ABSTRACT: Gripping device for picking up an object from a supporting surface, particularly bakery products (4) from a baking tray or from a baking tin (3), wherein the gripping device comprises a manipulator (1) for accommodating and at least temporarily holding the object, wherein the manipulator (1) comprises at least one jet aperture (10), which jet aperture is adapted for discharging therefrom a pressurised jet of a fluid in a direction between the (object) and the supporting surface (3) for creating an overpressure between the object and the supporting surface.
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Gripping device and method for picking up an object

The invention relates to a gripping device for picking up an object from a supporting surface, particularly bakery products from a baking tray or from a baking tin. The invention furthermore relates to a manipulator for accommodating and at least temporarily holding the object. The invention furthermore relates to a method for gripping an object from a supporting surface by means of a gripping device.

Several types of gripping device for gripping an object are known. For instance an object that sits on a base can be gripped by means of a gripping device provided with a manipulator having gripping arms that grip the object on its side.

Another possibility is to grip the object by means of a gripping device provided with a manipulator having a carrying element that can be slid, at least partially, under the object. An example of such a gripping device is described in European patent application 1 029 637. Said European patent application describes a gripping device comprising a holder provided with four parallel tubes extending downward, through which an elastic wire runs. The lowermost end of the elastic wire is arcuate when not under tension and can be slid under the object for picking up the object.

Furthermore gripping devices are known that use a vacuum for picking up the object. For instance European patent application 0 526 403 describes a gripping device comprising a gripping element in the form of a suction cup connected to a suction device.
Another example of a gripping device using a vacuum is described in European patent application 1162163. The manipulator of this gripping device is provided with a suction opening operating with a vacuum which suction opening leads to the inside of a hollow suction body. The shape of the suction opening and at least a part of the inside of the suction body correspond to the lateral shape of the object to be picked up. The inside of the suction body is connected to suction means, which by means of suctioning air are able to create a vacuum. By sucking in air the object can be received in the suction body.

A drawback of the known gripping device described above is that the object may get damaged when being picked up if said object does not lie free, for instance because the object is stuck to a base. Especially in case of fragile objects that do not lie free, such as for instance bakery products, there is a good chance of damage during picking up.

It is an object of the invention to provide a gripping device and a method for gripping an object wherein the chance of damage during picking up objects that do not lie free is at least reduced.

To that end a first aspect of the invention provides a device according to the preamble, wherein the gripping device comprises at least one jet aperture, which jet aperture is adapted for discharging therefrom a pressurised jet of a fluid in a direction between the object and the supporting surface for creating an overpressure between the object and the supporting surface.

An idea behind the present invention is that discharging a pressurised jet in a direction between the object and the supporting surface can create an overpressure between the object and the supporting surface, as a result of which the object can be released from the supporting surface without considerably damaging the object. Subsequently the object that now lies free can be picked up by a gripping device in the known manner.
Another advantage of the device according to the invention, wherein the gripping device comprises a manipulator for accommodating and at least temporarily holding the object, wherein said manipulator comprises the at least one jet aperture, is that the jet aperture or nozzle is disposed and oriented on the gripping device such that it optimally cooperates with a gripping mechanism of the manipulator and/or is optimally able to release the object to be picked up from the base or from a container. After releasing the object can immediately be picked up by the manipulator.

Moreover a gripping device, at least its manipulator, is often moved towards the object to be picked up in order to pick it up. In the device according to the invention this motion can also be used to place the at least one jet aperture at the correct position with respect to the object so that no additional provisions are needed to that end.

The at least one jet aperture may be placed in or at the manipulator in different ways and at different positions. Among other things the at least one jet aperture may be placed on or in gripping arms, on or in a carrying element, near a suction cup, or on or in a suction body of the manipulator.

The meaning of the concept "supporting surface" should be taken broadly here. This concept naturally includes a flat supporting surface such as a baking tray, but also textured supporting surfaces, moulds and baking tins, the raised edges of which also serving as supporting surface. When the object supports on a flat supporting surface, the pressurised jet has to be discharged in a direction of the edge of the object and the flat supporting surface in order to create an overpressure between the object and the supporting surface. When the object supports in a container, for instance a mould or baking tin, the pressurised jet has to be discharged in a direction of the edge of the object and the container for creating an overpressure between the object and the supporting surface.
Preferably for picking up bakery products from a baking tin having raised walls that at least partially surround the bakery product, the at least one jet aperture is adapted for discharging the jet oriented substantially parallel to a raised wall and between the bakery product and the raised wall. In this way the fluid is efficiently directed between the object and the supporting surface for creating an overpressure between the object and the baking tin having raised edges. A further advantage of directing the jet substantially parallel to the raised wall is that the chance of damaging the object is further reduced.

Depending on the nature of the object to be picked up, a liquid or a gaseous medium can be used for the pressurised jet.

Preferably the jet aperture is adapted for discharging a gaseous medium. In general a gaseous medium will less quickly affect and/or damage an object, as a result of which this type of medium is preferred. Particularly in case of objects that have to be kept dry, such as for instance bakery products, using a gaseous medium is preferred.

Preferably the gaseous medium comprises compressed air. Compressed air is a cheap gaseous medium that is often available at places of work. Nitrogen may for instance be used as a gaseous medium for picking up oxidisable objects.

It will be clear that the idea behind the present invention is applicable to a large number of different gripping device and/or manipulators. Originally the idea resulted from a problem, as recognised by the inventor, that particularly occurs with dough products that have to be picked up from a mould or baking tin, for instance after baking the dough products. Because a bakery tin generally surrounds the dough product to a large extent it is often impossible to engage the dough product on the side or to slide a carrying element under the dough product, without damaging the dough product.
For that reason use is preferably made of a gripping device using overpressure for picking up dough products from a baking tin. However if the dough products do not lie free in their baking tins, but for instance partially stick to the baking tins, strong suction is necessary in order to pick up the dough products. Using such strong suction may damage the dough products. Especially dough products provided with soft stuffing, a sugar layer or almond shavings, at their top side may easily get damaged at that top side due to strong suction.

To provide improvement on at least one of the above-mentioned aspects, an embodiment of the gripping device according to the invention is provided with a manipulator comprising:
- a carrying body provided with an accommodation space for at least partially accommodating the object, wherein the carrying body is provided with an opening for receiving the object which opening forms a debouchment of the accommodation space, and wherein the carrying body is provided with at least one jet aperture, and
- a connection for connecting the suction means, which connection communicates with the accommodation space.

Preferably the carrying body is provided with an edge bounding the debouchment of the accommodation space, which edge is provided with the at least one jet aperture, which preferably is oriented away from the accommodation space. For at least partially accommodating the object in the accommodation space of the carrying body the opening is sufficiently large to at least partially enclose the object. In other words, the edge bounding the debouchment of the accommodation space, encloses the object at least partially and will be able to extend to near the edge between the object and the supporting surfaces. Said edge therefore is an optimal location for positioning a jet aperture.
In a further embodiment the manipulator according to the invention comprises a cloche-shaped carrying body, which cloche-shaped carrying body furthermore comprises:

- an opening for receiving the object,
- a lateral confining means situated within the cloche-shaped carrying body for the object, which lateral confining means forms an accommodation space debouching at the opening for at least partially receiving the object, wherein the confining means is adjacent to the opening,
- a connection for the connection of the suction means communicating with the opening via an inside of the cloche-shaped carrying body, and
- at least one jet aperture, which is situated in or near the cloche-shaped carrying body.

Just like the gripping device described in European patent application 1 162 163, this embodiment of the gripping device according to the invention is adapted for picking up objects by means of a vacuum. The cloche-shaped carrying body is adapted for picking up the object via the opening. The picking up is made possible by a suction action of the suction device, wherein the object is at least partially received via the opening into the cloche-shaped carrying body. The object is enclosed by the lateral confining means.

The concept "cloche-shaped carrying body" refers to a carrying body that can be placed over the object like a cloche.

Preferably the jet aperture is arranged in or near an edge of the cloche-shaped carrying body which is adjacent to the opening. As the cloche-shaped carrying body can be placed over the object, the edge of the cloche-shaped carrying body which is adjacent to the opening encloses the object and will be able to extend to near the edge between the object and the supporting surfaces. Said edge therefore is an optimal location for placing a jet aperture.
Preferably the jet aperture is arranged in the edge of the cloche-shaped carrying body which is adjacent to the opening, and a supply line to the jet aperture is at least partially accommodated in the cloche-shaped carrying body. Thus a cloche-shaped carrying body having a relatively thin cloche wall and without external supply lines can be designed, as a result of which the lateral extension of the manipulator can be limited. As a result the cloche-shaped carrying bodies can be placed closely together in order to engage and pick up several objects placed closely together simultaneously.

Preferably the shape of the opening for receiving the object corresponds with the lateral shape of the object to be picked up. Due to this lateral shape of the opening a strong air flow is created between the object and the lateral confining means when suction around the object takes place. This strong air flow can be used to receive and hold the object in the gripping device as a result of the air resistance between the products and the air flow as a result of the high air speed. The expert will understand that the strength of the air flow among other things depends on the size of the air slit between the object and the opening of the suction flow rate of the suction means. It will be clear that the size of the opening for receiving the object should at least be slightly larger than the size of the object to be picked up, so that the object can be received in the accommodation space undamaged.

In an embodiment of the manipulator according to the invention the accommodation space is provided with a stop member, wherein the stop member has a surface oriented towards the debouchment which surface is adapted to a surface of the object, particularly the bakery products, oriented towards the manipulator. The stop member forms a mechanic barrier to the object and ensures that the object is not accommodated into the accommodation space beyond said mechanic barrier. The stop member may for instance be formed out of perforated material disposed perpendicularly to the longitudinal axis of a cloche-shaped carrying body, spaced apart from the opening.
Preferably the surface of the stop member oriented towards the debouchment forms a closed surface. The closed surface will get dirty less quickly than a perforated surface and moreover is easier to clean. On the closed surface of the stop member no vacuum will moreover be active on the side of the object abutting the stop member. The stop member thus protects said side of the product. This embodiment is particularly suitable for objects such as for instance dough products which at their top side have for instance been provided with a soft stuffing, a sugar layer or almond shavings, and which may easily be damaged at said top side due to strong suction.

For using a stop member having a closed surface as described above, the suction may be guided past the stop member. Preferably the manipulator according to the invention comprises a suction opening between the stop member and a wall of the accommodation space for sucking out air by the suction means through the suction opening. Preferably the suction opening practically entirely surrounds the stop member. These preferences furthermore ensure that the air flow generated by the suction means will mainly be active around the object, even if the object has been accommodated in the accommodation space and abuts the stop member.

It is furthermore advantageous when the gripping device, at least its manipulator, comprises an ejector mechanism for ejecting the object from the accommodation space. It has turned out that in the known gripping devices the object is not always discharged from the accommodation space of its own accord when the suction means are deactivated. For that purpose this embodiment of the device according to the invention provides means for actively ejecting the object from the accommodation space.

For instance suction means can be used that are also able to blow in air into the accommodation space for creating an overpressure in the accommodation space. Due to this overpressure a strong air flow is created around the object. This strong air flow results in an ejector mechanism for the object
as a result of the air resistance between the object and the air flow as a result of the high air speed.

Preferably the stop member provided with means for ejecting the object from the accommodation space. As this object, in case it is accommodated in the accommodation space, abuts the stop member, it is advantageous to provide the stop member with an ejector mechanism.

Preferably the stop member is mounted in the accommodation space in a way so as to be movable in a direction towards the opening, and the gripping device, at least its manipulator, comprises driving means for moving the stop member in the direction of the opening. The stop member can now be used to push the object out of the accommodation space.

Preferably the drive means comprise a spring, a weight or a pneumatic drive.

In a first embodiment, the stop member is spring mounted in the accommodation space. When receiving the object by means of the strong air flow as described above, the object is pushed against the stop member as a result of the air resistance between the object and the strong air flow. Due to the pressure force of the object against the stop member, the spring mounting of the stop member is pressed in and the object is received further into the accommodation space. Due to the pressing in, the spring mounting is put under tension. When the suction means are deactivated, the spring mounting can relax wherein the object is pushed out of the accommodation space.

In a second embodiment the stop member is provided with a weight that pushes the stop member in the direction of the opening under the influence of gravity. The weight is selected such that the pressure force of the object against the stop member when receiving the object is larger than the force with which the weight pushes the stop member in the direction of the opening. Due to the pressure force of the object the stop member is pushed
further into the accommodation space and the object is received further into the accommodation space. When the suction means are deactivated, the weight will push the stop member in the direction of the opening, thus pushing the object out of the accommodation space.

Contrary to spring mounting, wherein the spring force increases when the spring mounting is pressed in further, the force exerted by the weight on the stop member is practically independent of the distance over which the stop member is pressed into the accommodation space by the object.

In a third embodiment the stop member is coupled to a pneumatic drive which, when excited, pushes the stop member in the direction of the opening with respect to the accommodation space for ejecting the object. This ejector mechanism is able to operate independent from the suction means.

In an embodiment according to the invention the gripping device, at least its manipulator, is adapted for picking up an object having a virtually circular lateral shape and wherein the manipulator comprises at least three jet apertures for discharging jets of the fluid to at least three locations that are situated substantially equidistant from each other at the circumference of the object.

In another embodiment according to the invention the gripping device, at least its manipulator, is adapted for picking up an object having a virtually rectangular lateral shape and wherein the gripping device comprises at least four jet apertures for discharging jets of the fluid in a direction of at least four locations, wherein each location is situated substantially in the middle of one of the four sides of the object.

A second aspect of the invention provides a method according to the preamble, wherein the gripping device comprises a manipulator for picking up
and at least temporarily holding the object, wherein the manipulator comprises at least one jet aperture, which jet aperture is adapted for discharging therefrom a pressurised jet of fluid, which method comprises the following steps:

placing the manipulator having the at least one jet aperture and the object to be picked up near each other,

discharging a pressurised jet of fluid from the at least one jet aperture in a direction between the object and the supporting surface for creating an overpressure between the object and the supporting surface for releasing the object from the supporting surface,

picking up the object with the manipulator.

In an embodiment of this method the jet aperture is adapted for discharging a gaseous fluid. In a more particular embodiment thereof the gaseous fluid comprises compressed air.

Preferably a gripping device according to the invention as described above is used in this method.

In an embodiment of the method as described above the gripping device provided with a manipulator comprising a cloche-shaped carrying body, which cloche-shaped carrying body furthermore comprises:

an opening for picking up the object,

a lateral confining means situated within the cloche-shaped carrying body for the object, wherein the confining means is adjacent to the opening,

a connection for the connection of suction means communicating with the opening via an inside of the cloche-shaped carrying body,

wherein the object in the cloche-shaped carrying body is picked up via the opening by a suction action of the suction means, and wherein the object is at least partially accommodated in the cloche-shaped carrying body and thus is enclosed by the lateral confining means.
A further embodiment comprises a method for picking up bakery products from a baking tin having raised walls that at least partially surround the bakery product, wherein the at least one jet aperture is adapted for discharging the jet that is oriented substantially parallel to a raised wall and between the bakery product and the raised wall, which method comprises the following steps:

placing the gripping device, at least its manipulator, having the at least one jet aperture and the object to be picked up above one another,

discharging a pressurised jet of fluid from the at least one jet aperture simultaneously with the moving towards each other of the manipulator and the object,

picking up the object by a suction action of the suction means, wherein the object is at least partially accommodated in the accommodation space.

A third aspect of the invention provides a gripping device for picking up an object from a supporting surface, particularly bakery products from a baking tray or from a baking tin comprising a carrying body provided with an accommodation space for at least partially accommodating the object, wherein the gripping device is provided with an ejector mechanism for ejecting the object from the accommodation space. Preferably the gripping device is provided with a manipulator for picking up and at least temporarily holding an object, wherein the manipulator comprises the ejector mechanism.

The invention will be elucidated on the basis of the exemplary embodiment shown in the attached drawings, in which:

Figure 1 shows a view in cross-section of a first exemplary embodiment of a manipulator according to the invention;

Figure 2 shows a detail of figure 1;
Figure 3 shows a bottom view of the first exemplary embodiment of the manipulator;

Figures 4A-E show a side view of the first exemplary embodiment of the manipulator, wherein some steps of the method according to the invention are schematically shown;

Figure 5 shows a view in cross-section of a second exemplary embodiment of a manipulator provided with an ejector mechanism;

Figure 6 shows a detail of the view in cross-section of figure 5;

Figure 7 shows a bottom view of the manipulator of figure 5; and

Figure 8 shows a view in cross-section of a third exemplary embodiment of a manipulator according to the invention.

Figure 1 shows a first exemplary embodiment of the manipulator 1 according to the invention for picking up bakery products 4 from a baking tin or baking pan 3. The manipulator 1 is provided with a vacuum space 7 in which the bakery product 4 can be accommodated. The vacuum space 7 is connected to a connection for vacuum 5, to which means (not further shown) can be connected for ensuring a vacuum in the vacuum space 7. The manipulator 1 is provided with a carrying body 2, wherein the vacuum space is bounded by a circumferential lower edge 6 that is adapted to the shape of the bakery product 4, for allowing the bakery product in. This embodiment shows bakery products having a more or less round cross-section, as a result of which the vacuum space 7 will have a more or less round shape (also see figure 3).

In order to prevent that due to creating a vacuum in the vacuum space 7 the bakery product 4 get damaged against the inside of the vacuum space 7, the
manipulator 1 is provided with a stop member 8, designed as a closed surface provided with a circumferential edge 12. In this exemplary embodiment, the position of the stop member 8 in the vacuum space 7 can be set by means of a lead screw 9. The part of the vacuum space 7 that is situated below the stop member 8 forms the accommodation space for accommodating the bakery products. By means of the lead screw 9 the degree to which the bakery product can be received in the accommodation space, can be set and adjusted to for instance the type of bakery product. The lead screw 9 is furthermore provided with a nut 11 for blocking the lead screw 9 against undesirable movements.

At the lower edge 6 the manipulator is provided with three jet apertures 10 for discharging jets of the fluid. The jet apertures 10 are practically equidistanted from each other along the lower edge 6 and are adapted for discharging jets to at least three locations that are practically equidistanted from each other on the circumference of the object. The jets are furthermore directed towards a point that is situated underneath the carrying body 2 and practically on the axis of symmetry of the carrying body 2. The three jets as it were run over the surface of a straight circular cone of which the ground surface is adjacent to the lower edge 6 and of which the tip points away from the accommodation space, in the direction of the objects to be picked up, such as for instance bakery product 4.

The supply lines 13 to the jet apertures 10 are partially accommodated in the carrying body 2. These supply lines 13 are furthermore connected to a compressed air line (not shown) via connections 14 at the outer circumference of the carrying body 2.

Furthermore the jet apertures 10 in this exemplary embodiment are formed by an insert 15, which among others determines the size and the direction of the jet apertures 10. Alterations in these parameters of the jet apertures are possible by changing the inserts 15. As a result for instance size, width and
direction of the compressed air jets from the jet apertures may be adjusted to the objects and the supporting surface. In this example the bakery products 4 and the baking tin 3.

5 Figure 2 shows a detailed view of the cross-section of the manipulator 1. Here again the baking tin 3 is shown and the bakery product 4. Stop member 8 and vacuum space 7 are also indicated. In addition for the sake of clarity the inside wall 20 of the vacuum space 7 is indicated which forms a lateral confining means for the bakery product 4. The jet aperture 10 is furthermore shown in figure 2, from which jet aperture in a preferred embodiment especially for bakery products pressurised air, preferably compressed air, can be jetted. By jetting the compressed air along the side wall of the baking tin, in the direction indicated by arrow A, on the one hand the bakery product is released from the wall of the baking tin, or the bakery product sticking to the edge of the baking tin is prevented. On the other hand due to an overpressure between the bakery product 4 and the baking tin 3 an additional pressure force is created for removing the bakery product 4 from the baking tin 3. In this embodiment the supply channel 13 for jet aperture 10 is accommodated in the wall of the manipulator 1.

20 The operation of the manipulator as schematically shown in figure 4 is as follows:
- The manipulator and the baking tin 3 with the bakery product 4 therein are placed above one another. In this example with a round bakery product 4 in a round baking tin 3 and a round carrying body 2, the middle of the bakery product 4 in the baking tin 3 is placed near the axis of symmetry of the carrying body 2 (see figure 4A).
- Subsequently a vacuum is created in the vacuum space 7 by means of the connection 5, and the carrying body 2 is moved in the direction of the bakery product 4 in the baking tin 3.
- Subsequently the three jet apertures 10 are aligned with respect to the bakery product 4 in the baking tin 3. The alignments of the three jets of
compressed air contact the bakery product 4 at three locations that are practically equidistanced from each other on the circumference of a circle of which the centre is at the axis of the carrying body 2 and on the middle of the bakery product, as schematically shown in figure 4C by means of dotted lines. As the carrying body 2 is still moved in the direction of the bakery product 4 in the baking tin 3 the locations where the alignments contact the bakery product will move towards the edge of the bakery product. In other words the radius of the circle on which the locations where the jets of compressed air will contact the bakery product will increase.

The moment the alignments of the jets of compressed air are directed between the edge of the bakery product 4 and the baking tin 3, compressed air is blown from the three jet apertures 10, as indicated in figure 4D. The jets of compressed air ensure an overpressure between the baking tin 3 and the bakery product 4. This overpressure ensures that the bakery product 4 is released from the baking tin 3. The later results in the bakery product 4 due to the overpressure partially being lifted from the baking tin 3.

Once the jets of compressed air have released the bakery product 4 from the baking tin 3, they can be deactivated.

The moment the carrying body 2 has arrived close enough to the bakery product 4, the air flow generated by the vacuum in the vacuum space 7, will take over the bakery product 4 from the baking tin 3 wherein the top side of the bakery product will abut the stop member 8. The bakery product 4 is now received by the manipulator and can be transported to a further treatment station or packaging station by the manipulator.

At the location of the further treatment station or packaging station the vacuum in the vacuum space 7 is stopped and the bakery product 4 may fall out of the carrying body under the influence of gravity. In a further embodiment the vacuum space 7 is temporarily brought at overpressure as a result of which the bakery product 4 is pushed out of the carrying body 2.

Preferably the distance between the lower edge 6 of the carrying body 2 and the lower side of the bakery product 4 is such, that the bakery product does
not protrude below the lower edge 6. As a result the bakery product is protected from damage during further transport.

In a second exemplary embodiment the manipulator 1 is provided with a stop member 8 which is spring mounted in the carrying body 2, as shown in figure 5. The stop member 8 is mounted on the lead screw 9 which is placed so as to be slidable in axial direction along the guides 17 in the carrying body 2. Between the carrying body 2 and the stop member 8 a spring 16 is placed which pushes the stop member 8 in the direction of the lower edge 6. The farthest position of the stop member 8 in the direction of the lower edge 6 is determined by the nut 11 which in the farthest position of the stop member 8 abuts an abutment surface 18. This farthest position is adjustable by means of nut 11.

When accommodating the object 4 by means of the strong air flow as described above, the object 4 is pushed against the stop member 8. Due to the pressure force of the object 4 against the stop member 8, the spring 16 is pushed in and the stop member 8 slides further into the vacuum space 7. Due to the pressing in the spring mounting is put under tension. The stop member 8 slides so far into the vacuum space 7 until the spring pressure of the spring 16 equals the compression force of the object 4 against the stop member, or until the stop member reaches the stop edge 19. When the suction means are deactivated the spring 16 can relax, the object 4 being pushed out of the carrying body 2.

The detailed view of the manipulator according to this second exemplary embodiment shows that the supply channel 13 for the jet aperture 10 is accommodated in the wall of the manipulator. In this exemplary embodiment the jet aperture 10 is formed between an inside wall 20 of the vacuum space 7 and the outside wall of the carrying body 2. If, as is the case in this exemplary embodiment, the jet apertures need not be changed, the insert 15 as shown in the figures 1 and 2 can be dispensed with.
The bottom view of this second exemplary embodiment as shown in figure 7, further shows that the jet apertures 10 are substantially disposed in the inside wall 20. Moreover this exemplary embodiment is provided with six jet apertures 10 that are practically equidistanted from each other at the circumference of the stop member 8. In this exemplary embodiment the stop member 8 is provided with continuous openings 21. The stop member 8 may also be designed without openings 21, as shown in the exemplary embodiment of figure 3.

It will be clear that the exemplary embodiments of the invention described above are intended as illustrations of the invention and are not intended to limit the invention. An expert will most certainly be capable of designing alternative embodiments that fall within the scope of protection of the attached claims.

For instance the position of the stop member 8 in the exemplary embodiment is adjustable. A fixed position of the stop member 8 is of course also possible. The position of the stop member for instance does not have to be adjustable when the gripping device is permanently used for the same type of object. As a result the construction of the manipulator can be simpler and the resulting gripping device can be cheaper.

The exemplary embodiments furthermore show that the jet apertures 10 and their supply lines 13 have been accommodated in the carrying body. A simple third exemplary embodiment of the device according to the invention may also use nozzles 22 or jet tubes that may for instance be attached at the outside of the carrying body 2 as schematically shown in figure 8.

Figure 8 shows a simple gripping device according to the invention, wherein the carrying body 2 has a structure comparable to the first exemplary embodiment as shown in figure 1. In this simple gripping device however
nozzles 22 have been placed at the outside, which nozzles are connected to supply lines 13 for supplying for instance compressed air to the nozzles 22. The nozzles 22 have been provided with jet apertures 10 for discharging a jet of compressed air. An advantage of such a simple gripping device is that the walls of the carrying body 2 can be thin as no lines or jet apertures have to be accommodated therein.
Claims

1. Gripping device for picking up an object from a supporting surface, particularly bakery products from a baking tray or from a baking tin, wherein the gripping device comprises a manipulator for accommodating and at least temporarily holding the object, wherein the manipulator comprises at least one jet aperture, which jet aperture is adapted for discharging therefrom a pressurised jet of a fluid in a direction between the object and the supporting surface for creating an overpressure between the object and the supporting surface.

2. Gripping device according to claim 1, wherein the jet aperture is adapted for discharging a gaseous fluid.

3. Gripping device according to claim 2, wherein the gaseous fluid comprises compressed air.

4. Gripping device according to claim 1, 2 or 3 for picking up bakery products from a baking tin having raised walls that at least partially surround the bakery product, wherein the at least one jet aperture is adapted for discharging the jet oriented substantially parallel to a raised wall and between the bakery product and the raised wall.

5. Gripping device according to any one of the claims 1-4, wherein the manipulator comprises an accommodation space for at least partially accommodating the object and is provided with an opening for receiving the object which opening forms a debouchment of the accommodation space.
and wherein the manipulator comprises a connection for connecting the suction means, which connection communicates with the accommodation space.

6. Gripping device according to claim 5, wherein the manipulator is provided with an edge bounding the debouchment of the accommodation space, which edge is provided with the at least one jet aperture.

7. Gripping device according to claims 5 or 6, wherein the jet aperture is oriented away from the accommodation space.

8. Gripping device according to claim 1-4, wherein the manipulator comprises a cloche-shaped carrying body, wherein the cloche-shaped carrying body furthermore comprises:

- an opening for receiving the object,
- a lateral confining means situated within the cloche-shaped carrying body for the object, which lateral confining means forms an accommodation space debouching at the opening for at least partially accommodating the object, wherein the confining means is adjacent to the opening,
- a connection for the connection of the suction means communicating with the opening via an inside of the cloche-shaped carrying body, and
- at least one jet aperture, which is situated in or near the cloche-shaped carrying body.

9. Gripping device according to claim 8, wherein the jet aperture is arranged in or near an edge of the cloche-shaped carrying body which is adjacent to the opening.

10. Gripping device according to claim 8, wherein the jet aperture is arranged in the edge of the cloche-shaped carrying body which is adjacent to the opening, and wherein a supply line to the jet aperture is at least partially accommodated in the cloche-shaped carrying body.
11. Gripping device according to any one of the claims 5-10, wherein the shape of the opening for receiving the object corresponds with the lateral shape of the object to be picked up.

12. Gripping device according to any one of the claims 5-11, wherein the accommodation space is provided with a stop member, wherein the stop member has a surface oriented towards the debouchment which surface is adapted to a surface of the object, particularly the bakery products, oriented towards the gripping device.

13. Gripping device according to claim 12, comprising a suction opening between the stop member and a wall of the accommodation space for sucking out air by the suction means through the suction opening.

14. Gripping device according to claim 13, wherein the suction opening practically entirely surrounds the stop member.

15. Gripping device according to claims 12, 13 or 14, wherein the surface of the stop member oriented towards the debouchment forms a closed surface.

16. Gripping device according to any one of the claims 5-15, wherein the manipulator comprises an ejector mechanism for ejecting the object from the accommodation space.

17. Gripping device according to any one of the claims 12-15, wherein the stop member is provided with means for ejecting the object from the accommodation space.

18. Gripping device according to claim 17, wherein the stop member is mounted in the accommodation space in a way so as to be movable in a direction oriented towards the opening, and wherein the gripping device
comprises driving means for moving the stop member in the direction of the opening.

19. Engagement means according to claim 18, wherein the drive means comprise a spring, a weight or a pneumatic drive.

20. Gripping device according to any one of the preceding claims, wherein the manipulator is adapted for picking up an object having a virtually circular lateral shape and wherein the manipulator comprises at least three jet apertures for discharging jets of the fluid to at least three locations that are situated substantially equidistance from each other at the circumference of the object.

21. Gripping device according to any one of the claims 1-19, wherein the manipulator is adapted for picking up an object having a virtually rectangular lateral shape and wherein the manipulator comprises at least four jet apertures for discharging jets of the fluid in a direction of at least four locations, wherein each location is situated substantially in the middle of one of the four sides of the object.

22. Method for picking up an object from a supporting surface by means of an gripping device, wherein the gripping device comprises a manipulator for picking up and at least temporarily holding the object, wherein the manipulator comprises at least one jet aperture, which jet aperture is adapted for discharging therefrom a pressurised jet of fluid, which method comprises the following steps:

placing the manipulator having the at least one jet aperture and the object to be picked up near each other;

discharging a pressurised jet of fluid from the at least one jet aperture in a direction between the object and the supporting surface for creating an overpressure between the object and the supporting surface for releasing the object from the supporting surface,
picking up the object with the manipulator.

23. Method according to claim 22, wherein the jet aperture is adapted for discharging a gaseous fluid.

24. Method according to claim 23, wherein the gaseous fluid comprises compressed air.

25. Method according to any one of the claims, 22-24, wherein the manipulator comprises a cloche-shaped carrying body, which cloche-shaped carrying body furthermore comprises:
   an opening for picking up the object,
   a lateral confining means situated within the cloche-shaped carrying body for the object, wherein the confining means is adjacent to the opening,
   a connection for the connection of suction means communicating with the opening via an inside of the cloche-shaped carrying body,
   wherein the object in the cloche-shaped carrying body is picked up via the opening by a suction action of the suction means, and wherein the object is at least partially accommodated in the cloche-shaped carrying body and thus is enclosed by the lateral confining means.

26. Method for picking up an object by means of an gripping device according to any one of the claims 1-22, which method comprises the following steps:
   placing the manipulator having the at least one jet aperture and the object to be picked up near each other,
   discharging a pressurised jet of fluid from the at least one jet aperture in a direction between the object and the supporting surface for creating an overpressure between the object and the supporting surface for releasing the object from the surface,
   picking up the object with the manipulator.
27. Method for picking up an object with an gripping device according to any one of the claims 5-22 for picking up bakery products from a baking tin having raised walls that at least partially surround the bakery product, wherein the at least one jet aperture is adapted for discharging the jet that is oriented substantially parallel to a raised wall and between the bakery product and the raised wall, which method comprises the following steps:

placing the manipulator having the at least one jet aperture and the object to be picked up above one another,

discharging a pressurised jet of fluid from the at least one jet aperture simultaneously with the moving towards each other of the manipulator and the object,

picking up the object by a suction action of the suction means, wherein the object is at least partially accommodated in the accommodation space of the manipulator.

28. Gripping device for picking up an object from a supporting surface, particularly bakery products from a baking tray or from a baking tin comprising a manipulator provided with an accommodation space for at least partially accommodating the object, wherein the manipulator comprises an ejector mechanism for ejecting the object from the accommodation space.

29. Manipulator for picking up an object from a supporting surface and at least temporarily holding an object, wherein the manipulator comprises at least one jet aperture, which jet aperture is adapted for discharging therefrom a pressurised jet of fluid in a direction between the object and the supporting surface for creating an overpressure between the object and the supporting surface.

30. Gripping device for picking up an object comprising one or more of the characterising measures described in the attached description and/or shown in the attached drawings.
31. Method for picking up an object in a holder comprising one or more of the characterising measures described in the attached description and/or shown in the attached drawings.

32. Manipulator for picking up an object comprising one or more of the characterising measures described in the attached description and/or shown in the attached drawings.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A21B3/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search: 13 September 2004

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Silvis, H
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