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(54) **FASTENING DEVICE**

(57) The present invention relates to a fastening device (10), said fastening device (10) comprising an expansion sleeve (11) having an, in particular cylindrical, elongated hollow sleeve body (13), wherein the sleeve body (13) comprises one or more, preferably four, longitudinal slots (15), which are provided spatially spaced from one another in the sleeve body (13), an elongated expansion pin (12) being provided as a drive-in pin, wherein the sleeve body (13) defines a receiving space (24), which is provided for receiving and guiding the expansion pin (12) being inserted into the sleeve body (13). In order that the fastening device (10) is universally useable for different sized applications, and wherein, at the same time the fastening device (10) can get manufac-

tured easily and cost-effectively, it is provided according to the present invention, that the elongated expansion pin (12) comprises a longitudinal profile element (28), that the elongated expansion pin (12) comprises at least one, in particular longitudinal, rib element (32) protruding outwardly from an outer surface of the longitudinal profile element (28), and that the rib element (32) is provided for exerting a pressure force on an inner surface (35) of the sleeve body (13), when the expansion pin (12) gets inserted into the receiving space (24) of the sleeve body (13). In particular, the elongated expansion pin (12) and the sleeve body (13) are connected to one another via a material bridge (34), said material bridge (34) connecting the expansion pin (12) with the sleeve body (13).

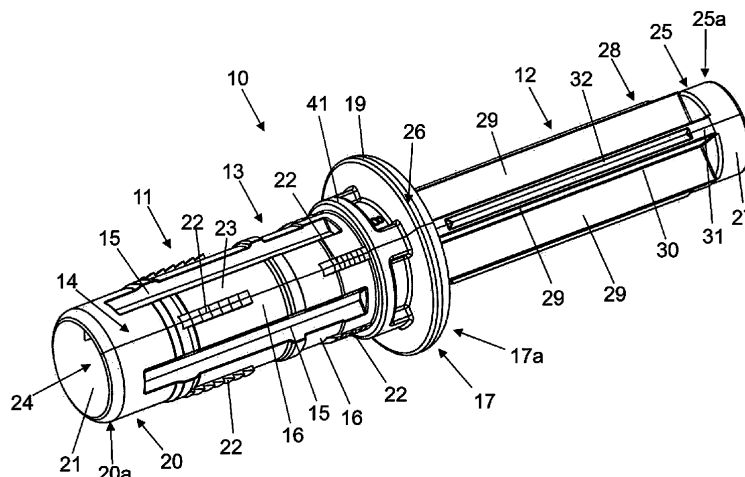


Fig. 1

Description

[0001] The present invention refers to a fastening device according to the preamble of independent claim 1 as well as to the preamble of independent claim 5. Furthermore, the present invention is directed to a waste container, and to a method of mounting a first component to a second component by making use of a fastening device according to the invention. Finally, the present invention is directed to different preferred methods of manufacturing such fastening devices.

[0002] Fastening devices in different configurations are well known for decades. DE 1 097 117 A for example describes a fastening device which is configured as a cylindrical expansion dowel. The dowel, which is made of a plastic material, is slotted over a part of its length. The rear end of the dowel has an opening for inserting a fastening screw. The front end of the dowel is provided with sawtooth-shaped incisions on the dowel circumference.

[0003] EP 2 182 223 A2 describes a nail dowel comprising an expansion sleeve and an expansion pin being a nail, a screw nail, a screw or the like. The expansion pin is arranged in a ready-to-use state as an insert in the expansion sleeve and is encapsulated with the material that forms the expansion sleeve. However, the expansion pin is not completely, but only partially encapsulated. The expansion pin can thus be driven into a receiving space of the expansion sleeve after the nail dowel has been introduced into a borehole. The expansion sleeve expands outwardly and the nail dowel can get fastened in the ground. In order to get this nail dowel manufactured, the expansion pin made of steel is inserted as an insert into an injection moulding tool. Next, the expansion sleeve, which is made of plastic, partially encapsulates the expansion pin during an injection moulding step. However, this method is complex and it needs several manufacturing steps.

[0004] Fastening devices which are configured as so-called hinge pins and which form part of a hinge device, are widely used to pivotably secure a first component, a lid device for example, to a second component, a container body of a container for example. Such a container can be provided as a waste container for example. In the latter case, such hinge pins are generally used to pivotably link a lid device to a waste container body.

[0005] Known hinge pins of that kind, which are generally provided as solid body components, are made of an elastomeric material. Their diameter is slightly larger than the diameter of a receiving sleeve of the hinge device. The hinge pins are hammered into the receiving sleeve under the exertion of an impact force. As a result, the hinge pins are squeezed together and thus generate a form-fitting connection.

[0006] In recent years it has become more and more known to provide such waste containers with a modular configuration. That means that the different components, such as the lid device, the container body and the like

are manufactured as individual components which can get freely combined and which can get individually exchanged, if necessary. This usually happens on-site. However, in order to remove a hinge pin as described before it is at least necessary to use a special tool. This is time-consuming and carries the risk of injuries. Other hinge pins cannot get removed anymore or they are destroyed during the removal procedure.

[0007] A different problem with such hinge pins is that the hinge pin diameter must be synchronized to the inner diameter of the receiving sleeve of the hinge device. If the hinge pin diameter is too large, it is not possible to push the hinge pin into the receiving sleeve of the hinge device. On the other hand, if the hinge pin diameter is too small, no adequate connection can get realized. In situations, where an exchange of a hinge pin due to the exchange of a respective component of the waste container takes place on-site, it is therefore necessary to have different sized hinge pins at hand. This leads to an increased effort. This effect is increased by a number of elements added in the modular system in time or with modifications of existing elements. With each new element or change, the tolerance field increases. In time hinge pins therefore need to adapt to growing tolerances.

[0008] The general principles as described in EP 2 218 223 A2 are therefore not suitable to get transferred to such hinge pins as described above, since they are not universally useable with hinge devices, in particular receiving sleeves of hinge devices, of different sizes.

[0009] In the field of manufacturing, handling and maintaining of waste containers, manufacturing costs and time are significant factors. Furthermore, in view of a circular economy, it is more and more important to provide components that can get re-used.

[0010] Therefore, it is the object of the present invention to provide a fastening device, in particular a hinge pin, said fastening device consisting of an expansion sleeve and an expansion pin being provided as a drive-in pin, wherein the fastening device is universally useable for different sized applications, in particular receiving sleeves, wherein the fastening device can get re-used, and wherein, at the same time, the fastening device can get manufactured easily and cost-effectively.

[0011] In accordance with the present invention, this object is solved according to a first aspect of the invention by the fastening device with the features according to independent claim 1, according to a second aspect of the present invention by the fastening device with the features according to independent claim 5, according to a third aspect of the present invention by the waste container with the features according to independent claim 12, according to a fourth aspect of the present invention by the method of mounting a first component to a second component by means of such a fastening device according to the present invention according to independent claim 14, and according to a fifth aspect of the present invention by the method of manufacturing such a fastening device according to the present invention according

to independent claim 15.

[0012] Additional features and details of the present invention become apparent from the dependent claims, from the description and from the drawings. Therein, features and details which are described in connection with one of the aspects according to the invention apply with respect to their disclosure in their entirety also to the other aspects according to the invention, so that statements made with respect to one aspect of the invention also apply to their full extent to the other aspects of the invention, and vice versa.

[0013] According to the first aspect, which comprises the features of independent claim 1 the elongated expansion pin is configured in a special way. According to the second aspect, which comprises the features of independent claim 5, the fastening device consisting of the expansion sleeve and the expansion pin is configured in a special way. However, both aspects underlie the same common basic idea, that a fastening device is provided that can get easily and cost-efficiently manufactured, whereby the fastening device is universally useable on site in connection with different sized applications, and wherein the fastening device can get re-used. Preferred embodiments for both aspects are described in more detail further below. The fastening device according to the first aspect of the invention as well as the fastening device according to the second aspect of the invention have the following features in common.

[0014] According to both aspects, a fastening device is provided. In particular, a fastening device is used to securely connect two different components with one another, whereby a first component is fastened to a second component, or vice versa. According to a preferred embodiment, the fastening device is provided for pivotably connecting the two components with one another. In such a case the fastening device is preferably provided as a hinge pin, said hinge pin being part of a hinge device. Some preferred embodiments of applications using such a fastening device are described in more detail further below.

[0015] As a first component, the fastening device comprises an expansion sleeve, said expansion sleeve having an elongated hollow sleeve body. In particular, the sleeve body is an elongated body that is hollow on the inside and open on both end faces, and that has a length which is greater than its maximum internal diameter.

[0016] The present invention is not limited to specific cross-sections for the hollow sleeve body. For example, the hollow sleeve body can have a rectangular or square or triangular cross-section. According to a preferred embodiment the hollow sleeve body has a circular cross-section. In this case, the hollow sleeve body has a circular inner diameter, and the hollow sleeve body is provided as a cylindrical sleeve body.

[0017] The sleeve body, in particular the wall or walling of the sleeve body, comprises one or more, preferably four, longitudinal slots, which are provided spatially spaced from one another in the sleeve body, in particular

in the wall or walling of the sleeve body. That means that the slots run in a lengthwise dimension or direction. If the hollow sleeve body is provided as a cylindrical sleeve body, it is preferably provided that the slots are evenly distributed over the perimeter of the sleeve body. In particular, the slots extend over a part of the lengths of the sleeve body. In particular, the material areas between two adjacent slots are configured as tongues or straps. Due to a force that is exerted from the inside of the sleeve body against the material areas between two adjacent slots, these material areas can get pushed outwards. Due to said force the material areas between two adjacent slots get expanded in an expansion direction, which is preferably perpendicular or almost perpendicular to the moving direction of an expansion pin, which will be explained in more detail further below. The slot or slots provide the flexibility for an easy assembly of the fastening device, as will be explained in more detail further below.

[0018] The present invention is not limited to a specific number of slots. At minimum it is necessary that the hollow sleeve body comprises one such slot. However, it is preferred that the hollow sleeve body comprises two or more such slots, three or four slots for example. According to a preferred embodiment, the hollow sleeve body comprises four slots. Four slots give the hollow sleeve body sufficient flexibility to get it easily assembled in a receiving sleeve. This will be described in more detail further below. Furthermore, the hollow sleeve body gets evenly in contact with the receiving sleeve, when the fastening device is activated.

[0019] As a second component, the fastening device comprises an elongated expansion pin being provided as a drive-in pin. In particular, a drive-in pin is a pin that gets pushed into the hollow sleeve body, when an impact force is exerted onto the pin. The expansion pin comprises a first end portion and a second end portion being opposite to the first end. The first end portion ends up in a first end, and the second end portion ends up in a second end. The first end portion comprises a head element which is provided for receiving the impact force, which can get exerted by means of a hammer or another suitable tool for example. The second end portion, in particular the second end, may comprise a chamfer for better guiding and positioning.

[0020] The hollow sleeve body comprises a receiving space, whereby the wall or walling of the hollow sleeve body borders the receiving space. The receiving space is provided for receiving and particularly guiding the expansion pin being inserted into and pushed through the sleeve body, by means of an impact force being exerted on the expansion pin, in particular on the head element thereof. The sleeve body comprises a first end portion providing an insertion opening for the expansion pin and a second end portion opposite to the first end. The first end portion ends up in a first end, and the second end portion ends-up in a second end. The first and/or second end portion, in particular the first and/or second end, may comprise a chamfer for better guiding and positioning.

[0021] When the expansion pin is pushed through the receiving space of the hollow sleeve body, at least parts of the outer surface of the expansion pin get in contact with the inner surface of the hollow sleeve body, in particular with the wall or walling thereof. The expansion pin exerts a pressure force on the inner surface of the hollow sleeve body, in particular on the material areas being provided between adjacent slots in the sleeve body, such that the material areas between the slots get expanded outwards. For that reason, the overall expansion of the expansion pin perpendicular to the lengthwise expansion of the expansion pin is preferably a bit longer than the inner diameter of the hollow sleeve body. Thus, the moving expansion pin will expand the sleeve body of the expansion sleeve, in particular the material areas between adjacent slots, by means of which any tolerance in a receiving sleeve of a component can get bridged, for which the fastening device is used, and which will be described in more detail further below.

[0022] According to the first aspect of the invention as claimed in independent claim 1, the elongated expansion pin is provided in a specific way. According to this first aspect, the elongated expansion pin comprises a longitudinal profile element, or the elongated expansion pin is provided as a longitudinal profile element. That means that the profile element runs in a lengthwise dimension or direction. Furthermore, it is preferably provided that the profile element has a length which is greater than its maximum diameter. The profile element can be configured in different ways. Therefore, the present invention is not limited to any specific configurations. Nevertheless, a number of advantageous embodiments thereof are described in more detail further below.

[0023] The elongated expansion pin comprises at least one, in particular longitudinal, rib element, which protrudes outwardly from an outer surface of the longitudinal profile element. In particular a rib element is a narrow strip element that is placed or shaped or provided or formed on the outer surface of the longitudinal profile element.

[0024] According to the invention it is sufficient that the elongated expansion pin comprises only one such rib element. However, for sufficient stability and a secure connection it is preferably provided that the elongated expansion pin comprises two or more such rib elements, which are provided spatially spaced from one another on the outer surface of the longitudinal profile element. It is preferably provided that the rib elements are evenly distributed over the perimeter of the elongated expansion pin. If the expansion pin comprises two or four rib elements, two rib elements are preferably provided at opposite sides of the expansion pin respectively.

[0025] According to the first aspect of the invention, the or each rib element is provided for exerting a pressure force on an inner surface of the sleeve body when the expansion pin gets inserted into the receiving space of the sleeve body and pushed therethrough. When the expansion pin is pushed through the hollow sleeve body,

the at least one rib element gets in contact with the inner surface of the hollow sleeve body as explained further above. Thus, a form fit and/or a frictional fit is generated between the outer surface of the hollow sleeve body and a component surrounding the sleeve body, a receiving sleeve for the fastening device for example.

[0026] Preferably, the overall diameter of the profile element including the at least one rib element is slightly greater than the inner diameter of the receiving space of the hollow sleeve body.

[0027] According to a preferred embodiment, the at least one rib element has a triangular shape. In general, a triangle is a polygon with three edges. With one of these edges the triangular rib element is connected to the longitudinal profile element of the elongated expansion pin. Opposite to this "connecting edge" the triangular shaped rib element comprises a triangle-tip, said triangle-tip being provided to get in contact with the inner surface of the hollow sleeve body. According to a preferred embodiment, the rib element is configured as an elongated member, an elongated profile element for example, said member or profile element particularly having a constant and unchanging triangular cross-section.

[0028] Therefore, the area of the rib element which comes in contact with the hollow sleeve element is very small, such that the impact force which is necessary to push the expansion pin through the hollow sleeve body is not too great. On the other hand, the triangular configuration of the rib element allows a firm fit of the expansion pin inside the sleeve body.

[0029] When the expansion pin gets pushed inside the hollow sleeve body and into a "locking position", the triangular rib elements press the hollow sleeve body, in particular the material areas between two adjacent slots in the sleeve body, against a component surrounding the fastening device, a receiving sleeve for example. The impact force that is exerted on the expansion pin, is transferred to the hollow sleeve body via the triangular rib elements whereby the tips of the triangular rib elements are in contact with the inner surface of the hollow sleeve body, whereby the triangular rib elements press and/or cut and/or shear the hollow sleeve body, in particular the wall or walling thereof. If the component surrounding the fastening device, the elongated hollow sleeve body thereof for example, is bigger, than the triangular rib elements will not cut so deep into the material of the hollow sleeve body, but will result in a larger expansion of the sleeve body due to the pressure force exerted on the inner surface of the sleeve body by the rib elements. Therefore, the arrangement and configuration of the rib elements allow to create more flexibility and/or to cover deviations.

[0030] According to a preferred embodiment, the length of the at least one rib element is shorter than the length of the longitudinal profile element. That means that the rib element extends over a part of the length of the longitudinal profile element. At least one end of the rib element(s) in particular the end facing the sleeve body,

preferably comprises a chamfer for better guiding and positioning.

[0031] In general, the present invention is not limited to specific geometrical values for the different components of the fastening device. According to an exemplary embodiment, the height of the rib elements may be in a range between 0.3mm and 0.7mm, preferably 0.5mm. The inner diameter of the hollow sleeve body, if the sleeve body has a cylindrical configuration, may vary between 15mm and 20mm, preferably between 19.2mm and 19.7mm. The expansion sleeve may have a length between 40mm and 60mm, preferably a length of 50mm.

[0032] According to the second aspect of the present invention, or alternatively as a preferred embodiment in accordance with the first aspect of the present invention, the fastening device comprises the features according to independent claim 5.

[0033] According to the second aspect of the present invention, the elongated expansion pin and the sleeve body are connected to one another via at least one material bridge.

[0034] In its initial state, and before the expansion pin gets pushed inside the hollow sleeve body for its operational mode, the fastening device is provided as one single member, said fastening device comprising the expansion sleeve and the expansion pin being integral parts thereof. In general, a material bridge is a, in particular integral or bonded, connection between two components, between the hollow sleeve body and the expansion pin in the present case. The material bridge has a thickness that is sufficient to hold the expansion pin and the hollow sleeve body together during transportation and storage of the fastening device. At the same time, the material bridge must be as thin as possible such that the expansion pin and the hollow sleeve body can get separated from each other without any complications, when the impact force is exerted on the expansion pin. The present invention is not limited to specific thickness values for the material bridge. According to a preferred embodiment, which however does not delimit the scope of protection, the material bridge has a thickness of less than 1mm, a thickness between 0.3mm and 0.6mm for example. Using such a material bridge between the expansion pin and the hollow sleeve body allows to manufacture the entire fastening device in one piece and in one single manufacturing process. Embodiments for suitable manufacturing processes are described in more detail further below. According to a preferred embodiment, the material bridge is provided as a film hinge or a film gate.

[0035] For the purpose of the present invention, it is generally sufficient to provide only one such material bridge. However, according to a preferred embodiment, two or more material bridges are provided for stability reasons and for more robustness of the fastening device.

[0036] According to a preferred embodiment, the material bridge connects the second end portion, in particular the second end thereof, of the expansion pin with

the first end portion, in particular the first end thereof, of the hollow sleeve body. Dependent on the configuration of the fastening device, the material bridge can be realized at a different location.

[0037] In the following, a number of different embodiments are described for the longitudinal profile element of the elongated expansion pin. For example, the longitudinal profile element can be configured as a solid material element or as a hollow profile element, each preferably having a cross-section or contour which corresponds to the cross-section or contour of the hollow sleeve body, in particular the receiving space thereof. For example, if the hollow sleeve body has a cylindrical shape having a receiving space with a circular cross-section, the longitudinal profile element of the elongated expansion pin may have a circular cross-section as well. If the receiving space of the hollow sleeve body comprises a rectangular or square cross-section, the longitudinal profile element of the elongated expansion pin can be configured accordingly.

[0038] According to a preferred embodiment, the longitudinal profile element of the elongated expansion pin is provided as a cross-profile element. The cross-profile element comprises four legs or arms, that intersect vertically and centrally. In particular, all legs or arms have the same length and/or width. Each leg or arm has a first end that is directed to respective first ends of the other legs or arms, whereby the four legs or arms are connected or joined to each other via their first ends respectively. Furthermore, each leg or arm has a second end opposite to its first end, said second end being a free end. At least one rib element is provided at a second end of at least one of the legs or arms. In general, it is sufficient for the present invention, that only one rib element is provided at one leg or arm. However, for stability reasons and for providing a secure connection between the expansion pin and the hollow sleeve body, two or more, preferably four, rib elements are provided at the legs or arms. If two rib elements are used, the rib elements are provided at free ends of such legs or arms, which are opposite to each other. If four rib elements are used, each free end of each leg or arm is provided with a rib element respectively.

[0039] According to a preferred embodiment, the head element of the expansion pin has a shape and/or size that corresponds to the shape and/or size of the receiving space of the sleeve body and/or of the insertion opening of the sleeve body. This allows a better guiding and positioning of the expansion pin inside the hollow sleeve body.

[0040] The present invention is not limited to specific embodiments for the head element of the expansion pin. It is one purpose of this head element to receive an impact force, by means of which the expansion pin gets pushed and moved through the receiving space of the hollow sleeve body of the expansion pin. According to a preferred embodiment the head element has a circular shape. According to a different preferred embodiment,

the head element has the shape of the longitudinal profile element of the expansion pin. In this case the head element can be provided by an end of the longitudinal profile element.

[0041] According to yet another preferred embodiment the head element has the shape of a cross. In such a case the insertion opening of the sleeve body may have a corresponding cross shape as well. By use of such a head element the expansion pin can get easily re-used. The cross-shaped head element preferably comprises a base area being square or almost square in shape. The four legs or arms of the cross are provided in each corner of the base area, and they protrude from these corners to the outside beyond the base area.

[0042] In order to increase the static friction, at least one clamping tooth, or at least one clamping hook, or at least one sawtooth-shaped arrangement consisting of two or more clamping teeth or hooks is provided which protrudes from an outer surface of the sleeve body, in particular from a material area between two slots in the sleeve body.

[0043] Preferably the height of the tooth/teeth or hook/hooks of the sleeve element is selected or determined in a defined relationship and/or dependent to the height of the rib element or rib elements of the elongated expansion pin. In particular, the height of the tooth/teeth or hook/hooks of the sleeve element is selected or determined proportionally to the height of the rib element or rib elements of the elongated expansion pin. If the height of the rib element(s) is reduced, for less friction during the push-in movement of the expansion pin into the hollow sleeve body for example, this reduction in height is compensated by enlarging the height of the tooth/teeth or hook/hooks at the outside of the sleeve body.

[0044] According to a preferred embodiment, the second end portion of the sleeve body, in particular the second end thereof, provides an exit opening for the expansion pin. When the fastening device gets activated, the expansion pin is pushed through the insertion opening into the receiving space of the hollow sleeve body. If the fastening device gets deactivated, the expansion pin must get pushed out of the hollow sleeve body again. However, in contrast to the known solutions described further above, it is no longer necessary to use a special tool. By exerting an impact force on the head area of the expansion pin again, by means of a simple hammer for example, the expansion pin gets further pushed through the hollow sleeve body and finally through the exit opening, whereby the expansion pin can leave the hollow sleeve body via the exit opening. According to a preferred embodiment, the insertion opening provided by the first end portion of the sleeve body and the exit opening each have the same diameter and/or the same cross-section. According to a different embodiment, the insertion opening provided by the first end portion of the sleeve body and the exit opening each have a different diameter and/or a different cross-section.

[0045] According to yet another preferred embodiment, the expansion sleeve comprises a sleeve head which is provided at the first end portion of the sleeve body, in particular at the first end thereof, said sleeve head having a larger diameter and/or a larger cross-sectional area than the hollow sleeve body. In such a case the sleeve head surrounds the insertion opening of the hollow sleeve body as well. In particular, the sleeve head functions as some kind of a stop element, which prevents the hollow sleeve element from completely entering and disappearing inside the receiving sleeve, and which prevents the components being fastened by the fastening device from sliding-off from the fastening device. According to a preferred embodiment, the expansion sleeve additionally comprises a fixation ring being provided between the sleeve body and the sleeve head. The fixation ring, which also has the function of a guiding section, may have a diameter lying between the diameter of the sleeve head and the sleeve body. Either the sleeve head, as well as the fixation ring may comprise at least one chamfer for better guiding and positioning.

[0046] According to a preferred embodiment, the second end portion of the expansion pin has an inclined, in particular a conically tapered, course, which ends-up in the second end of the expansion pin. By this, positioning and guiding of the expansion pin is increased, in particular if the expansion pin is re-used. If a material bridge as mentioned above is used, the material bridge can be realized, where the inclination of the second end portion of the expansion pin starts. According to another preferred embodiment, the material bridge can be realized at the second end of the expansion pin or somewhere in the inclined course of the second end portion of the expansion pin.

[0047] According to a preferred embodiment, the expansion sleeve and the expansion pin are made of a plastic material, preferably of the same plastic material. The present invention is not limited so specific plastic materials. For example, the expansion pin and the hollow sleeve body can be made of High-Density-Polyethylene (HDPE), of a plastic material on a Polyolefins basis, of a recycle plastic material, of a regrinded plastic material or the like. In particular, the plastic material used for the fastening device is an injection mouldable plastic material or a plastic material that can be used in an additive manufacturing process such as 3D-printing.

[0048] Since it is possible to re-use the fastening device, at least the hollow sleeve body and/or the expansion pin thereof, the fastening device is a suitable contribution to the circular economy.

[0049] How the fastening device according to the invention is used to fasten two components with one another will be explained in more detail with regard to the method according to the fourth aspect of the invention further below. Therefore, the disclosure of the fourth aspect of the invention applies with respect to its disclosure in entirety also to the fastening device according to the invention, so that all of the statements made with respect

to fourth aspect of the invention also apply to their full extent to the fastening device according to the first and second aspects of the invention, and vice versa.

[0050] In general, the fastening device according to the present invention is capable of connecting a first component to a second component. The present invention is thereby not limited to specific fields of application. According to a preferred embodiment, the fastening device is provided as a hinge pin. A hinge pin, which is part of a hinge device, serves to pivotably connect a first component with a second component. Therefore, the fastening device is capable of pivotably connecting two different components with each other. According to a preferred embodiment, the hinge device comprises a hinge pin, which is the fastening device, as well as a receiving sleeve, into which the hinge pin gets inserted.

[0051] According to a preferred embodiment, the fastening device, in particular the hinge pin, is used in the field of containers, such containers having a container body and a lid device. By means of a hinge device, which incorporates the fastening device in form of a hinge pin, the lid device gets pivotably connected to the container body. The present invention is not limited to specific types of containers. Such containers can be realized as any small, medium or large sized containers, which are used for storing and/or transporting any kind of goods.

[0052] According to a preferred embodiment, which however does not delimit the scope of protection, the fastening device is used in connection with a waste container for at least temporarily storing waste and/or any kinds of valuable substances, such as glass, metal, plastic, organic waste, paper, residual waste and the like.

[0053] Therefore, according to the third aspect of the invention, a waste container is provided, which comprises the features of independent claim 12.

[0054] This waste container comprises a container body. Furthermore, the waste container comprises a lid device for covering a receiving opening being provided in the container body. The lid device is pivotally mounted to the container body. Preferably, the lid device is pivotally mounted to the container body via a hinge device, said hinge device comprising a fastening device, in particular a hinge pin, according to the first and second aspect of the invention. Therefore, the disclosure of the first aspect and of the second aspect of the invention apply with respect to the disclosure in entirety also to the waste container according to the third aspect of the invention, so that all of the statements made with respect to first and second aspect of the invention and with respect to the general description of the invention also apply to their full extent to the third aspect of the invention, and vice versa.

[0055] According to a preferred embodiment, the hinge device comprises at least one lid eyelet being provided at the lid device, as well as a hinge sleeve being provided at the container body. In this case, the hinge sleeve corresponds to the term "receiving sleeve" which is often used in connection with the fastening device as described

further above. According to a preferred embodiment, the hinge sleeve is provided by a handle tube of the container body. According to this embodiment, the fastening device, in particular the hinge pin, is guided or capable of getting guided through the lid eyelet of the lid device, and is inserted or is capable of getting inserted into the hinge sleeve of the container body.

[0056] In the following, preferred embodiments of such a waste container, which is equipped with a fastening device according to the invention, are described in detail.

[0057] Such a waste container may have a holding capacity between 200 litres and 700 litres. Nevertheless, the present invention is also applicable in connection with larger waste containers having a holding capacity of up to 1700 litres. In any case the present invention is not limited to waste containers having a specific holding capacity.

[0058] In particular the waste container is a movable waste container, which means that the waste container is equipped with a number of wheels, two, three or four wheels for example. In particular the wheels are attached to the waste container at its lower end, in the area of the container bottom for example.

[0059] In its basic configuration the waste container comprises at least a container body. The container body comprises a side wall which sideways borders a receiving space inside the container body. The present invention is not limited to specific shapes and configurations of the side wall and therefore, of the container body. For example, the side wall can have a round shape, an elliptical shape, an oval shape or the like. According to a different embodiment, the side wall can have a polygonal shape. According to a preferred embodiment the side wall comprises a rectangular shape or a shape approaching at least a rectangle, such that the container body shows a respective shape as well.

[0060] Downwardly closed is the container body by means of a base element, which is the bottom of the container body and from which the side wall protrudes upwardly. Preferably, the height of the sidewall is greater than, in particular a multiple of, the width and/or of the depths of the bottom of the container body. At the upper end of the side wall, which is, in comparison to the container bottom, the opposite end of the side wall, and which represents and defines the upper edge of the container body as well, the container body comprises a receiving opening for the waste and/or for the valuable substances. According to a preferred embodiment, the receiving opening is bordered by the sidewall of the container body, such that the receiving opening spans the entire cross section of the container body at its upper end or edge.

[0061] The sidewall and the bottom element of the container body limit an inner space of the container body, said inner space defining and being the receiving space for storing the waste and/or the valuable substances.

[0062] For the purpose of storing different fractions of waste and/or of valuable substances at the same time, it is preferably provided that the inner space of the con-

tainer body is divided into a number of different compartments, for example by use of one or more separation plates, by use of additional insertion containers or by uses of a combination thereof.

[0063] For covering the receiving opening, the waste container is provided with a lid device, said lid device being mounted to the waste container, to the container body for example. The lid device comprises a lid body and at least one handle device being provided at the lid body. By means of the handle device, the user can open and close the lid device. It is sufficient that the lid body comprises only one handle device. Nevertheless, according to a preferred embodiment, the lid device comprises two such handle devices which are arranged on the lid body.

[0064] According to a preferred embodiment the lid device is pivotally mounted to the container body at the upper edge of the container body. This can be achieved by means of at least one hinge device. According to a preferred embodiment, the lid device is configured as a hinged lid device. The hinge device comprises at least one hinge sleeve, which acts as a receiving sleeve for the fastening device, a hinge pin in this case. The hinge device can be provided by a handle tube of the waste container, which is associated to the waste container body.

[0065] Next, and according to the fourth aspect of the invention, a method is provided, how a first component, in particular a lid device, can get mounted to a second component, in particular a container body, by means of a fastening device according the first and second aspects of the invention, whereby the method comprises the steps of independent claim 14. In this respect, the disclosure of the first, second and third aspect of the invention apply with respect to the disclosure in entirety also to the method according to the fourth aspect according to the invention, so that all of the statements made with respect to first, second and third aspect of the invention and with respect to the general description of the invention also apply to their full extent to the fourth aspect of the invention, and vice versa.

[0066] In a first step, the elongated hollow sleeve body of the expansion sleeve is inserted into at least one receiving sleeve of a second component. In case of a waste container, this second component is a waste container body. In this context, the receiving sleeve preferably is a handle tube, the waste container body being equipped with. In such a case the fastening device and the receiving sleeve preferably are part of a hinge device. This hinge device preferably comprises at least one lid eyelet being provided at the lid device, as well as a hinge sleeve being provided at the container body, said hinge sleeve being provided by the handle tube for example. Once the lid device has been placed on the container body, the elongated hollow sleeve body of the expansion sleeve is guided through the lid eyelet of the lid device, and is inserted and pushed into the hinge sleeve of the container body, into the handle tube for example. The sleeve head

of the expansion sleeve prevents the sleeve body from entirely sliding into the hinge sleeve.

[0067] In a next step, by exerting an impact force onto the head element of the expansion pin being defined by the first end portion, in particular by the first end, of the expansion pin, by means of a hammer for example, the elongated expansion pin is pushed into the receiving space of the hollow sleeve body via the insertion opening that is provided by the first end portion, in particular at the first end, of the sleeve body. If the elongated expansion pin and the hollow sleeve body are connected to one another via at least one material bridge, as described in accordance with the second aspect of the invention, the material bridge gets destroyed due to the impact force and both components get separated from each other such that the expansion pin can now freely move through the hollow sleeve body.

[0068] When the expansion pin is pushed through the receiving space of the sleeve body into its "locking position", by means of a push with a hammer or the like for example, the expansion pin expands the expansion sleeve, in particular the sleeve body, outwards, under aid of the one or more, preferably four, longitudinal slots, which are provided spatially spaced from one another in the sleeve body. In particular, the material areas between two adjacent slots get pushed outwards and therefore, get outwardly expanded, due to the rib elements for example, which protrude outwardly from the outer surface of the longitudinal profile element of the expansion pin. In particular, the rib elements, which can have a triangular shape, press the hollow sleeve body, in particular the material areas between two adjacent slots in the sleeve body, against the inner wall of the receiving sleeve, the handle tube for example. The impact force that is exerted on the expansion pin, is transferred to the hollow sleeve body via the rib elements whereby the tips of the rib elements get in contact with the inner surface of the hollow sleeve body, whereby the triangular rib elements press and/or cut and/or shear the hollow sleeve body, in particular the wall or walling thereof. Preferably, the sleeve body, in particular the material areas between adjacent slots get expanded in an expansion direction, which is perpendicular or almost perpendicular to the direction of the movement of the expansion pin through the hollow sleeve body. By means of this, any tolerances in the receiving sleeve, the container handle for example, can get bridged.

[0069] Finally, upon the expansion of the expansion sleeve, in particular the sleeve body, the expansion sleeve gets pressed against an inner wall of the receiving sleeve, thus generating a form fit and/or a force fit connection.

[0070] Disassembly works in a similar way. Then, the expansion pin must get pushed out of the hollow sleeve body again. By exerting an impact force on the head area of the expansion pin again, by means of a simple hammer for example, the expansion pin gets further pushed through the hollow sleeve body and finally through the

exit opening of the hollow sleeve body, whereby the expansion pin can leave the hollow sleeve body via the exit opening. The expansion pin can be received by and inside the handle tube.

[0071] In the following, different methods are explained, how the fastening device according to the present invention can get manufactured. It is assumed that the fastening device is made of a plastic material, and that the fastening device can get manufactured in one single manufacturing step.

[0072] According to the methods according to the fifth aspect of the present invention according to independent claim 15, the fastening device is manufactured by means of an injection moulding process, in particular by means of a One-Component (1K)-Injection-Moulding-Process. Therefore, it is preferably provided that the fastening device according to the first and second aspect of the invention is made by an injection moulding process. Injection moulding per se is well known in the art. In general, it is a manufacturing process for manufacturing parts by injecting molten material into a mould. In a first step, the material to be used, plastic material in the present case, is melted. Then the molten material is injected into the mould cavity, where it cools down and hardens to the configuration defined by the mould cavity. In case that the expansion pin and the hollow sleeve body of the fastening device are connected to one another via a material bridge, an injection moulding process is very suitable to manufacture the fastening device as one single part in one single manufacturing processing step. For manufacturing the fastening device, a conventional injection moulding process can be used, full-automatic with an injection moulding tool with jaw design and a slide tool, as well as with a hotrunner.

[0073] According to a different method according to independent claim 15, the fastening device is manufactured by means of an additive manufacturing process, in particular by means of a 3D-printing process. Therefore, it is preferably provided that the fastening device according to the first and second aspect of the invention is made by an additive manufacturing process. Additive manufacturing is a computer-controlled process that creates three dimensional objects by depositing materials, usually in layers. The objects to be manufactured are built layer by layer, which is in contrast to traditional manufacturing processes, which often require machining or other techniques to remove surplus materials. In case that the expansion pin and the hollow sleeve body of the fastening device are connected to one another via a material bridge, an additive manufacturing process is very suitable to manufacture the fastening device as one single part in one single manufacturing processing step.

[0074] However, the present invention is not limited to the aforementioned manufacturing processes.

[0075] As a basic member, that have all different aspects of the invention in common, the present invention relates to a fastening device, said fastening device comprising an expansion sleeve having an, in particular cy-

lindrical, elongated hollow sleeve body, wherein the sleeve body comprises one or more, preferably four, longitudinal slots, which are provided spatially spaced from one another in the sleeve body, an elongated expansion pin being provided as a drive-in pin, wherein the sleeve body defines a receiving space, which is provided for receiving and guiding the expansion pin being inserted into the sleeve body. In order to provide a the fastening device that is universally useable for different sized applications, and wherein, at the same time the fastening device can get manufactured easily and cost-effectively, it is provided according to the present invention, that the elongated expansion pin comprises a longitudinal profile element, that the elongated expansion pin comprises at least one, in particular longitudinal, rib element protruding outwardly from an outer surface of the longitudinal profile element, and that the rib element is provided for exerting a pressure force on an inner surface of the sleeve body, when the expansion pin gets inserted into the receiving space of the sleeve body. Alternatively, or in combination, the elongated expansion pin and the sleeve body are connected to one another via a material bridge, said material bridge connecting the expansion pin with the sleeve body.

[0076] For a better understanding of the present invention, a preferred embodiment of the present invention will now be described by way of an example with reference to the accompanying drawings, in which

Figures 1 to 4 depict several views of a first embodiment of a fastening device according to the present invention;
Figure 5 depicts a situation, where the different components of the fastening device according to the first embodiment are connected to each other by way of a material bridge;
Figure 6 schematically depicts the basic functionality of the fastening device according to the present invention;
Figures 7 to 10 depict several views of a second embodiment of a fastening device according to the present invention; and
Figures 11 to 15 depict several views, how the fastening device according to the invention is used with a waste container.

[0077] All of the Figures show a fastening device 10, which is used in connection with a waste container 50.

[0078] Figures 1 to 4 show the general construction of the fastening device 10 according to a first embodiment, which is used as a hinge pin. The fastening device 10 comprises two major components, an elongated expansion sleeve 11 and an elongated expansion pin 12. The expansion sleeve 11 comprise an elongated hollow sleeve body 13. The sleeve body 13 is an elongated body that is hollow on the inside and open on both end faces. The hollow sleeve body 13 has a circular inner diameter,

and thus, the hollow sleeve body 13 is provided as a cylindrical sleeve body 13. The wall 14 of the sleeve body 13 comprises one or more, preferably four, longitudinal slots 15, which are provided spatially spaced from one another in the sleeve body 13. The slots 15 extend over a part of the lengths of the sleeve body 13. Material areas 16 between two adjacent slots 15 are configured as tongues or straps. The sleeve body 13 comprises a first end portion 17, which ends-up in a first end 17a, and which defines the head area of the hollow sleeve body 13. An insertion opening 18 for receiving an expansion pin is provided at the first end 17a. Furthermore, the hollow sleeve body 13 comprises a sleeve head 19, which is provided at the first end 17a of the sleeve body 13, said sleeve head 19 having a larger diameter and/or a larger cross-sectional area than the hollow sleeve body 13. A fixation ring 41 is provided between sleeve body 13 and sleeve head 19. The fixation ring 41, which has a guiding function as well, has an outer diameter that is greater than the outer diameter of sleeve body 13, but which is smaller than the outer diameter of sleeve head 19.

[0079] A second end portion 20 of the sleeve body 13, which ends-up in a second end 20a, provides an exit opening 21 for the expansion pin 12, whereby the insertion opening 18 provided by the first end 17a of the sleeve body 13 and the exit opening 21 each have the same diameter and/or the same cross-section. In order to increase the static friction, at least one sawtooth-shaped arrangement 22 consisting of two or more clamping teeth is provided which protrudes from an outer surface 23 of the sleeve body 13. The hollow sleeve body 13 comprises a receiving space 24, which is bordered by the wall 14 of the sleeve body 13. The receiving space 24 is provided for receiving the elongated expansion pin 12. The expansion pin 12 is provided as a drive-in pin, that gets pushed into the hollow sleeve body 13, when an impact force is exerted onto the expansion pin 12. The expansion pin 12 comprises a first end portion 25, that ends-up in a first end 25a, and a second end portion 26, which ends-up in a second end 26a, said second end portion 26 being opposite to the first end portion 25. The first end portion 25 comprises a head element 27 which is provided for receiving the impact force, that can get exerted by means of a hammer or another suitable tool for example. The head element 27 of the fastening device according to Figures 1 to 4 is configured as a circular shaped head element 27.

[0080] The elongated expansion pin 12 comprises a longitudinal profile element 28, which is provided as a cross-profile element. The cross-profile element comprises four legs 29, that intersect vertically and centrally. All legs 29 have the same length and/or width. Each leg 29 has a first end 30 that is directed to respective first ends 30 of the other legs 29, whereby the four legs 29 are connected to each other via their first ends 30 respectively. Furthermore, each leg 29 has a second end 31 opposite to its first end, said second end 31 being a

free end. A rib element 32 is provided at each second end 31 of each leg 29. Therefore, the rib elements 32 protrude outwardly from an outer surface of the longitudinal profile element 28. According to the embodiment shown in Figures 1 to 4, the rib elements 32 are evenly distributed over the outer perimeter of the elongated expansion pin 12. All rib elements 32, which is best shown in Figures 2 and 3, have a triangular shape. In general, a triangle is a polygon with three edges. With one of these edges the triangular rib element 32 is connected to the longitudinal profile element 28 of the elongated expansion pin 12. Opposite to this "connecting edge" the triangular shaped rib element 32 comprises a triangle-tip 33, said triangle-tip 33 being provided to get in contact with the inner surface of the hollow sleeve body 13. Therefore, the area of the rib element 32 which comes in contact with the hollow sleeve body 13 is very small. The length of the rib elements 32 is shorter than the length of the longitudinal profile element 28. That means that the rib elements 32 extend over a part of the length of the longitudinal profile element 28 only.

[0081] Figures 1 to 3 show the fastening device 10 in its initial state, when the expansion pin 12 is still located outside the hollow sleeve body 13, whilst Figure 4 shows a schematic representation, where the expansion pin 12 is inserted in the hollow sleeve body 13.

[0082] In its initial state, and before the expansion pin 12 gets pushed inside the hollow sleeve body 13 for its operational mode, the fastening device 10 is provided as one single member, said fastening device 10 comprising the expansion sleeve 11 and the expansion pin 12 being integral parts thereof. The elongated expansion pin 12 and the sleeve body 13 are connected to one another via at least one material bridge 34. This is shown in Figure 5. The material bridge 34 is provided as a film hinge or a film gate. The material bridge 34 connects the second end 26a of the expansion pin 12 with the first end 17a of the hollow sleeve body 13. When the fastening device 10 is in its operational mode, the expansion pin 12 gets pushed into and then through the receiving space 24 of the hollow sleeve body 13, whereby an impact force is exerted onto the head area 27 of the expansion pin 12. By means of this impact force, the material bridge 34 gets disrupted, such that the expansion pin 12 can move through the hollow sleeve body 13.

[0083] A second embodiment of the fastening device 10 is depicted in Figures 7 to 10. The basic configuration of the fastening device 10 is identical to the basic configuration of the fastening device according to Figures 1 to 5. In particular, the configuration of the expansion sleeve 11 is identical to the expansion sleeve 11 according to the embodiment shown in Figures 1 to 5. Same applies to the basic configuration of expansion pin 12 having a longitudinal profile element 28 including four legs 29, each leg having a rib element 32 at its second free end. In order to avoid any repetitions, full reference is therefore made to the description in connection with Figures 1 to 5. Furthermore, identical components are

denoted with identical reference numerals.

[0084] However, the head element 38 of expansion pin 11 and the sleeve head 19 show differences in comparison to the embodiment shown in Figures 1 to 5. As can be seen from Figures 8a and 8b, the head element 30 of expansion pin 12 has the shape of a cross. The cross-shaped head element 38 comprises a base area 39 being square or almost square in shape. The four arms 40 of the cross are provided in each corner of the base area 39, and they protrude from these corners to the outside beyond the base area 39. In this case the insertion opening 18 of the sleeve body inside sleeve head 19 has a corresponding cross shape. By use of such a head element 38 the expansion pin 12 can get easily re-used. Furthermore, a better guiding and positioning of the expansion pin 12 inside the hollow sleeve body can get realized. For that purpose, the insertion opening 18 has the same configuration as head element 38. Figures 7, 8a and 8b show the fastening device 10 in its initial state, when the expansion pin 12 is still located outside the hollow sleeve body 13, whilst Figure 8c shows a schematic representation, where the expansion pin 12 is inserted in the hollow sleeve body 13.

[0085] Figures 9a and 9b depict a situation, where the different components of the fastening device 10 according to the second embodiment are connected to each other by way of a material bridge 34. As can be seen in Figures 9a and 9b, the second end portion 26 of the expansion pin 12 has an inclined, in particular a conically tapered, course, which ends-up in the second end 26a of the expansion pin 12. The at least one material bridge 34 is provided in the inclined course of the second end portion 26. By this, positioning and guiding of the expansion pin 12 is increased, in particular if the expansion pin is re-used.

[0086] As can be derived from Figure 10, the insertion opening 18 and the exit opening 21 of the sleeve body 13 are different in size and shape. The insertion opening 18 improves guiding and positioning of the expansion pin 12. The exit opening 21 has the function to release the expansion pin 12, if the fastening device 10 gets disassembled. Then the expansion pin 12 gets pushed out of the sleeve body 13 via exit opening 21. Therefore, it is advantageous if the exit opening 21 is as large as possible and if the cross-section of the exit opening 21 is as simple as possible. In the embodiment shown in Figures 7 to 10, the exit opening 21 has a simple circular shape.

[0087] In its initial state, and before the expansion pin 12 gets pushed inside the hollow sleeve body 13 for its operational mode, the fastening device 10 is provided as one single member, said fastening device 10 comprising the expansion sleeve 11 and the expansion pin 12 being integral parts thereof. The elongated expansion pin 12 and the sleeve body 13 are connected to one another via at least one material bridge 34, which is, in particular shown in Figures 9a, 9b and 10 as well.

[0088] Each rib element 32 in both embodiments shown in Figures 1 to 5 as well in Figures 7 to 10, is

provided for exerting a pressure force on an inner surface 35 of the sleeve body 13, when the expansion pin 12 gets inserted into the receiving space 24 of the sleeve body 13 and pushed therethrough. This situation is shown in Figure 6. When the expansion pin 12 is pushed through the hollow sleeve body 13, the rib elements 32 get in contact with the inner surface 35 of the hollow sleeve body 13. The rib elements 32 press the hollow sleeve body 13, in particular the material areas 16 between two adjacent slots 15 in the sleeve body 13, against a component surrounding the fastening device 10, a receiving sleeve for example, which can be a handle tube 55 of a container body as explained in connection with Figures 11 to 15 further below. The impact force that is exerted on the expansion pin 12, is transferred to the hollow sleeve body 13 via the triangular rib elements 32 whereby the triangle tips 33 of the triangular rib elements 32 are in contact with the inner surface 35 of the hollow sleeve body 32, whereby the triangular rib elements 32 press and/or cut and/or shear the hollow sleeve body 13, in particular the wall 14 thereof. If the component surrounding the elongated hollow sleeve body 13, is bigger, than the triangular rib elements 32 will not cut so deep into the material of the hollow sleeve body 13, but will result in a larger expansion of the sleeve body 13 due to the pressure force exerted on the inner surface 35 of the sleeve body 13 by the rib elements 32.

[0089] Next, and in combination with Figures 11 to 15, the general function of the fastening device 10 will be explained in detail at hand of a waste container 50. Figure 11 shows the waste container 50 for temporarily storing waste and/or valuable substances. The waste container 50 comprises a container body 51, which receives the waste and/or the valuable substances. At its upper edge, the container body 51 comprises a receiving opening (not shown), which is closed by a lid device 52. The lid device 52 is pivotably attached to the container body 51 by means of at least one hinge device 53, preferably by means of two hinge devices 53. The lid device 52 comprises two lid eyelets 54. The hinge device 53 comprises a receiving sleeve for the fastening device 10, which is provided as a handle tube 55 being associated to the container body 51.

[0090] Once the lid device 52 has been placed on the container body 51, in a first step, as shown in Figure 12, the elongated hollow sleeve body 13 of the expansion sleeve 11 is guided through the lid eyelet 54 of the lid device 52, and is inserted and pushed into the hinge sleeve of the container body 51, into the handle tube 55 in the present case. The sleeve head 19 of the expansion sleeve body 13 prevents the sleeve body 13 from entirely sliding into the handle tube 55.

[0091] In a next step, which is shown in Figure 13, by exerting an impact force 36 onto the head area 27, 38 of the expansion pin 12, by means of a hammer for example, the elongated expansion pin 12 is pushed into the receiving space 24 of the hollow sleeve body 13 via the insertion opening 18 that is provided by the first end 17 of the

sleeve body 13 (see Figures 1 to 5 or 7 to 10 for example). If the elongated expansion pin 12 and the hollow sleeve body 13 are connected to one another via a material bridge 34, the material bridge 34 gets destroyed due to the impact force 36 and both components get separated from each other such that the expansion pin 12 can now freely move through the hollow sleeve body 13. When the expansion pin 12 is pushed through the receiving space of the sleeve body 13 into its "locking position", as shown in Figure 13, by means of a push with a hammer or the like for example, the expansion pin 12 expands the expansion sleeve 13 outwards in an expansion direction 37, under aid of the one or more, preferably four, longitudinal slots 15, which are provided spatially spaced from one another in the sleeve body 13. In particular, the material areas 16 between two adjacent slots 15 get outwardly expanded, due to the rib elements 32, which protrude outwardly from the outer surface of the longitudinal profile element 28 of the expansion pin 12 (see Figures 1 to 10 as well). In particular, the triangular shaped rib elements 32 press the hollow sleeve body 13, in particular the material areas 16 between two adjacent slots 15 in the sleeve body 13, against the inner wall of the handle tube 55, which is shown in Figure 14. The impact force that is exerted on the expansion pin 12, is transferred to the hollow sleeve body 13 via the rib elements 32 whereby the triangle tips 33 of the triangular rib elements 32 get in contact with the inner surface 35 of the hollow sleeve body 13, whereby the triangular rib elements 32 press and/or cut and/or shear the hollow sleeve body 13, in particular the wall 14 thereof (see Figure 6 as well).

[0092] Finally, upon the expansion of the expansion sleeve 11, the expansion sleeve 11 gets pressed against an inner wall of the handle tube 55, thus generating a form fit and/or a force fit connection.

[0093] Disassembly, which is shown in Figure 15, works in a similar way. Then, the expansion pin 11 must get pushed out of the hollow sleeve body 13 again. By exerting an impact force on the head area 27,38 of the expansion pin 12, by means of a simple hammer for example, the expansion pin 12 gets further pushed through the hollow sleeve body 13 and finally through the exit opening 21 of the hollow sleeve body 13, whereby the expansion pin 12 can leave the receiving space 24 of hollow sleeve body 13 via the exit opening 21. The expansion pin 12 can be received by and inside the handle tube 55, from where it can get easily removed, once the lid device 52 has been separated from the container body 51.

List of reference numerals

[0094]

10 Fastening device
11 Expansion sleeve
12 Expansion pin
13 Sleeve body

14 Wall of sleeve body
15 Slot
16 Material area
17 First end portion of sleeve body
5 17a First end of sleeve body
18 Insertion opening
19 Sleeve head
20 Second end portion of sleeve body
20a Second end of sleeve body
10 21 Exit opening
22 Sawtooth-shaped arrangement
23 Outer surface of sleeve body
24 Receiving space
25 First end portion of expansion pin
15 25a First end of expansion pin
26 Second end portion of expansion pin
26a Second end of expansion pin
27 Head element
28 Longitudinal profile element
20 29 Leg
30 First end of leg
31 Second end of leg (Free end of leg)
32 Rib element
33 Triangle tip
25 34 Material bridge
35 Inner surface of sleeve body
36 Impact force
37 Expansion direction
38 Head element
30 39 Base area
40 Arm
41 Fixation ring
50 Waste container
35 51 Container body
52 Lid device
53 Hinge device
54 Lid eyelet
55 Handle tube

Claims

1. A fastening device (10), in particular a hinge pin, said fastening device (10) comprising an expansion sleeve (11) having an, in particular cylindrical, elongated hollow sleeve body (13), wherein the sleeve body (13) comprises one or more, preferably four, longitudinal slots (15), which are provided spatially spaced from one another in the sleeve body (13),

an elongated expansion pin (12) being provided as a drive-in pin, wherein the expansion pin (12) comprises a first end portion (25) and a second end portion (26) being opposite to the first end portion (25), said first end portion (25) comprising a head element (27, 38) being provided for receiving an impact force (36),

wherein the sleeve body (13) comprises a receiving space (24), which is provided for receiving the expansion pin (12) being inserted into the sleeve body (13),

and wherein the sleeve body (13) comprises a first end portion (17) providing an insertion opening (18) for the expansion pin (12) and a second end portion (20) opposite to the first end portion (17),

characterized in

that the elongated expansion pin (12) comprises a longitudinal profile element (28),

that the elongated expansion pin (12) comprises at least one, in particular longitudinal, rib element (32) protruding outwardly from an outer surface of the longitudinal profile element (28), and

that the rib element (32) is provided for exerting a pressure force on an inner surface (35) of the sleeve body (13), when the expansion pin (12) gets inserted into the receiving space (24) of the sleeve body (13).

2. The fastening device according to claim 1, **characterized in that** the at least one rib element (32) has a triangular shape.
3. The fastening device according to claim 1 or 2, **characterized in that** the elongated expansion pin (12) comprises two or more rib elements (32) being provided spatially spaced from one another on the outer surface of the longitudinal profile element (28).
4. The fastening device according to anyone of claims 1 to 3, **characterized in that** the length of the at least one rib element (32) is shorter than the length of the longitudinal profile element (28).
5. A fastening device (10), in particular a hinge pin, said fastening device (10) comprising an expansion sleeve (11) having an, in particular cylindrical, elongated hollow sleeve body (13), wherein the sleeve body (13) comprises one or more, preferably four, longitudinal slots (15), which are provided spatially spaced from one another in the sleeve body (13),

an elongated expansion pin (12) being provided as a drive-in pin, wherein the expansion pin (12) comprises a first end portion (25) and a second end portion (26) being opposite to the first end portion (25), said first end portion (25) comprising a head element (27, 38) being provided for receiving an impact force (36), wherein the sleeve body (13) comprises a receiving space (24), which is provided for receiving the expansion pin (12) being inserted into

the sleeve body (13),

and wherein the sleeve body (13) comprises a first end portion (17) providing an insertion opening (18) for the expansion pin (12) and a second end portion (20) opposite to the first end portion (17),

in particular a fastening device (10) according to anyone of claims 1 to 4,

characterized in

that the elongated expansion pin (12) and the sleeve body (13) are connected to one another via at least one material bridge (34), in particular via a film hinge, said material bridge (34) preferably connecting the second end portion (26) of the expansion pin (12) with the first end portion (17) of the sleeve body (13).

6. The fastening device according to anyone of claims 1 to 5, **characterized in that** the longitudinal profile element (28) of the elongated expansion pin (12) is provided as a cross-profile element, said-cross profile element having four legs (29), wherein the at least one rib element (32) is provided at a free end (31) of at least one of the legs (29).
7. The fastening device according to anyone of claims 1 to 6, **characterized in that** the head element (27) of the expansion pin (12) has a shape and/or size that corresponds to the shape and/or size of the receiving space (24) of the sleeve body (13) and/or of the insertion opening (18) of the sleeve body (13), and/or that the head element has a circular shape (27) or the shape (38) of a cross.
8. The fastening device according to anyone of claims 1 to 7, **characterized in that** at least one clamping tooth, or at least one clamping hook, or at least one sawtooth-shaped arrangement (22) consisting of two or more clamping teeth or hooks protrudes from an outer surface (23) of the sleeve body (13).
9. The fastening device according to anyone of claims 1 to 8, **characterized in that** the second end portion (20) of the sleeve body (13) provides an exit opening (21) for the expansion pin (12).
10. The fastening device according to anyone of claims 1 to 9, **characterized in that** the expansion sleeve (11) comprises a sleeve head (19) which is provided at the first end portion (17) of the sleeve body (13), said sleeve head (19) having a larger diameter and/or a larger cross-sectional area than the sleeve body (13), and, in particular that the expansion sleeve (11) comprises a fixation ring (41) being provided between the sleeve body (13) and the sleeve head (19).
11. The fastening device according to anyone of claims

- 1 to 10, **characterized in that** the second end portion (26) of the expansion pin (12) has an inclined, in particular a conically tapered, course.
12. A waste container (50), which is provided for at least temporarily storing waste and/or valuable substances, wherein the waste container (50) comprises a container body (51), and wherein the waste container (50) comprises a lid device (52) for covering a receiving opening being provided in the container body (51), said lid device (52) being pivotably mounted to the container body (51) via a hinge device (53), said hinge device (53) comprising a fastening device (10), in particular a hinge pin, according to anyone of claims 1 to 11.
13. The waste container according to claim 12, **characterized in that** the hinge device (53) comprises a lid eyelet (54) being provided at the lid device (52), that the hinge device (53) comprises a hinge sleeve being associated to the container body (51), said hinge sleeve particularly being provided by a handle tube (55) of the container body (51), and that the fastening device (10), in particular the hinge pin, is guided or capable of getting guided through the lid eyelet (54) of the lid device (52), and is inserted or is capable of getting inserted into the hinge sleeve of the container body (51).
14. A method of mounting first component, in particular a lid device (52), to a second component, in particular a container body (51), by means of a fastening device (10) according to anyone of claims 1 to 11, **characterized in** by the following steps:
- A) The elongated hollow sleeve body (13) of the expansion sleeve (11) is inserted into at least one receiving sleeve of the second component;
- B) By exerting an impact force (36) onto the head element (27, 38) of the expansion pin (12) being defined by the first end portion (25) of the expansion pin (12), the elongated expansion pin (12) is pushed into the receiving space (24) of the sleeve body (13) via the insertion opening (18) that is provided by the first end portion (17) of the sleeve body (13);
- C) When being pushed through the receiving space (24) of the sleeve body (13), the expansion pin (12) outwardly expands the sleeve body (13) due to the one or more, preferably four, longitudinal slots (15), which are provided spatially spaced from one another in the sleeve body (13);
- D) Upon the expansion of the sleeve body (13), the expansion sleeve (11) gets pressed against an inner wall of the receiving sleeve of the second component.

15. A method of manufacturing a fastening device according to anyone of claims 1 to 11, **characterized in that** the fastening device (10) is manufactured by means of an injection moulding process, in particular by means of a One-Component (1 K)-Injection-Moulding-Process, or **in that** the fastening device (10) is manufactured by means of an additive manufacturing process, in particular by means of a 3D-printing process.

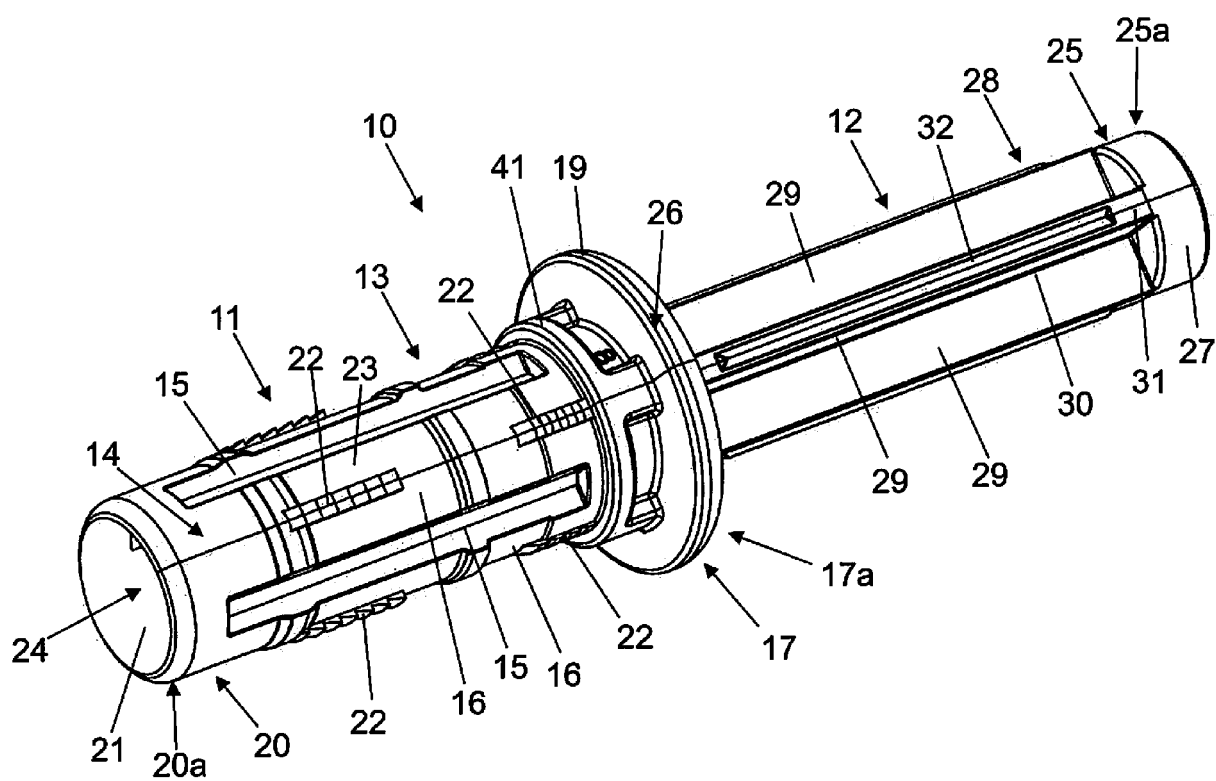


Fig. 1

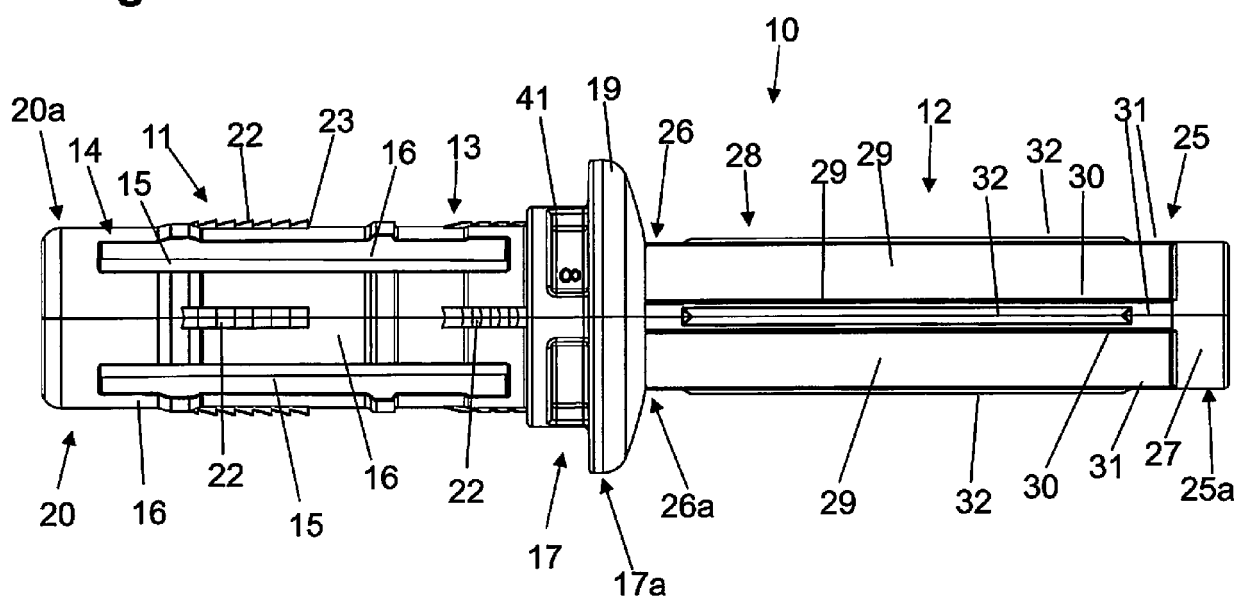


Fig. 2

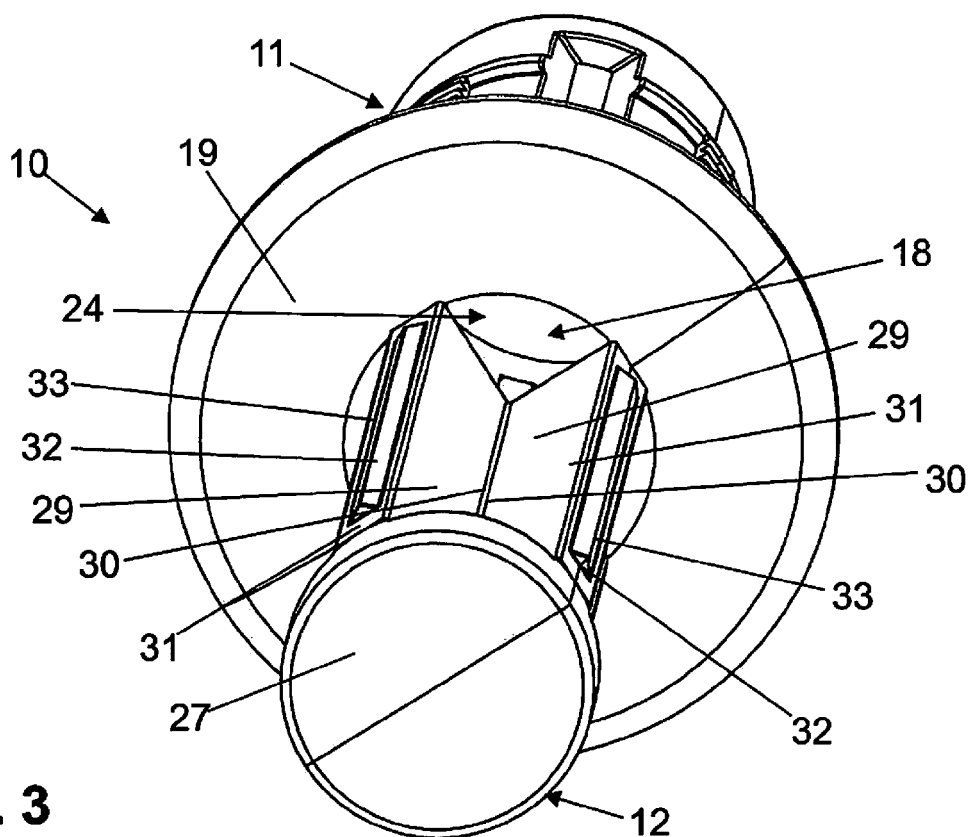


Fig. 3

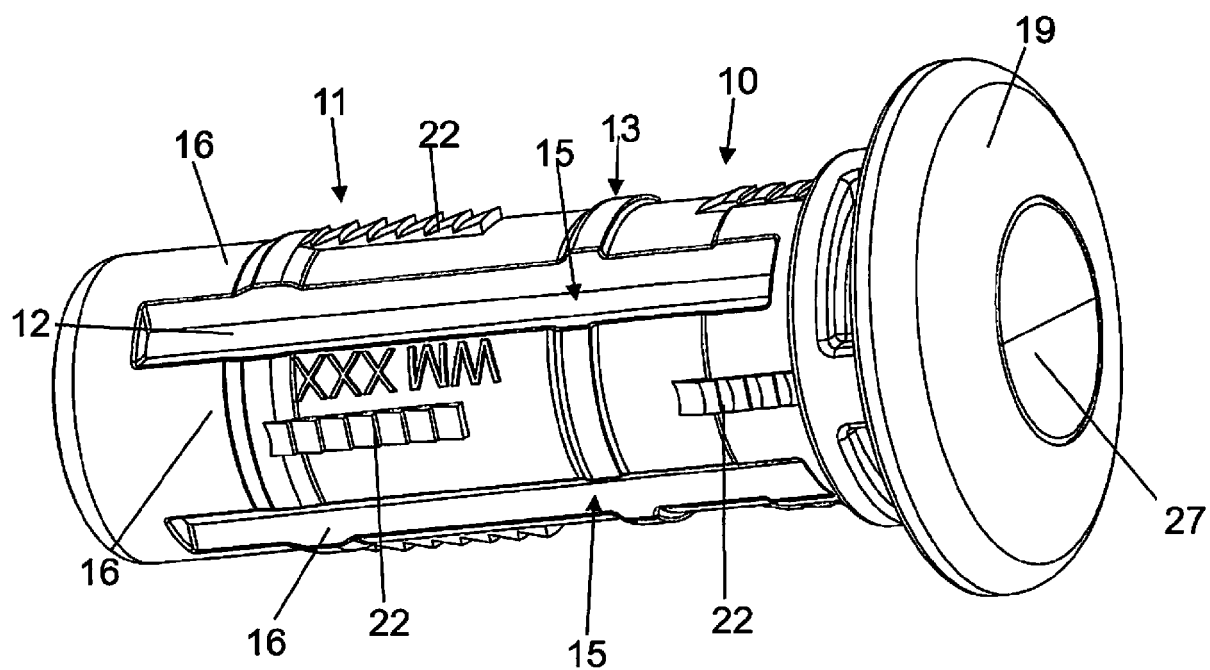


Fig. 4

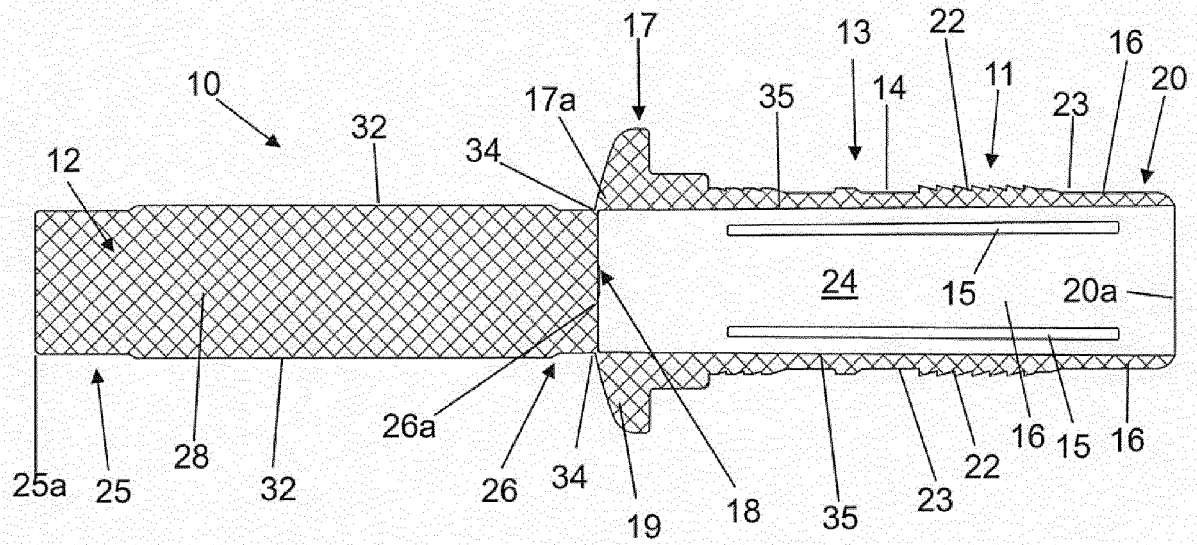


Fig. 5

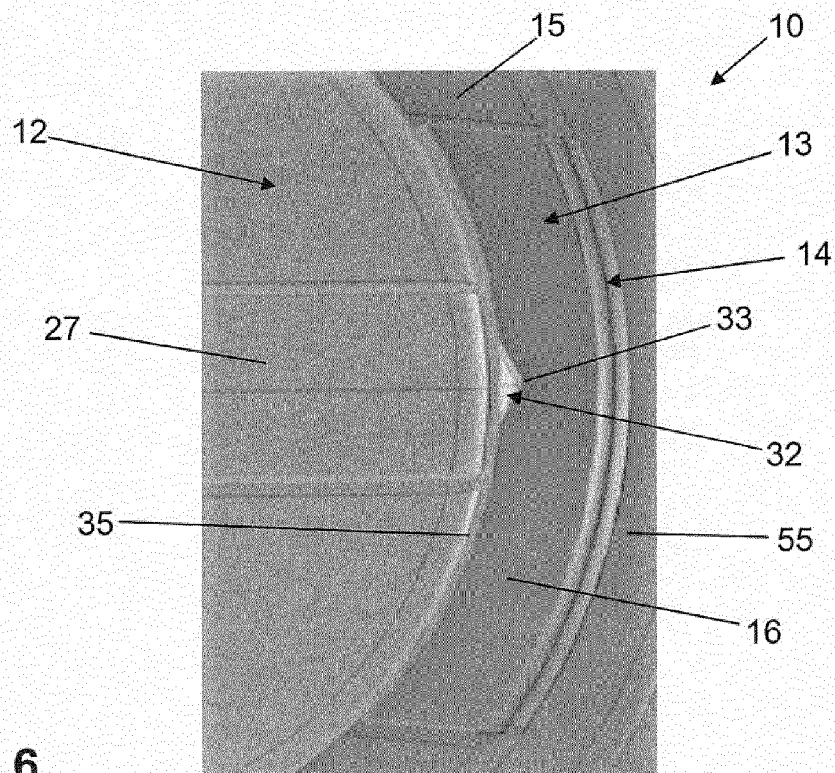


Fig. 6

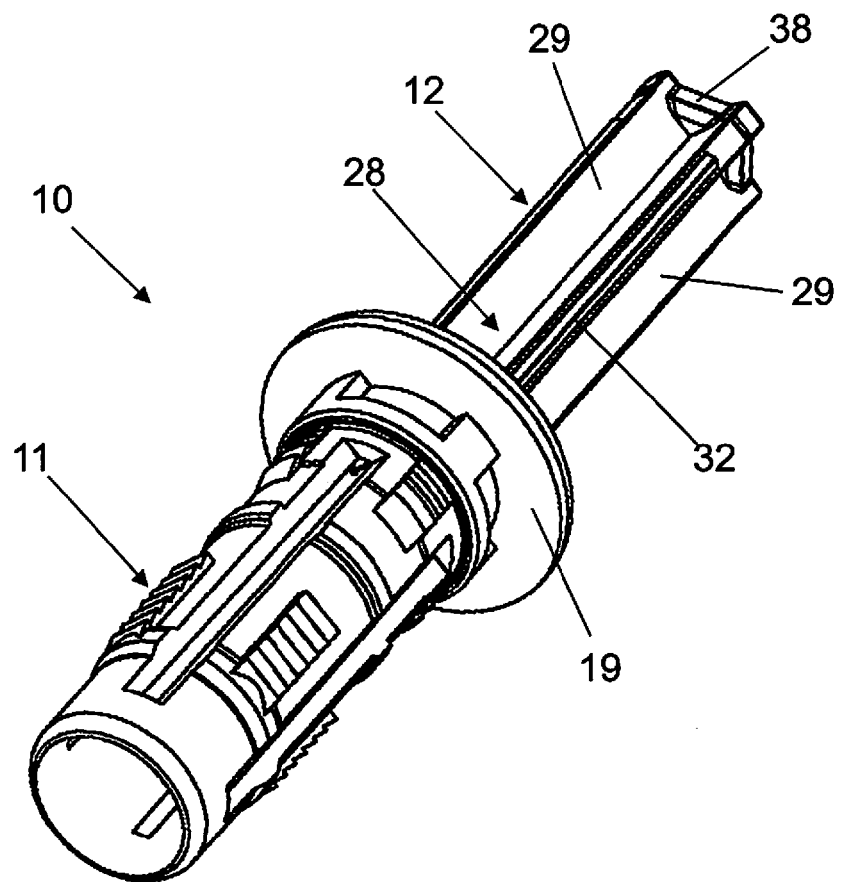


Fig. 7

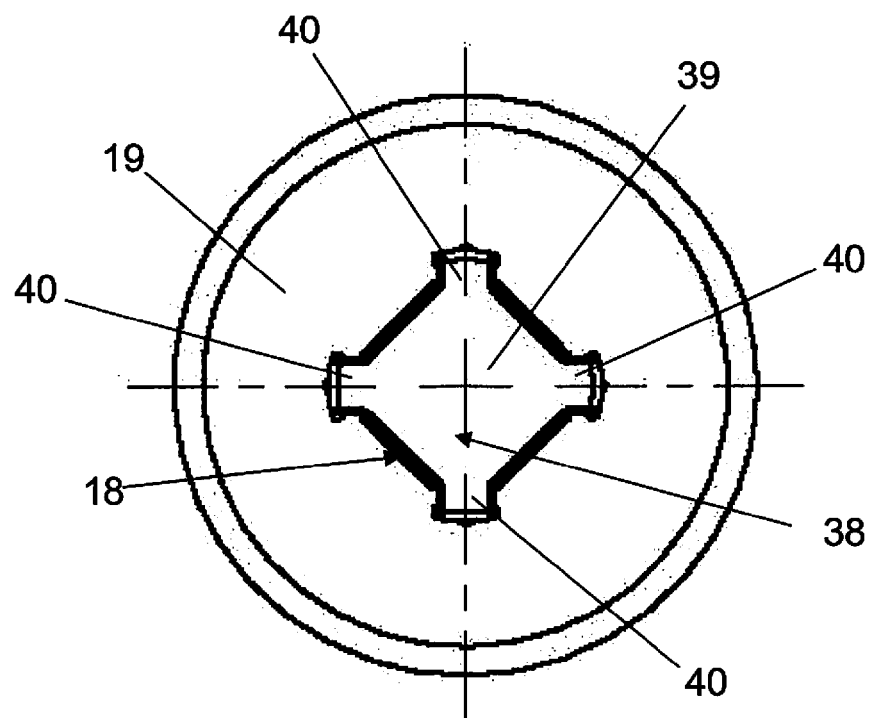


Fig. 8a

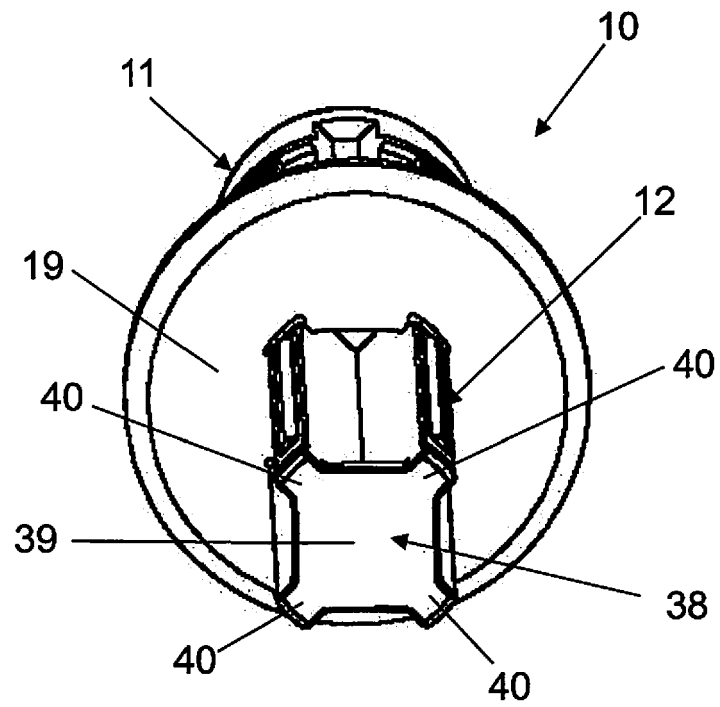


Fig. 8b

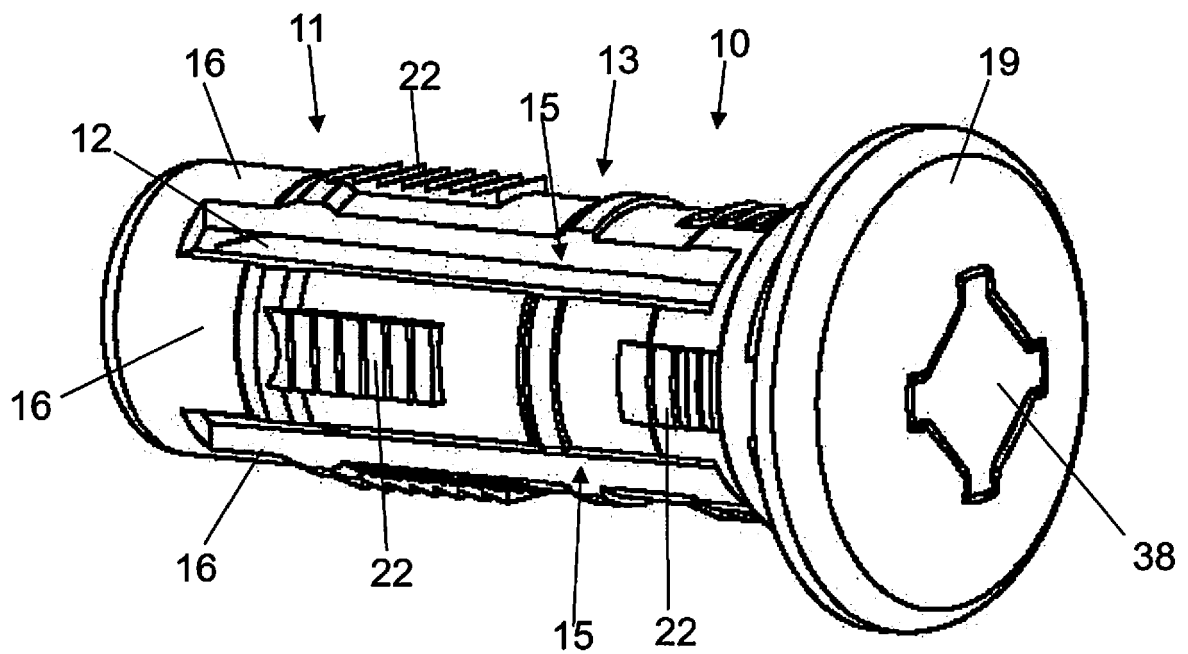


Fig. 8c

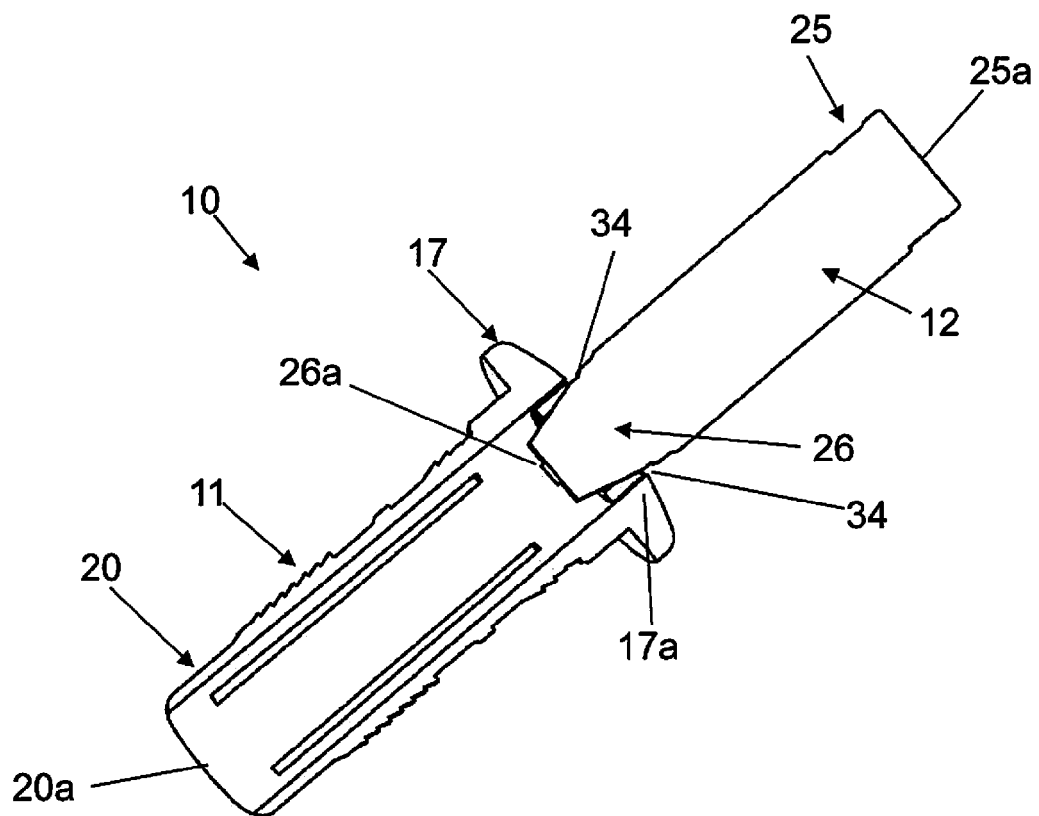


Fig. 9a

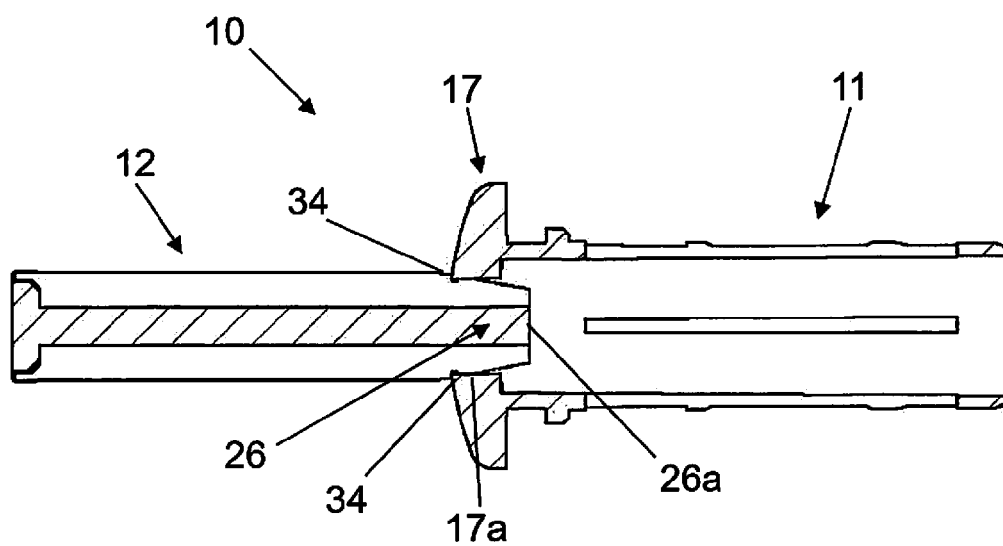


Fig. 9b

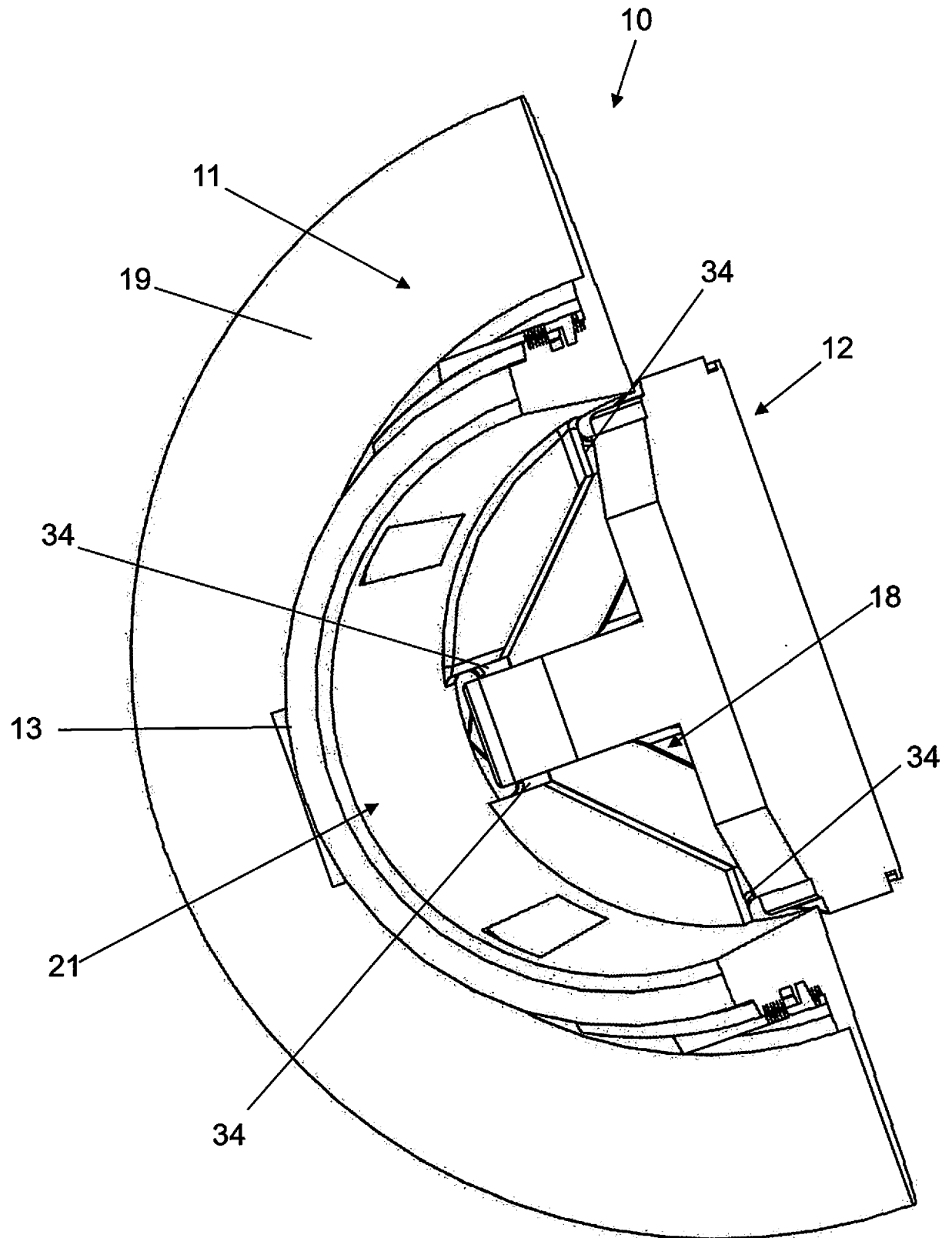


Fig. 10

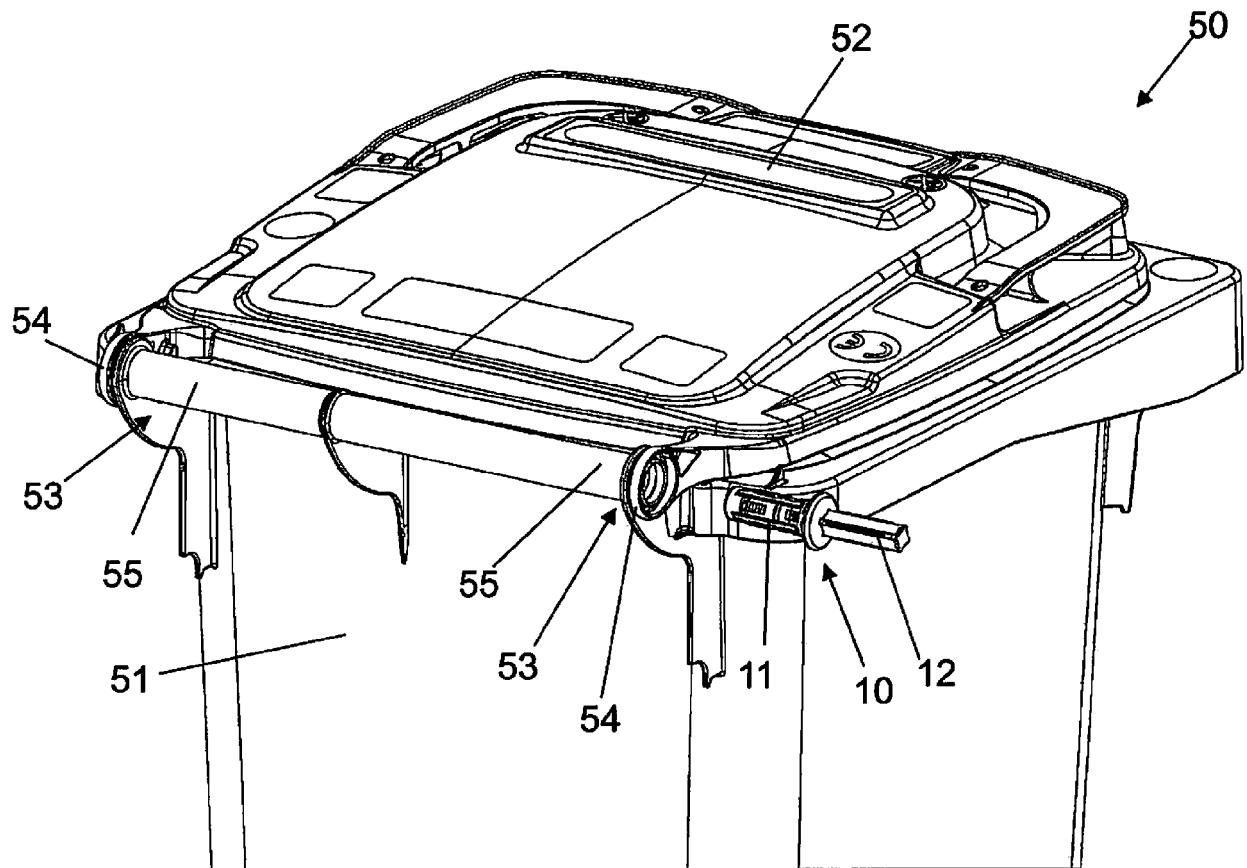


Fig. 11

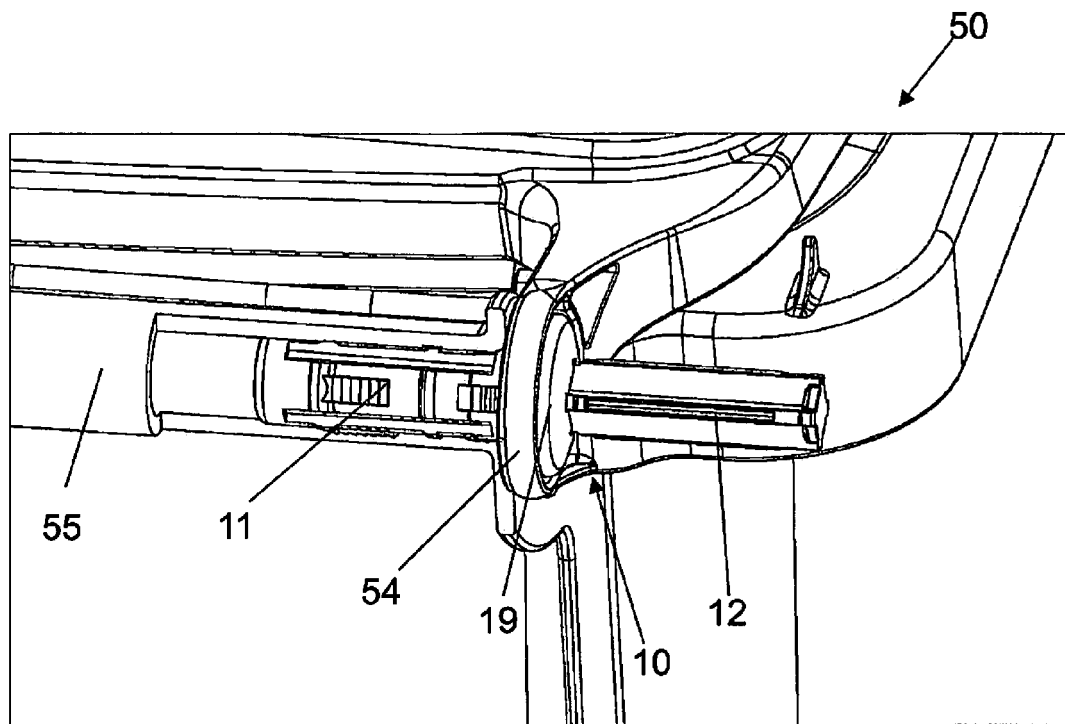


Fig. 12

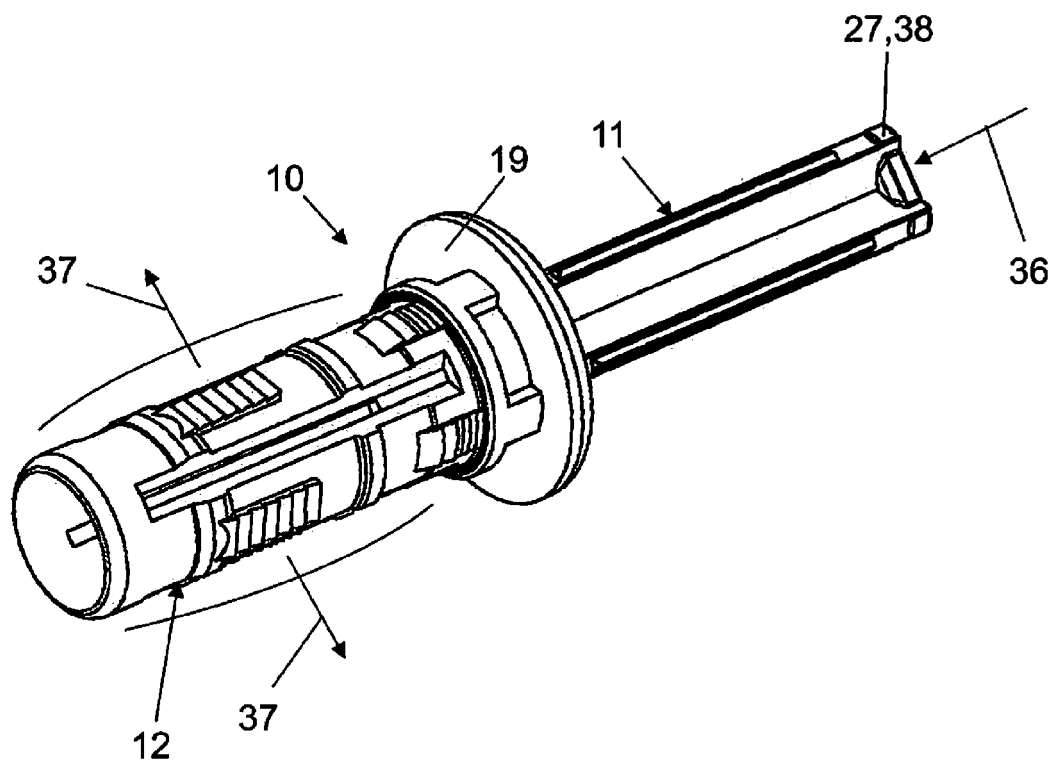


Fig. 13

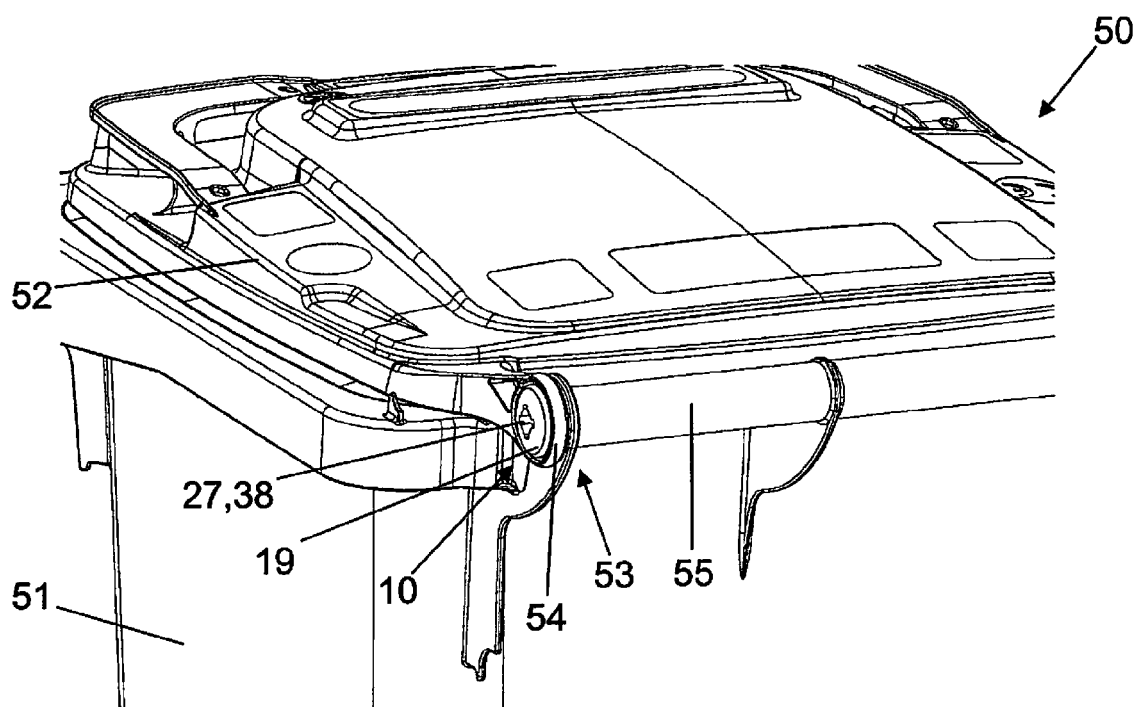


Fig. 14

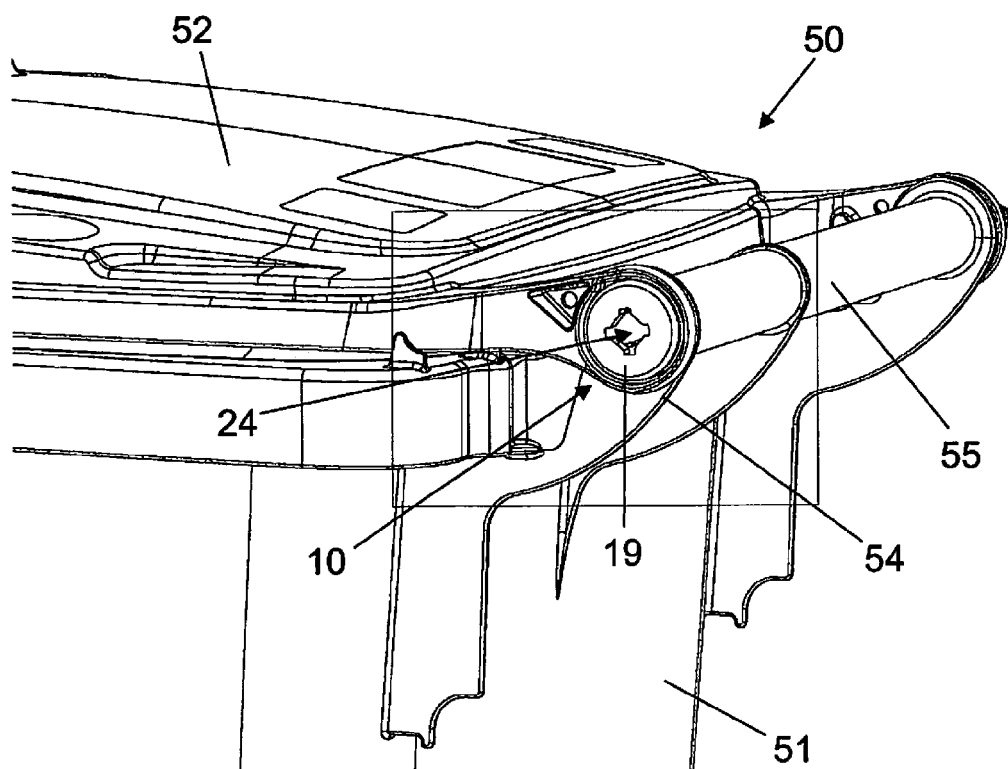


Fig. 15



EUROPEAN SEARCH REPORT

Application Number

EP 22 15 1196

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