0vVaw2ahtwsKMzI37Tdt68IlaVf [retrieved on 2019-03-22] page 19 - page 21; figure 3 -----	1-12
A	US 6 082 797 A (ANTONETTE WILLIAM B [US]) 4 July 2000 (2000-07-04) cited in the application the whole document -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/077587

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1755993	A1	28-02-2007	AT 454341 T 15-01-2010
			EA 200602029 A1 27-04-2007
			EP 1755993 A1 28-02-2007
			US 2008261504 A1 23-10-2008
			WO 2005105627 A1 10-11-2005

US 6082797	A	04-07-2000	NONE
