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(73) Patenthaver: **Deutsches Institut für Lebensmitteltechnik e.V., Prof.-von-Klitzing-Strasse 7, 49610 Quakenbrück, Tyskland**

(72) Opfinder: **Hukelmann, Bernhard, Fasanenweg 2, 49610 Quakenbrück, Tyskland**

(74) Fuldmægtig i Danmark: **Dennemeyer & Associates S.A, Bavariastr. 7, D-80336 München, Tyskland**

(54) Benævnelse: **FREMGANGSMÅDE TIL TRANSPORT AF FØDEVARESKIVER**

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Method for transporting slices of food products

The invention relates to the use of a device and a method for the transport of food slices, in particular for the portioning and/or packaging of food slices, as well as a method for producing packaged food slices, which are positioned on a support. Further, the invention relates to the use of a conduit section, which forms a suction section and, for example, is configured in the manner of a suction gripper for periodical or cyclical gripping and/or lifting of food slices, which are arranged against a suction opening of the gripper device, as a gripper device for food slices, which overlap.

The food slices optionally overlap completely or do not overlap completely or only partially, for example, by a percentage of 5-95%. The gripper device according to the present invention has a suction opening, which can be loaded with low pressure. The process realizable using the gripper device permits the simultaneous transport of a multiplicity of food slices, for example, on a support with subsequent sealing or covering of the support for the production of packaged food slices. The low pressure can be applied by a connected low pressure source and preferably can be generated by a low pressure source connected to the gripper device, the drive of which consists of a compressed air source. The device and the process implemented with it are adapted in particular to the gripping or the transport of food slices, which can have a dry surface or a liquid film, watery and/or oily, on the surface. Preferred foods are slices of meat, slices of sausage, slices of cheese, slices of bread, optionally with separating foil in between, made, for example, of paper or plastic. In a preferred embodiment, the device is arranged according to a cutting machine, in particular, according to a slicer, and transports a multiplicity of food slices on a support, which is preferably subsequently sealed. Preferably, the cutting machine deposits the food slices with an incomplete overlap and the gripper device grips or transports a multiplicity of food slices in this overlap.

Prior art

Generally, it is known for the transport of objects to arrange vacuum grippers on their surface, which produce low pressure by means of a connected low pressure source or with a built-in vacuum pump.

EP 2149517 A2 describes a suction gripper, which has an ejector nozzle operated with compressed air for generating a low pressure on its suction side and a suction chamber connected to the suction side, which spans a suction opening covered by a grid.

Problem addressed by the invention

The problem addressed by the invention is to provide the use of an alternative gripper device and an alternative process for the gripping and the transport of food slices and preferably for the production of packaged food slices. In particular, the device should permit the gripping or transport of a multiplicity of food slices, which are not completely overlapping. Preferably, the gripper device is connected with a low pressure source.

General description of the invention

The invention solves the problem with the features of the claims and in particular provides for the use of a conduit section as a gripper device for food slices, which forms a suction opening. The suction opening is established for the simultaneous transport of food slices. It has been proven that a multiplicity of food slices, which partially overlap, can be simultaneously, i.e. while retaining their partial overlap, held by means of low pressure against a suction opening and precisely transported through movement of the gripper device with the suction opening and can be precisely deposited after reduction of the low pressure, for example, on a support. The overlap of the food slices is maintained, so that the method permits the simultaneous transport of the food slices. In an advantageous manner, the device and the process have no mechanical gripper, which must be arranged beneath the food slices.

The overlap of the food slices is, for example, 5 to 95%, preferably 10 to 90%, more preferably 20 to 80% or 30 to 70%, in each case with regard to surfaces of the food slices facing each other, which are delimited by their narrow sides or edges.

The simultaneous transport of a multiplicity of food slices is attributed to the fact that the low pressure, which is applied to the suction opening, acts in the spaces in between the overlapping food slices and between the latter causes the Bernoulli Effect, so that food slices are pulled against each other. In embodiments, in which food slices completely overlap, the food slices preferably have the same size and/or stick together, in particular, in that they have a moist surface. Accordingly, the low pressure generator is a continuous low pressure generator, which is connected to the conduit section, and which sucks in inrushing air through the suction opening and between the food slice, and maintains a low pressure even in the case of inrushing air.

Preferably the transport or the gripping of the food slices with applied low pressure lasts 0.2 to 10 seconds, preferably 0.2 to 2 seconds, more preferably 0.5 to 1 second.

The device is advantageous for use in that it has no elements movable relative to each other, which contact the food slices, for example, no elements of a gripper movable relative to each other.

The suction opening is arranged terminally on the conduit section, which forms the suction section and, for example, can be funnel-shaped, cylindrical or bell-shaped. The suction opening has a size, which is optionally larger than the total area of the multiplicity of food slices, for example, longer and/or wider than the total area formed by the multiplicity of food slices. Alternatively, the suction opening is smaller than the total area formed by the multiplicity of food slices and is completely covered by these in arrangement against the multiplicity of food slices. The suction opening preferably has extensively closed edges, so that the suction opening is completely delimited and encompassed by a circumferential edge. Preferably, the edge, which delimits the suction opening, is arranged in a plane.

The embodiment, in which the suction opening is smaller than the total area formed by the multiplicity of food slices, permits a method for the production of packaged food slices by transport of the food slices on a support, the walls of which extend considerably, for example, by at least 0.5cm, more preferably at least 2cm or at least 5cm or at least 10cm over the base of the support. For the gripper device contacts the food slices only on the surface, which lies opposite the support or the surface, which is positioned on the support. Moreover, the device in the embodiment, in which the suction opening is smaller than the total area formed by the multiplicity of food slices, does not project above the edges of the food slices and permits a method for the production of packaged food slices with positioning of the food slices on the support, while the food slices are sucked against the suction opening, with subsequent reduction of the low pressure. In this embodiment of the method, the support can have walls, which closely adjoin the edges of the food slices, for example, with a distance of maximally 5mm, preferably maximally 2 or maximally 1mm.

Independent of the cross section of the conduit section at a distance to the suction opening, the suction opening can have rectangular, circular, oval or any other form, preferably a form, which corresponds to an uninterrupted surface section of the total area, which is formed by the overlapping food slices.

The edges, which delimit the suction opening, can be rigid or elastic, for example, rubber elastic.

The conduit section connects the suction opening with an opening, which is connected to a low pressure source. Within the conduit section, distance pieces are preferably arranged, which project maximally up to the plane of the suction opening, preferably end at a distance to the plane of the suction opening, for example, at a distance of 0.2 to 2cm or up to 1cm. The distance pieces are, for example, fixed on the inner surface of the conduit section, which forms the suction section, which ends in the suction opening. The distance pieces are, for example, spaced among each other by 10 to 1 cm, preferably 5 to 2cm. An individual web or a grid, for example, made from at least two parallel or intersecting webs, can be attached within the conduit section.

The suction section formed from the conduit section is connected to a low pressure generator, so that low pressure generated by the low pressure generator acts through the suction section in the suction opening delimited by the edge. The low pressure generator can be arranged immediately adjacent to the suction section or be connected to the suction section by means of a rigid or flexible conduit.

Preferably, the gripper device has a time-dependent control, which clocks the application of the low pressure, particularly, coordinates with the movement of the gripper device, in that in a first end position low pressure acts in the conduit section, for example, through the engagement of the low pressure generator, and in a second end position spaced apart for ejecting the food slices the low pressure is switched off or relaxed in the conduit section and preferably an ejector is operated or in the case of a preferred low pressure generator the second opening of the central tube is closed. Optionally the gripper device has a proximity switch, which is arranged to control the application of the low pressure and, for example, controls a low pressure generator or controls a valve arranged between the low pressure generator and the gripper device. In one embodiment, the proximity switch has an optical sensor or an element mounted movably on the gripper device, which is moved from its unloaded position by the approach of the food. Such a movably mounted element can, for example, be a spring-loaded element. Optionally, the proximity switch has a small tube, which is loaded with compressed air and the mouth of which projects maximally into the plane of the suction opening and is connected with an actuator, for example, with a valve, which engages the low pressure generator in covering the mouth. Preferably, the device is arranged in a first position, in which the suction opening is arranged against the overlapping food slices, to load the conduit section with low pressure and to switch off the low pressure in

a second position spaced apart from the first position and preferably also to load the conduit section with overpressure and /or to operate the ejector.

The device has a controlled low pressure generator, or is connected in a controlled manner with a low pressure generator. The control of the low pressure generator or the control of the connection to the low pressure generator permits the control of the application of low pressure to the suction opening and the controlled reduction or interruption of the low pressure for depositing the food slices after their positioning on the support.

Preferably the device has an ejector, which, for example is movable and is disposed against the suction opening, to remove the food slices from the suction opening. The ejector can be arranged outside, preferably inside the conduit section and, for example, be movable mechanically, hydraulically, preferably by compressed air, or electromechanically. Alternatively, the ejector can be a small tube which can be loaded with compressed air, which leads into the plane of the suction opening or at a distance from this plane, so that food slices sucked against the suction opening by compressed air, which exits from the mouth of the small tube, are moved away from the suction opening. Preferably, the ejector is controlled depending on the position of the gripper device.

The method for the production of packaged food slices comprises the steps of providing food slices, particularly by cutting, and arranging the food slices, particularly with complete overlap, preferably with only proportional overlap, arranging the suction opening of the device against the food slices, applying low pressure to the gripper device formed from the conduit section, for example, by generating low pressure by means of the low pressure generator, sucking in the food slices on the suction opening spanned by the conduit section, positioning the food slices on a support, reducing the low pressure, optionally applying overpressure to the suction opening, and depositing the food slices on the support, optionally with the step of removing the food slices by means of an ejector, of removing the device from be food slices and preferably sealing the support, for example, by sealing by means of a lid, which in particular is a foil.

The low pressure generator can be a vacuum pump. Preferably, the low pressure generator is drivable by means of a compressed air source.

The preferred low pressure generator has a central channel in a housing, which is preferably arranged along the longitudinal center axis of the housing. The central channel has a first opening, which is spanned by a convex surface about the central

channel. The convex surface extends preferably rotationally symmetrically about the longitudinal axis of the central channel and particularly preferably has a curvature parabolic to the radius of the longitudinal center axis of the central channel, the gradient of which increases in the direction towards the longitudinal center axis of the central channel, i.e. the gradient of which becomes greater with decreasing radius, in order to form a curvature increasing relative to the longitudinal center axis. The central channel has its smallest cross section in connection with the convex surface and broadens from this smallest cross section in the direction towards its second opening, which is opposite the first opening, preferably with conically increasing cross section.

This first opening of the central channel is delimited by an annular outlet opening of an inlet channel. Here, the annular outlet opening is formed by a shoulder spaced apart from the convex surface, so that the cross section of the outlet opening is arranged in a section adjacent to the first opening, preferably is spaced apart about an axial section of the longitudinal axis of the central channel. The shoulder is preferably annular, so that with the spaced apart convex surface, which spans the first opening, it forms an annular outlet opening about the longitudinal axis of the central channel.

The suction section is opposite the first opening and spaced about the annular outlet opening is connected with the low pressure generator. Optionally, the suction section can have a rigid or flexible conduit adjacent to the first opening or adjacent to the shoulder, through which the low pressure acts and is spaced apart from the edge, for example, by a total of 20cm to 5m or more, for example, in order to keep the gripper device itself small and in order to keep the noise emanating from the low pressure generator away from the gripper device.

Generally, the suction opening preferably has an open cross section, wherein the cross section of the suction section formed by the conduit section can be spanned by webs or a grid, which reduces the penetration of sucked in objects, in particular, of food components. Preferably, a grid, which spans the suction section, preferably at a distance to the suction opening, has grid openings with a cross section, which is equal to or smaller than the cross section of the central channel at its section of the smallest cross section. In this design, only components are sucked through the grid, which can also go through the section of the smallest cross section of the central channel, so that blockages of the central channel are prevented. Grids or webs can be arranged at a distance to the suction opening within the conduit section, for example, spaced from

10% to 80% or up to 50% of the distance between the suction opening and first opening of the suction opening.

Webs or grids, which span the suction opening or the suction section, can have outlets, which are smaller than the food to be held, since this low pressure generator is generally disposed, in the case of a compressed air supply to suck the food against the suction opening and in the case of an interruption of the compressed air supply to let the food drop from the suction opening, for example, under the influence of gravity. This low pressure generator preferably has a valve, which is disposed to periodically open the compressed air supply to the annular outlet opening, so that the food is then sucked against the edges, and, accordingly, to interrupt the compressed air supply, in order to let the food fall. The shoulder is formed, for example, from a pipe section. The low pressure formed at the first opening acts in the pipe section.

The second opening of the central channel is connected with an outlet opening, from which the compressed air flowing in through the annular outlet opening exits in a mixture with air sucked in through the suction opening and sucked in solid and/or liquid components. For, upon application of compressed air to the annular outlet opening, the convex surface spanning the first opening generates a low pressure, which acts in the suction section, wherein the compressed air exiting from the annular outlet opening flows along the convex surface into the central channel and exits through its opposite second opening.

Optionally, the second opening of the central channel can be at least partially, in particular, completely closable, for example, by means of a valve, which is arranged at the second opening or at the outlet channel connected to the second opening. The valve can be arranged directly at the second opening or at a conduit, which is connected to the second opening of the central tube and forms the outlet channel. The step of closing the second opening leads in a process with the gripper device to the fact that a foodstuff sucked in at the suction opening is pushed away or blown away. For the closing of the second opening prevents the escape of the compressed air mixed with the sucked in air through the central channel and generates an overpressure in the pipe section, which exits through the conduit section and the suction opening.

Preferably the conduit section is connected directly to the pipe section of the preferred low pressure generator; in particular, the conduit section and pipe section can be adjoined to each other or designed in one piece.

Preferably, the outlet opening is formed in that the second opening of the central channel is connected to an outlet channel, which leads into the outlet opening. The outlet opening preferably has a cross section, which is directed in the direction towards the plane, in which the suction opening is arranged, and preferably lies parallel to the cross section of the suction opening, so that solid or liquid components exiting from the outlet opening exit in the direction towards the food arranged on at the suction opening.

In one embodiment the outlet channel is formed by a section of the housing, which is arranged at a distance about the surface of the conduit, which lies opposite the inlet channel. In this way, the inlet channel and outlet channel can be arranged coaxially to the central channel and be separated from each other by a conduit, which is arranged between housing and outer wall of the central channel.

Preferably, the outlet channel is formed by the inner wall of a housing and the pipe section, which forms the suction section and has a shoulder, which delimits the annular outlet opening with the spaced convex surface at the first opening of the central channel. The housing encompasses the central tube, which forms the central channel, so that the surface of the central tube, which is opposite the central channel, forms the outlet channel with the inner wall of the housing and a part of the pipe section. Preferably, the housing has a compressed air connection and the connecting inlet channel, which conducts the compressed air to the annular outlet opening. The inlet channel is preferably in one section designed as a pipe or hose and has an annular channel section arranged about the annular opening, which is preferably coaxial to the annual outlet opening. The annular channel section preferably has a constant cross section arranged rotationally symmetrically about the annular outlet opening. The section of the inlet channel designed as a pipe or hose can be installed outside the housing, or preferably run inside the housing. Particularly preferably, the inlet channel runs inside at least one gripper rod, which connects the pipe section with the housing and, for example, is attached to a housing section, which is arranged opposite the suction opening, for example, at the second end.

Preferably, the housing section opposite the suction opening is designed as a carrier plate, which has a fastening device for fastening the gripper device to a machine- or robot arm, which, for example is a component of a slicer, wherein the fastening device optionally bears the compressed air connection. Accordingly, the housing preferably has a carrier plate opposite the suction opening or at a distance to the suction opening, which is connected to the pipe section by means of at least one carrier.

In this embodiment it is preferred, that the housing is spaced apart from the second opening of the central tube, particularly in that the carrier plate is arranged at a distance from the second opening, so that the volume between the inner wall of the housing and the central tube forms the outlet channel, so that, for example, a reduction of the flow speed and/or a reduction of the noise development at the outlet opening is achieved through the enlargement of the cross section from the central channel to the outlet channel .

Further preferably, the housing opposite the second opening of the central tube, for example, the lid plate, is designed inwardly convex, for example, dome-shaped, with parabolic cross section or conical, and preferably symmetrical to the longitudinal axis of the central tube, so that the housing or the lid plate project in the direction towards the central tube. This embodiment is advantageous due to the lower noise development when operating, for example, in comparison with a housing with cylindrical internal cross section.

The low pressure generator of this embodiment has a suction opening spanned by a conduit section, which forms a suction section, wherein at a distance to the suction opening in the pipe section a convex surface is arranged spaced about the annular outlet opening of the suction section, which spans a first opening of a central channel formed in a central tube, wherein the convex surface leads into an axial section with the smallest cross section of the central channel, to which a section of the central channel connects, which broadens towards a second opening opposite the first opening, and the annular outlet opening is connected via an inlet channel with a compressed air connection, wherein the central tube is guided displaceably along its longitudinal axis in a recess of the pipe section, up to a first abutment surface, which has the central tube on its outer surface opposite the central channel, against which rests a second abutment surface of the pipe section parallel to it, wherein preferably the central tube is encompassed by a housing.

The gripper device with such a low pressure generator is easy to clean and is suitable, in particular, for use for cleaning in an automatic dishwasher, in that the central tube is arranged detachably on a section of the pipe section spaced from the first opening. In this embodiment, the central tube can have a first abutment surface on its surface arranged opposite the central channel, which extends at least proportionally, preferably extensively closed about the central tube. The central tube is arranged detachably on the pipe section, in that the first abutment surface of the central tube is

adjoined detachably to a second abutment surface, which is arranged on the pipe section, optionally can be latched to the second abutment surface and, in particular, abuts only against the second abutment surface and through the gravity and/or the force generated with the entry of compressed air is loaded against the second abutment surface. In this embodiment, the central tube can be removed from the second abutment surface by unlocking or by movement without detaching a connection or an additional fastening, so that the central tube can easily be separated from the pipe section and the elements arranged on the latter for cleaning.

Preferably, the second abutment surface is at least sectionwise, preferably completely parallel to the first abutment surface, in order to form a sufficient seal in arrangement against each other between the inlet channel and the central channel. Preferably, the first abutment surface is arranged in an axial section between the first opening spanned by the convex surface and the opposite second opening of the central tube and the second abutment surface is arranged at a distance to the shoulder of the pipe section, which is equal to the distance of the first abutment surface to the first opening plus the axial extension of the annular outlet opening. Further preferably, the first and second abutment surfaces extend radially to the longitudinal center axis of the central tube.

Preferably, the second abutment surface is arranged on a socket of the pipe section, which lies opposite the suction section or opposite the suction opening. The socket comprises preferably a portion of the inlet channel and with the annular shoulder of the pipe section forms the annular channel section, which extends about the annular outlet opening. Optionally, a socket has recesses in the section adjoining a housing. The housing can be connected to the socket, for example, by means of engaging the socket and a section of the housing adjoining the outlet opening. Preferably, the housing has a carrier plate, which by means of at least one carrier, which extends preferably parallel to the central tube, connects to the socket. Particularly preferably, at least 2, more preferably 3 carriers are arranged between the carrier plate and socket, of which at least one carrier forms an annular section of the inlet channel. Optionally, the low pressure generator can have precisely one carrier, which is arranged between the carrier plate and socket and forms an annular section of the inlet channel.

Optionally, an actuator is arranged on the central tube, with which the central tube can be moved with respect to the pipe section, in particular, parallel to the longitudinal axis of the central tube. Such an actuator can move the complete central

tube with respect to the first opening, or move a section of the central tube in respect to the first opening, for example, if the actuator moves two sections of the central tube against each other. The section of a central tube split into two sections, which faces the second end, is preferably fixed thereby on the housing. By means of such an actuator the distance of the first opening or of the convex surface of the central tube can be adjusted to the shoulder of the pipe section, so that the annular outlet opening is adjustable by the actuator, and thus the strength of the low pressure, which, in particular at the same pressure as the compressed air, is generated by the compressed air flowing into the annular outlet opening. Moreover, such an actuator serves to control the air volume, which flows through the central channel, so that, for example, in the embodiment with a valve, which closes the second opening of the central channel, the air volume exiting the suction opening is controlled when the central channel is closed. Such an actuator, which adjusts the cross section or the size of the annular outlet opening, can, for example, be arranged between the first and the second abutment surface or between the central tube and the housing. The actuator can, for example have a piezo-element and be arranged between the first and second abutment surface. Alternatively, the actuator can move two sections of the central tube against each other along the central axis of the central tube, which, for example, are mutually displaceable or are engaged with each other by means of a thread.

Optionally, the actuator can be controlled by a pressure sensor, which, for example, is arranged in the suction section of the pipe section or of the conduit section, so that in the process a regulation of the low pressure results at the suction opening. Accordingly, the low pressure generator in a preferred embodiment has a pressure sensor arranged in the suction section, particularly in the pipe section or conduit section, which controls the actuator, for example, in order in the process to adjust a preset low pressure at the suction opening .

Optionally, the central tube is engaged with the pipe section, if the first is arranged against the second abutment surface, for example, engaged by means of thread or by means of a bayonet catch. In this embodiment, the actuator can have an adjusting screw and/or a servomotor and be arranged between the pipe section and central tube, wherein the central tube is engaged rotatably with a thread of the pipe section.

In this embodiment, the central tube can optionally be arranged exclusively by arrangement of its first abutment surface against the second abutment surface arranged

on the pipe section exactly positioned on the pipe section, preferably in combination with the guidance of the central tube along its longitudinal axis in the pipe section, in order to form the annular outlet opening with the first opening, since during operation the compressed air flowing through the annular outlet opening generates a low pressure, which loads the convex surface of the central tube against the abutment surface. If the first abutment surface is formed from an, for example, annular base about the central tube, the over pressure generated within the housing can load and hold the base of the central tube against the second abutment surface. Accordingly, the low pressure generator of this embodiment can be designed without firmly bonded or clamping connection or screw connection between the central tube and the pipe section.

In one embodiment, the low pressure generator can have or consist of a pipe section with a preferably circular shoulder and a second abutment surface arranged at a distance to the shoulder and an annular channel section arranged between the shoulder and the second abutment surface, which is connected to an inlet channel, as well as a central tube with a first opening, which is bordered by a convex annular surface, an opposite second opening and a first abutment surface, which is configured parallel to the second abutment surface, is arranged against the second abutment surface and is arranged between first and second opening on the central tube, wherein preferably an outlet opening is formed in that the second opening of the central channel is connected to the outlet channel, which , in particular, is formed from the inner wall of the housing and the outer surface of the central tube, wherein the outlet channel leads into an outlet opening, which is arranged in the direction towards the plane, in which the suction opening is spanned.

Generally, the outlet opening can be formed in the alternative to the opening between the housing and the pipe section, which is connected to the conduit section forming the suction opening, from one end of a conduit, which is connected to the second opening of the central tube. This alternative embodiment permits the discharge of exhaust air, which exits from the second opening of the central tube, at a greater distance from the housing. This embodiment is advantageous in that the noise development is even lower during operation in the housing.

Preferably, the inlet channel, which leads into the annular outlet opening, is formed from the outer wall of the central channel and a conduit spaced apart from this,

which is preferably cylindrical. The inlet channel is connected to a supply line with a compressed air connection, to which a compressed air source can be connected.

In using the low pressure generator according to the present invention in a method for transporting or lifting objects, which in particular are food, the compressed air connection is loaded with compressed air, which flows through the inlet channel and flows through the annular outlet opening approximately perpendicular to the longitudinal axis of the central channel. In this way, the convex surface, which extends radially about the longitudinal axis of the central channel, is flowed against by compressed air flowing radially to the longitudinal axis of the central channel. In interaction with the increasing diameter of the central channel in the section, which connects to its section with the smallest cross section adjoining the convex surface, a low pressure is generated, which acts through the suction section and the pipe section in the conduit section and into the suction opening spanned by the latter. The suction opening is bordered by the edge, which is attached to the conduit section. By arrangement of a foodstuff above the suction opening or on the edge, the gripper device sucks the food against the edge.

The compressed air exiting through the annular outlet opening of the preferred low pressure generator mixes with the air and solid or liquid components, which enter through the suction opening, through the first opening, through the central channel and after flowing through the outlet channel from the outlet opening. Since the central channel has its smallest cross section in its section, which adjoins the convex surface opposite the first opening, components sucked in, which pass through this smallest cross section of the central channel, can exit through the flow along the central channel through its second opening, and can subsequently exit through the outlet channel and the outlet opening, without being sucked in by a low pressure source such as a vacuum pump. In this way, possible contaminations outside of the gripper device are prevented by the special flow guidance of the preferred low pressure generator. In the arrangement of the outlet opening in the direction towards the plane, in which the suction opening is arranged, solid or liquid components released from the sucked in object can be transferred back again to the sucked in object with the preferred low pressure generator. Alternatively, the outlet opening can have a conduit or a hose, optionally with connected filter or cyclone for separation of solid or liquid components from the exiting air.

The central channel of the preferred low pressure generator is formed with a central tube, on the first end of which the first opening of the central channel is

arranged, and the opposite second end of which has a second opening. The outer wall of the central tube opposite the central channel forms the inlet channel for compressed air in the preferred embodiment jointly with a conduit encompassing the central tube, which is preferably cylindrical.

In an optional embodiment of the preferred low pressure generator, the central tube consists of at least two sections, of which a first section comprises the area of the central channel of its first opening up to at least into the smallest cross section of the channel, more preferably up to in the region of the conically broadening central channel and a second adjoining section, which continues the central channel, for example, its conically broadening section, and comprises the second opening, or ends in the second opening. Particularly preferably, the first and the second section of the central tube are displaceable against each other along the longitudinal axis of the central channel, for example, while they are movable against each other by means of thread engagement along the longitudinal axis of the central channel.

Preferably, the housing comprises the central tube arranged at least sectionwise coaxially in the cylindrical conduit, through which the outlet channel is formed between the conduit and the housing.

Exact description of the invention

The invention is now described more precisely in reference to the figures, which schematically

- in figure 1 show a suction gripper in top view,
- in figure 2 show a suction gripper in sectional view,
- in figure 3 show a suction gripper in sectional view,
- in figure 4 show an embodiment of the device in sectional view,
- in figure 5 show a preferred embodiment of the device in sectional view,
- in figure 6 show the embodiment from figure 2 with the sectional plane before the central tube and
- in figure 7 show an embodiment in sectional view.

In the figures, the reference numbers designate elements which are functionally the same. The details described in the figures can be combined according to the present invention, even if they are described with reference to different figures.

Figure 1 shows a gripper device 30 formed from a conduit section 36, the suction opening 18 of which is arranged on overlapping food slices 31. The food slices 31 are displaced relative to each other with overlap. The suction opening 18 of the gripper

device 30 extends only over an approximately central rectangular portion of the total area, which is formed by the food slices 31. Opposite the suction opening 18, the gripper device 30 has a connection 35, to which a low pressure generator can be connected.

Figure 2 shows the gripper device 30 in sectional view, while food slices 3 are sucked in by low pressure, which acts through the first opening 5. The distance pieces 34 arranged within the gripper device 30 extend up to a distance before the plane of the suction opening 18. The distance pieces 34 improve the retention of the food slices 31, in that they prevent contact of the food slices 31 with the inner wall of the gripper device 30. For contact of the food slices 31 with the inner wall of the gripper device 30 would reduce the effect of the low pressure on the total area of the food slices 31.

Figure 3 shows, that during the sucking in of the food slices 31, which adhere to each other less strongly, for example, have dry surfaces and/or are more flexible, at the suction opening 18. Also, in the case of such food slices 31 the distance pieces 34 hold the food slices 31 at a distance to the inner surface of the conduit section 36, which forms the gripper device 31 and spans the suction opening 18.

Figures 4 to 7 show the device with the preferred embodiment of the low pressure generator, the pipe section 16 of which the conduit section 36 adjoins.

As is shown in figure 4, the low pressure generator has a central tube 1, in which a central channel 2 is arranged, preferably coaxially to the central tube 1. At the first end 3 of the central channel 2, a convex surface 4 of the central channel 2 spans the first opening 5 of the central channel 2. The convex surface 4 extends from the smallest cross section of the central channel 2 up to the plane, in which the first opening is spanned. Preferably the convex surface 4 has a parabolic cross section perpendicular to the longitudinal center axis of the central channel 2, the gradient of which increases from the plane, in which the first opening 5 is arranged to the section of the central channel 2 with its smallest cross section. Relative to the plane, in which the first opening 5 is spanned, a section extends adjoining the area of the smallest cross section of the central channel 2, the cross section of which increases relative to the second opening 6, in particular broadens conically from the smallest cross section of the central channel 2 up to the second opening 6. The second opening 6 forms the second end 10 of the central tube opposite its first end 3. Adjoining the first opening 5 an annular outlet opening is arranged, to which an inlet channel 8 is connected for compressed air. Preferably the annular outlet opening 7 is aligned approximately perpendicular to the

longitudinal cente axis of the central channel 2, particularly preferably perpendicular to the convex surface 4, in order for this to flow tangentially with exiting compressed air.

The annular outlet opening 7 is formed by an region of the convex surface 4 spaced apart from the central axis of the central channel 2 and a shoulder 9 spaced apart from the latter, which, for example, borders on the inlet channel 8.

The inlet channel 8 is formed from a region of the outer wall 1a of the central tube 1 and at least sectionwise from a conduit 11, which is particularly preferably cylindrical and is arranged coaxially to the central channel 2. A compressed air connection 12, which is arranged on the housing 13, is connected with the inlet channel 8 by means of a compressed air channel.

At the second opening 6 of the central channel 2 an outlet channel 4 is connected, which leads into an outlet opening 19. The outlet channel 14 is formed according to the preferred embodiment sectionwise from the inner wall of the housing 13 and the outer wall of the conduit 11. The outlet channel 14 can be formed from the inner wall of the housing 13, which is arranged at a distance about the central tube 1. According to a preferred embodiment, the outlet opening 19 is directed towards the plane, in which the suction opening 18 is spanned.

The shoulder 9 comprises the region, in which the first opening 4 is arranged, or the area of the first end of the central tube 1, in which low pressure, which can also be referred to as suction section 15, is generated upon application of the low pressure generator with compressed air to the compressed air connection 12. The suction section 15 is formed by a conduit section 36 connected to the pipe section 16, which opposite the shoulder 9 leads into an edge 17, which spans the suction opening 18. Preferably, the suction opening 18 is spanned in a plane, which is approximately parallel to the plane of the first opening 5.

The pipe section 16 with the adjoining conduit section 36 spans the suction section 15 from the shoulder 9 arranged annularly about the annular outlet opening 7 up to the plane, in which the edge 17 is arranged. The pipe section 16 or the conduit section 36 can taper or broaden along the suction section 15 to the suction opening 18, preferably the suction opening 18 spans a cross section, which is equal to or greater than the cross section of the housing 13. Preferably, the pipe section 16 spanning the suction section 15 is formed in one piece with the conduit 11 and the shoulder 9.

Further preferably, the central tube 10 or its second section, is connected to the inner surface of the housing 13. Optionally, the central tube 1, or its second section, can

be formed in one piece with the housing 13. The conduit 11 can be fixed on the central tube 1 or on its second section, particularly in embodiments, in which the central tube 1 is formed from a first and a second section, and the first section is displaceable along the longitudinal axis of the central channel 2 to the second section of the central tube 1, for example, by means of a thread, in which the first and second section of the central tube 1 are engaged with each other. Such a thread forms an actuator 33, with which the section of the central tube 1 adjoining the annular outlet opening 7 is displaceable against the shoulder 9.

An optional grid 32, which forms distance pieces, is arranged at a distance to the suction opening 18 inside the pipe section 16.

In the embodiment of figure 5, the compressed air connection 12 is attached to the end of the housing 13, which is opposite the suction opening 18. The compressed air connection 12 is formed by means of a tubular inlet channel 8, which extends in the housing 13 from its end opposite the suction opening 18 to the pipe section 16 and has an annular channel section 20 inside the pipe section 16, which extends about the annular outlet opening 7. The annular outlet opening 7 is formed by the annular shoulder 9 of the pipe section 16 and the spaced convex surface 4 of the first opening 5 of the central tube 1. On its inner surface the central tube 1 forms the central channel 2, which extends from the first opening 5 at the first end 3 to the second opening 6 at the opposite second end 10 and between the first end 3 and the second end 10 has a section with the smallest cross section adjoining the convex surface 4 and enlarges between this section with the smallest cross section to the second end. Generally, as is also depicted here, the pipe section 16 can have a larger diameter than the annular shoulder 9 or than the annular outlet opening 7. It is thereby preferred, that the inlet channel 8 has an annular channel section 20, which extends over a portion of the radial section, preferably over the entire radial section between the annular outlet opening 7 and the diameter of the pipe section 16 adjoining the annular outlet opening 7.

The central tube 1 has a first abutment surface on its outer surface, which is opposite the central channel 2. The first abutment surface 21 can be formed from a recess in the circumference of the central tube 1, or from a base 23 projecting above the central tube 1. The recess or a base 23 projecting above the central tube 1 are preferably annular and form an annular first abutment surface 21. The first abutment surface 21 can extend radially about the longitudinal axis of the central tube 1 in a plane or be a section of a conical surface, which is optionally arched. The second abutment

surface 22 is parallel to the first abutment surface 21, so that the first and second abutment surface 21, 22 lie on top of each other. The central tube 1 is encompassed by a section or socket 24 of the pipe section 16 or guided in a longitudinally displaceable manner, so that the central tube 1 is inserted into this section or socket 24, until its first abutment surface 21 pushes against the second abutment surface 22. Optionally, an actuator 33, for example, a piezo-element, is arranged between the first abutment surface 21 and the second abutment surface 22. By actuating the actuator the central tube 1 is displaced along its longitudinal axis relative to the pipe section 16, so that the height of the annular outlet opening 7 between the shoulder 9 and the convex surface 4 is changed. Due to the large influence of the height of the annular outlet opening 7 on the low pressure generated by means of the compressed air, the actuator 33 is generally suitable for adjusting the low pressure generated during the process for gripping or transporting. Moreover, the actuator 33 has the advantage, in addition to the effect as a regulating device for low pressure and air volume, of forming a closure valve for the compressed air with the shoulder 9 and region of the convex surface 4.

The housing 13 has a carrier plate 25, which is connected by means of at least one annular section of the inlet channel 8 to the pipe section 16, preferably to at least two, more preferably to three carriers 26, which extend between carrier plate 25 and pipe section 16, wherein at least one carrier 26 forms a section of the inlet channel 8. Since the carrier plate 25 is arranged at a distance from the second end 10 of the central tube 1, the inner surface of the housing 13 with the outer surface of the central tube 1 and the carriers 26 forms the outlet channel 14, which extends up to the outlet opening 19, which is delimited between housing 13 and pipe section 16.

In figure 6, the section in front of the central tube 1 is pulled, so that the outer surface of the central tube 1 is visible. As depicted, it is generally preferable, that in embodiments, in which the outlet channel 14 leads into an outlet opening 19 directed in the direction towards the plane of the suction opening 19, the pipe section 16 has a socket 24 with a surface 27, which extends from the second abutment surface 22 up to the outlet opening 19, and in particular runs with an inclination towards the longitudinal axis of the central tube 1.

Figure 7 shows a low pressure generator with gripper device 28, in which the central tube 1 has two sections displaceable against each other along the common axis, which are controlled movably against each other by an actuator 33.

List of reference signs:

	1	central tube		18	suction opening
	1a	outer wall of central tube 1		19	outlet opening
	2	central channel		20	annular channel section
	3	first end of central tube 1		21	first abutment face
5	4	convex surface		22	second abutment face
	5	first opening		23	base of the central tube
	6	second opening		24	socket
	7	annular outlet opening		25	carrier plate
	8	inlet channel		26	carrier
10	9	shoulder		27	surface of the socket
	10	second end of central tube 1		30	gripper device
	11	conduit		31	food slices
	12	compressed air connection		32	grid
	13	housing		33	actuator
15	14	outlet channel		34	distance piece
	15	suction section		35	connection
	16	pipe section		36	conduit section
	17	edge			

20

FREMGANGSMÅDE TIL TRANSPORT AF FØDEVARESKIVER

PATENTKRAV

1. Anvendelse af en ledningssektion (36), der er forbundet med en lavtryksgenerator som en holdeindretning til fødevareskiver (31), som er anbragt med overlapning, **kendetegnet ved, at** ledningssektionen (36) danner en indsugningssektion (15) og har en indsugningsåbning (18) som i en første position af holdeindretningen med tilført lavtryk placeres mod fødevareskiverne (31), som er anbragt med overlapning, hvor lavtrykket tilføres, indtil en anden position af holdeindretningen placeres med afstand til den første position og frakobles i den anden position.

2. Anvendelse ifølge krav 1, **kendetegnet ved, at** holdeindretningen placeres således, at ledningssektionen (36) i den anden position kan påvirkes med overtryk og/eller ledningssektionen (36) har en udkaster, som aktiveres i den anden position).

3. Anvendelse ifølge et af de foregående krav, **kendetegnet ved, at** holdeindretningen har en lavtryksgenerator, som i en afstand til indsugningsanordningen (18) har en konveks overflade (4), som er anbragt med afstand til en rørsektion (16) med en ringformet udløbsåbning (7), hvor den konvekse overflade (4) åbner en første åbning (5) i en central kanal (2), der er dannet i et centralt rør (1), hvor den konvekse overflade (4) munder ud i en aksial sektion, som har det mindste tværsnit af den centrale kanal (2), til hvilken der tilstøder en sektion af den centrale kanal (2), der udvider sig i retning mod en første åbning (5), som ligger over for den anden åbning (6), og hvor den ringformede udløbsåbning (7) er forbundet med en trykluftsforbindelse (12) via en indløbskanal (8), hvor det centrale rør (1) ledes i langsgående retning forskydeligt i en udsparing i rørsektionen (16), indtil en første anlægsflade (21), der er tilvejebragt på den udvendige overflade af det centrale rør (1) over for den centrale kanal (2), ligger an mod en dermed parallel anden anlægsflade (22) af rørsektionen (16), hvor rørsektionen er forbundet med en ledningssektion (36) som har en indsugningsåbning (18).

4. Anvendelse ifølge krav 3, **kendetegnet ved, at** den ringformede udløbsåbning (7) er dannet af en sektion af den konvekse overflade (4), som er anbragt med radial afstand fra den centrale kanals (2) langsgående akse og af en ansats (9), som er anbragt med aksial afstand dertil, som i det mindste i et ringformet område dækker den konvekse overflade (4).

5. Anvendelse ifølge et af kravene 3 til 4, **kendetegnet ved, at** det centrale rør (1) er ført i en udsparing i en studs (24) af rørsektionen (16), og at den anden anlægsflade (22) omslutter udsparingen i studsen (24).

6. Anvendelse ifølge et af kravene 3 til 5, **kendetegnet ved, at** der i ledningssektionen (36) er anbragt mindst ét afstandsstykke (34) for at strække sig maksimalt ind i indsugningsåbningens (18) plan, og/eller at der i ledningssektionen (36) er anbragt mindst én udkaster, som kan bevæges imod indsugningsåbningen, eller som er et rør, som kan påvirkes med trykluft, hvor røret åbner ved eller i indsugningsåbningens (18) plan.

7. Anvendelse ifølge et af kravene 3 til 6, **kendetegnet ved, at** den anden åbning (6) i det centrale rør (1), som ligger over for den første åbning (5), kan lukkes i det mindste delvist ved hjælp af en ventil, hvilken ventil er anbragt ved den anden åbning (6) eller i en ledning, som er forbundet med den anden åbning (6) i det centrale rør (1), der danner en udgangskanal (14).

8. Anvendelse ifølge et af kravene 3 til 7, **kendetegnet ved, at** det centrale rør (1) er omsluttet af et hus (13), og indgangskanalen (8) er sektionsvist dannet af det centrale rørs (1) ydervæg (10), og at der er anbragt en ledning (11) koaksialt med en afstand.

9. Anvendelse ifølge et af kravene 3 til 8, **kendetegnet ved, at** rørsektionen (16) og ledningssektionen (36) støder op til hinanden.

10. Anvendelse ifølge et af kravene 3 til 9, **kendetegnet ved, at** der på det centrale rør (1) er anbragt en aktuator (33), via hvilken det centrale rør (1) er bevægeligt i det mindste sektionsvist i forhold til rørsektionens (16) ansats (9).

11. Anvendelse ifølge et af kravene 3 til 10, **kendetegnet ved, at** der er anbragt en tryksensor i rørsektionen (16) og/eller i ledningssektionen (36), og at aktuatoren (33) kan styres i afhængighed af målesignalet fra tryksensoren.

12. Anvendelse ifølge et af kravene 3 til 11, **kendetegnet ved, at** det centrale rør (1) er fastlåst til rørsektionen (16) ved hjælp af en bajonetlås eller et gevind.

13. Anvendelse ifølge et af kravene 3 til 12, **kendetegnet ved, at** den anden åbning (6) i det centrale rør (1) er forbundet med en ledning, som rager ud over huset (13).

14. Anvendelse ifølge et af kravene 3 til 13, **kendetegnet ved, at** huset (13) er anbragt med en afstand til den anden åbning (6) og omslutter en udløbskanal (14), der

munder ud i en udløbsåbning (19), som er afgrænset af rørsektionen (16) og huset (13) og vender i retning mod det plan, i hvilket indsugningsåbninger (18) ligger.

15. Anvendelse ifølge et af kravene 3 til 14, **kendetegnet ved, at** studsen (24) har en kontinuerlig overflade (27), som strækker sig fra den anden anlægsflade (22) til udgangsåbningen (19) og er skråtstillet imod det centrale rørs (1) langsgående akse.

16. Anvendelse ifølge et af de foregående krav, **kendetegnet ved, at** det centrale rør (1) er dannet af en første sektion og en anden sektion, som er bevægelige langs den centrale kanals (2) langsgående akse.

17. Anvendelse ifølge et af kravene 3 til 16, **kendetegnet ved, at** lavtryksgeneratoren har en ventil, som er indrettet til periodisk at åbne ledningen (11) for trykluftforsyningen til den ringformede udløbsåbning (7).

18. Anvendelse ifølge et af kravene 3 til 17, **kendetegnet ved, at** der er anbragt en tryksensor og/eller en nærhedssensor i indsugningssektionen, og at aktuatoren (33) kan styres i afhængighed af målesignalet fra tryksensoren.

19. Fremgangsmåde til fremstilling af fødevareskiver (31), der er anbragt med overlapning på en støtte, som omfatter trinnene med at tilvejebringe fødevareskiver (31), der har overlapning, og positionere fødevareskiverne (31) på støtten, **kendetegnet ved** brugen af en ledningssektion (36), der er forbundet med en lavtryksgenerator til fastholdning af fødevareskiver (31), hvor indsugningssektionen (18), der er dannet af ledningssektionen (36), i en første position anbringes mod fødevareskiverne (31), påføring af lavtryk til ledningssektionen (36), fastsugning af fødevareskiverne (31) til indsugningsåbningen (18) samt reduktion af lavtrykket og placering af fødevareskiverne (31) på støtten og fjernelse ledningssektionen (36) fra fødevareskiverne i en anden position, som har en afstand til den første position.

20. Fremgangsmåde ifølge krav 19, **kendetegnet ved, at** rørsektionen (16) inklusive ledningssektionen (36) forbundet dertil, som danner indsugningssektion (15), påvirkes med overtryk for at placere fødevareskiverne (31).

21. Fremgangsmåde ifølge et af kravene 19 til 20, **kendetegnet ved** brugen ifølge et af kravene 3 til 18.

Fig. 1

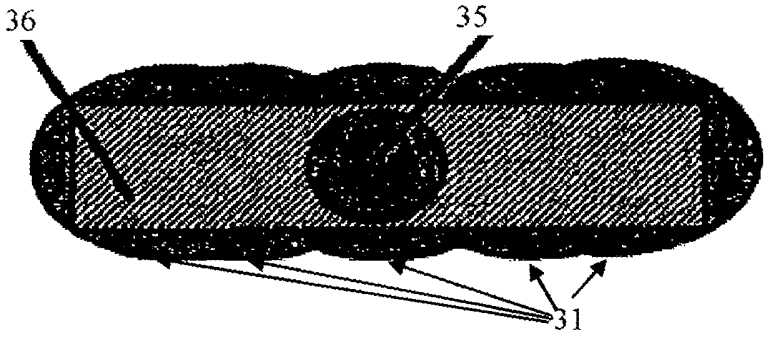

Fig. 2

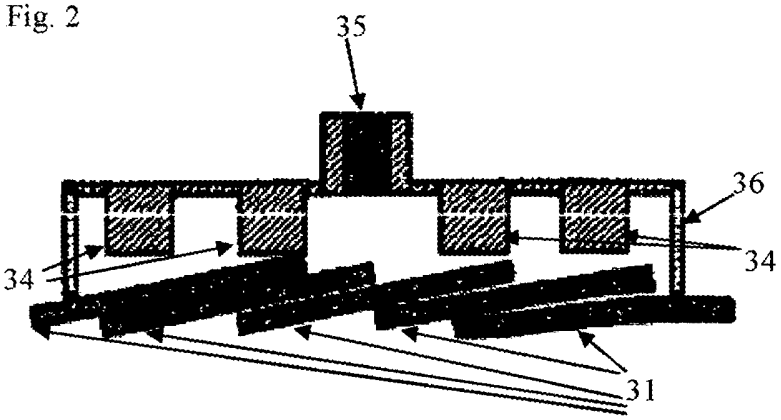

Fig. 3

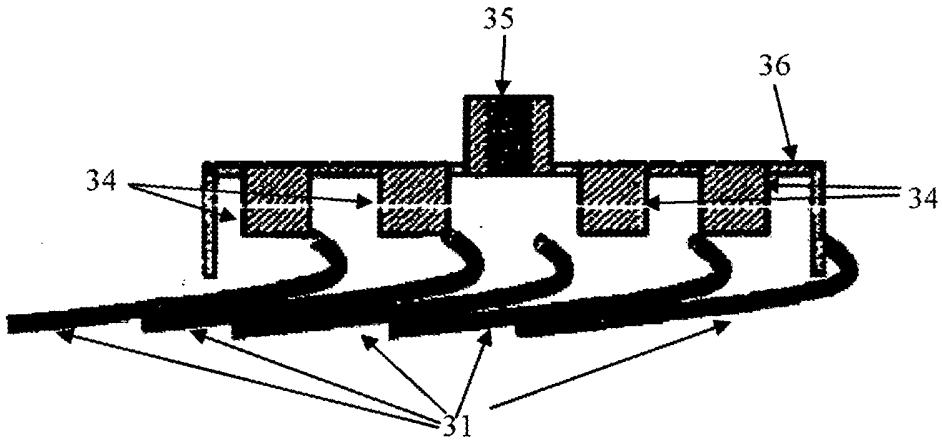

Fig. 4

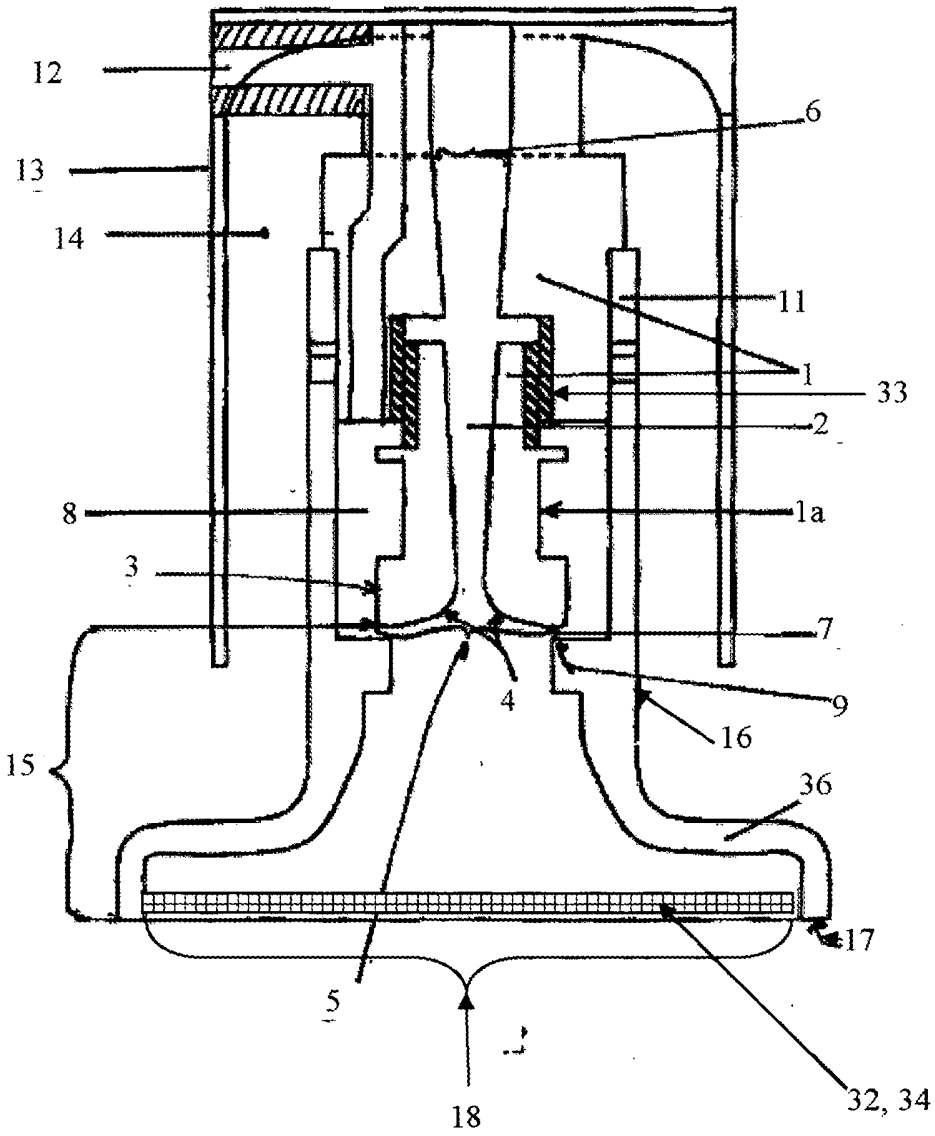

Fig. 5

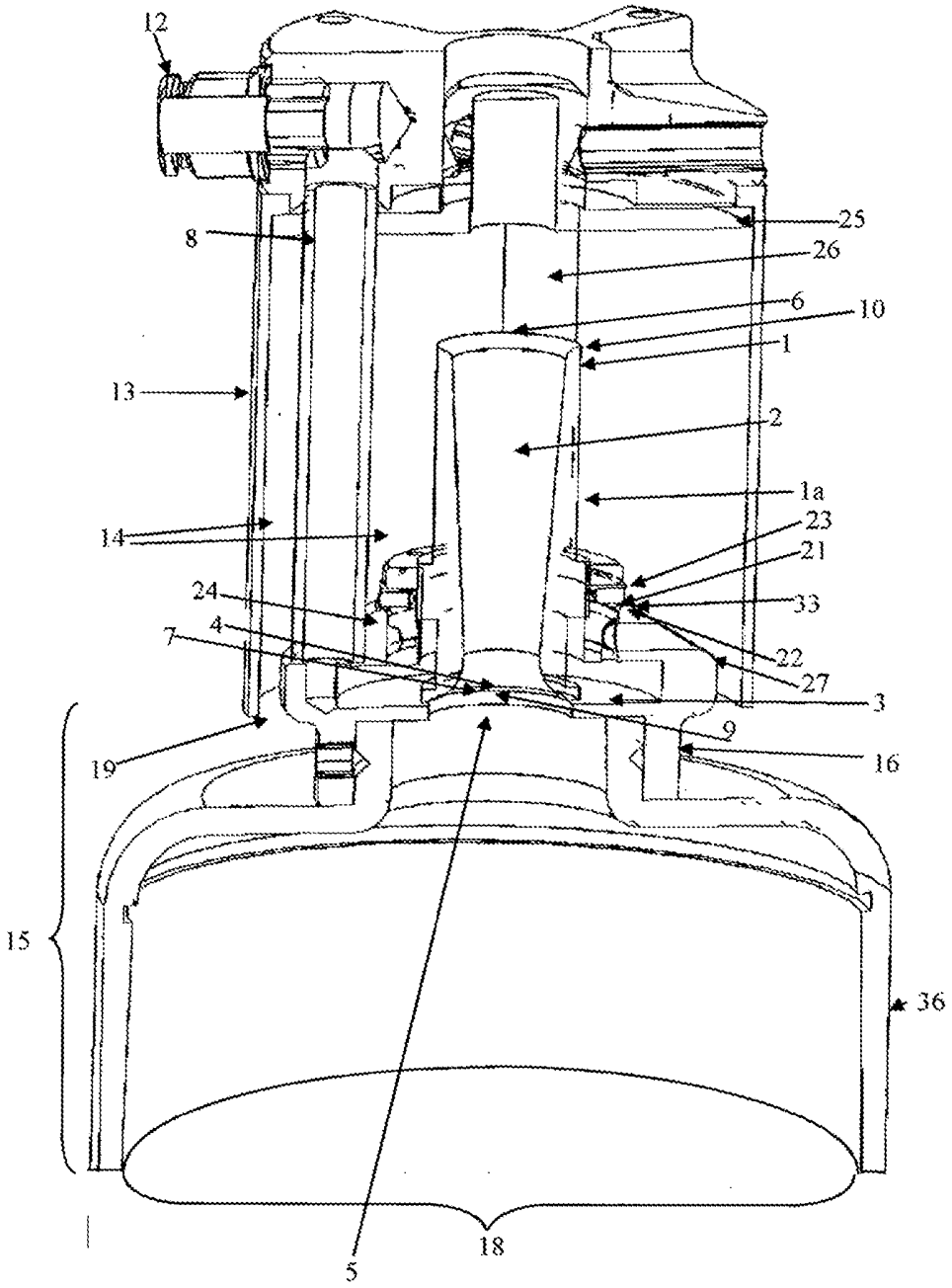

Fig. 6

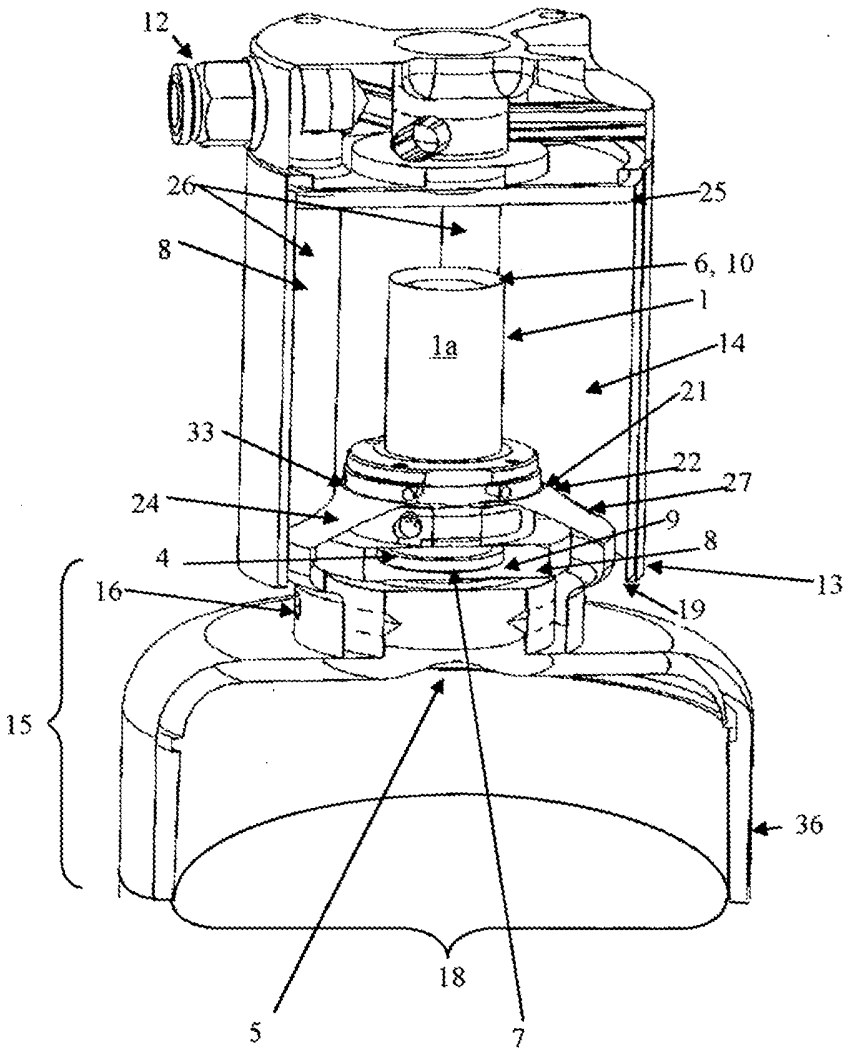

Fig. 7