(19) DANMARK

(10) **DK/EP 4170127 T3**

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: ***F 01 C 21/00 (2006.01)*** ***F 04 C 2/18 (2006.01)*** ***F 04 C 15/00 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2024-11-11**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-08-28**

(86) Europæisk ansøgning nr.: **21204258.4**

(86) Europæisk indleveringsdag: **2021-10-22**

(87) Den europæiske ansøgnings publiceringsdag: **2023-04-26**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **A. u. K. Müller GmbH & Co. KG, Dresdener Strasse 162, 40595 Düsseldorf, Tyskland**

(74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**

(54) Benævnelse: **Tandhjulspumpe**

(56) Fremdragne publikationer:
CA-A1- 2 325 173
CN-A- 108 204 363
US-A1- 2006 083 631
US-B1- 6 325 604

GEAR WHEEL PUMP

The invention relates to a gear pump for conveying a fluid with a conveying unit having at least two gears and a drive unit driving the gears, which are detachably connected to one another via connecting elements which can be actuated without tools according to claim 1. Further objects of the invention are a pump arrangement with such a gear pump and at least one valve unit as well as a method for tool-free, detachable connection of the conveying unit and the drive unit of such a gear pump.

Gear pumps of this type are used in various areas of technology to pump fluids, especially liquids, e.g. in vending machines or other systems in the food industry.

A gear pump usually has a conveying unit with two gears. The fluid to be pumped is conveyed via the teeth of the mutually engaging gears, which generate a pressure gradient along the conveying direction. A drive unit connected to the conveying unit, which is often designed as an electric motor, is used to drive the gears. The drive unit usually drives one gear wheel directly and the other indirectly due to the mutually engaging teeth. The conveying unit and the drive unit are often connected to one another via connecting elements which can be actuated without tools, which enables quick assembly and disassembly of such gear pumps or the replacement of individual components such as the drive unit.

From EP 3 282 086 A1 a gear pump for conveying a processing aid is known. The drive unit and conveying unit are detachably connected via separate connecting elements, which are designed as multi-part clamping rings. To connect the drive unit and conveying unit, they are first aligned axially to one another so that two flange-like clamping areas on the one hand of the drive unit and on the other hand of the conveying unit lie flat against one another. The clamping rings are then manually placed around the flange-like clamping areas and tightened using an actuating element designed like a clamping screw with a wing nut. The actuating element is connected to the clamping ring at one end in an articulated manner and is folded into a position tangential to the clamping area for clamping so that the wing nut engages behind a fork-shaped holding element. By subsequently turning the wing nut, the diameter of the clamping ring is reduced, whereby a clamping force is applied in the radial direction to the clamping area. The clamping rings have inclined surfaces so that the radial clamping force is converted into an axial connecting force

in the area of the flange-like clamping areas and is used to connect the drive unit and conveying unit.

In practice, the use of separate, clamp-like clamping rings has proven to be disadvantageous for such gear pumps, since the use of such clamping rings is associated with a complex assembly process requiring several steps. Furthermore, the creation of the connection using such clamping rings also depends to a certain extent on the skill of the fitter. This is because incorrect positioning or insufficient clamping force, for example, can lead to defective mounting that can impair the operation of the gear pump or even cause it to fail.

Further pumps with components that can be connected and disconnected without tools are disclosed in CN 108 204 363 A, US 6 325 604 B1, US 2006/083631 A1 and CA 2 325 173 A1.

Based on this, the invention sets itself the o b j e c t of specifying a gear pump, a pump arrangement and a method, which are characterized in that the conveying unit and drive unit of the corresponding gear pumps can be connected to one another in a simple and error-free manner.

This object is achieved in a gear pump of the type mentioned at the beginning by the features of claim 1. Advantageous further developments are specified in the dependent claims.

Due to the design according to claim 1, a simple and error-free connection of the drive unit with the conveying unit results. The bayonet connection defined in claim 1 allows for precise and repeatable assembly with a constant connection force in a user-friendly manner, even after repeated loosening, which can also be carried out safely by inexperienced assembly personnel. Defective mounting, which could result, for example, from incorrect positioning of the connecting elements or insufficient connecting force, are avoided.

In an advantageous design, it is proposed that connecting elements are arranged on the conveying unit and connecting elements are arranged on the drive unit and designed to correspond to one another. Such an arrangement enables a particularly simple and user-friendly connection or locking of the drive unit to the conveying unit. It is particularly advantageous when the same number of connecting elements is designed on the conveying unit and the drive unit. It is also advantageous when the connecting elements on the conveying unit and on the drive unit are designed to correspond in terms of their

respective geometry. In addition, it has proven to be advantageous when the connecting elements are designed to correspond with respect to their respective position on the conveying unit and the drive unit, whereby a particularly simple way of connecting the drive unit to the conveying unit can be established. The connecting elements can be arranged directly on the conveying unit and/or the drive unit. Alternatively, the connecting elements can also be arranged indirectly on the conveying unit and/or the drive unit via an intermediate element. The intermediate element can optionally also have an adapter function, for example for arranging different drive units on one and the same conveying unit.

In this context, it has proven to be particularly advantageous if the connecting elements are formed on mutually facing sides of the conveying unit and the drive unit. In this context, it can also be useful for connecting elements to be arranged on several sides of the conveying and/or drive unit. This increases the flexibility with regard to the connection of the conveying unit and drive unit with different alignments to one another.

An advantageous design provides that connecting elements are designed on flat fastening areas of the conveying unit and/or the drive unit. Once the latching elements have latched into place, the result is a flat contact and thus a reliable connection.

Furthermore, it has proven to be advantageous when the connecting elements are arranged at uniform distances, in particular angular distances, relative to one another. Such an arrangement allows the conveying unit and the drive unit to be easily connected to one another and is also advantageous with regard to the uniform transmission of forces between the conveying unit and the drive unit. This enables a particularly high-quality and solid connection to be achieved between the conveying unit and the drive unit. In this context, it is most preferred when the connecting elements are arranged at uniform distances relative to one another in the circumferential direction, whereby a particularly uniform connecting force can be generated.

It is further proposed that the connecting elements are designed in one piece with the conveying unit and/or the drive unit. Such an arrangement is particularly advantageous with regard to a simple connection, since the connecting elements are designed in a captive manner. Furthermore, such an embodiment is advantageous with regard to the manufacture of the conveying unit and/or the drive unit, e.g. by means of injection molding, since the connecting elements can be formed directly during the manufacture of the conveying unit and/or the drive unit.

In an advantageous further development of the invention, it is proposed that the conveying unit and the drive unit can be connected to one another in several mounting positions. Such a design enables a simple, user-friendly connection of the conveying unit to the drive unit, since the conveying unit and the drive unit can be connected to one another not only in one, but in several mounting positions or orientations. It has also proven to be advantageous when the mounting positions differ with respect to the rotational alignment of the conveying unit relative to the drive unit.

A further advantageous embodiment provides that the number of possible mounting positions corresponds to the number of corresponding connecting elements. An increased number of mounting positions can offer advantages regarding the arrangement of the conveying unit and drive unit. In particular, in certain installation situations, accessibility to certain areas of the conveying unit and/or the drive unit can be improved. Advantageously, two possible mounting positions can be provided for two pairs of connecting elements. Furthermore, with three pairs of connecting elements, three possible mounting positions can be provided, etc. It is most preferred if, with four pairs of connecting elements, four mounting positions are provided and can be selected. Such a design enables a quick and user-friendly connection of the drive unit to the conveying unit, as the number of possible mounting positions can already be determined based on the number of pairs of connecting elements.

In an advantageous further development of the invention, it is proposed that the connecting elements form a bayonet connection. Such a bayonet connection is particularly advantageous with regard to a simple and error-free latching connection of the drive unit to the conveying unit. Furthermore, a bayonet connection can enable an intuitive, repeatable, non-destructively detachable latching connection between the drive unit and the conveyor unit for the assembly personnel. Establishing a connection via a bayonet connection can also be easy and error-free for inexperienced mounting personnel.

In this context, it is proposed that the connecting elements are designed as bayonet hooks and/or corresponding recesses. Such a design enables a bayonet connection to be established easily. In particular, it is advantageous when the bayonet hooks are designed to engage in the corresponding recesses. In this context, it can be advantageous if the geometric configurations of the bayonet hooks and/or the recesses are adapted to one another or are designed to correspond to one another.

In this context, it is further proposed that the bayonet hooks have an essentially rectangular shape with a base and a latching part that spreads out at right angles from the base. Such an arrangement allows a simple and easy-to-mount connection by means of the bayonet connection. In addition, the latching part, which extends at right angles from the base, can be used in a simple manner to create a high-quality latching connection in a form-fit manner. As an alternative to the right-angled spreading, transverse spreading of the latching part from the base can also be provided in an angle range of 80° to 100° to the base.

In this context, it has proven to be advantageous in terms of design when the latching part points radially outwards or radially inwards.

It has also proven to be advantageous in terms of design when the recesses have a insertion area for inserting the bayonet hooks and a securing area for latching the bayonet hooks.

In this context, it is further proposed that the securing area is designed to cooperate with the latching part of the bayonet hook. Such a design enables a user-friendly and reliable connection between the drive unit and the conveying unit by means of a bayonet connection, even when it is loosened several times.

In a structurally advantageous design, the recesses are designed as circular ring segments, wherein the insertion areas extend over one half of the circular ring segments and the securing areas are arranged in the other half of the circular ring segments. It is preferred when the geometry of the insertion areas corresponds to the geometry of the bayonet hooks, and in particular the latching part of the bayonet hooks. Furthermore, such an arrangement can be advantageous in terms of user-friendly mounting of the conveying unit and drive unit. The production of a bayonet connection can be made possible in an advantageous manner by sequentially inserting the bayonet hooks into the insertion area of the recesses and then rotating the bayonet hooks relative to the recesses. This allows the latching part of the bayonet hooks to be latched in a form-fit manner with the securing area of the recesses. As an alternative to an extension over half of the circular ring segments, extensions over a component of between 30 % and 70 % and in particular 40 % and 60 % of the width of the circular ring segments can also be provided. In this context, other geometric relationships, in particular wider or less wide insertion areas, are also conceivable, adapted to the requirements of the connection between the conveying and drive unit.

In this context, it is also proposed that the securing areas extend flat and web-like from the outer radius of the circular ring segments in a radial direction over at least one third of the extent of the circular ring segments. As an alternative to an extension over one third of the radial extent, extensions of the securing areas of 10 % to 50 % and in particular 25 % to 45 % of the radial extent of the circular ring segments can also be provided.

In a further development of the invention, it is proposed that the securing areas have a compensating ramp for tolerance compensation, which is designed to interact with the latching parts of the respective bayonet hooks. Such a design enables tolerances to be compensated for in a simple and advantageous manner and enables a play-free latching connection between the conveying unit and the drive unit. It is preferred that the compensating ramp is designed in such a way that it can be reversibly deformed in the event of tolerance overlap.

In this context, it is also preferred when the compensating ramp is arranged on the securing area as an inclined plane that rises in the circumferential direction of the circular ring segment, which in particular extends over at least two thirds of the length of the securing area. Such a design of the compensating ramp enables simple and user-friendly tolerance compensation. Depending on the relative position of the latching part of the bayonet hook to the compensating ramp of the securing area, tolerances of different sizes can be compensated. The inclined plane can have a constant angle of rise or an angle of rise that varies over the length of the compensating ramp. The individual securing areas can have compensating ramps of the same design.

It is further proposed that the drive unit and the conveying unit are designed to be rotatable relative to one another about an axis of rotation for fixing or releasing the bayonet connection. In an advantageous manner, the drive unit and the conveying unit can first be inserted into one another in the axial direction along the axis of rotation in the region of the connecting elements and, in a second step, rotated relative to one another about an axis of rotation. This allows a simple latching connection of the drive unit to the conveying unit that can be established quickly and securely even by inexperienced operating personnel. Furthermore, such a connection can be released in a simple and non-destructive manner by reversing the method steps carried out for the connection.

In this context, it is further proposed that the axis of rotation corresponds to the driving axle of the drive unit. This enables an axisymmetric design, wherein the drive unit

and/or the conveying unit can be rotated around the drive axis for connection. Advantageously, the connection can be made by turning in one direction and the connection can be released by turning in the opposite direction.

In a further development of the invention, it is proposed that the conveying unit has at least two bayonet hooks and the drive unit has at least two corresponding recesses for engagement of the bayonet hooks. Such an arrangement is advantageous with regard to a simple and, in terms of the connecting force, uniform connection between the conveying unit and the drive unit. In this context, it may alternatively also be advantageous for the conveying unit to have at least two recesses and for the drive unit to have at least two corresponding bayonet hooks.

In a further development of the invention, it is proposed that the conveying unit has at least three, four or five bayonet hooks for connection to at least three, four or five corresponding recesses arranged on the drive unit. In this context, it is of particular advantage when the bayonet hooks and the corresponding recesses are arranged circularly and evenly around the circumference. It is also readily conceivable that the conveying unit has at least three, four or five recesses and that the drive unit has at least three, four or five bayonet hooks for engaging in the recesses. A larger number of corresponding bayonet hooks and recesses has proven to be advantageous in terms of the mechanical load-bearing capacity of the connection.

In a further development of the invention, it is further proposed that the bayonet connection has an anti-rotation lock. Such a design is advantageous for securing against unintentional releasing of the connection. Furthermore, an anti-rotation lock can protect the conveying unit and the drive unit against unwanted loosening of the connection as a result of shocks and/or vibrations that can occur during operation of the gear pump. The anti-rotation lock can also act as a connection indicator to indicate a correct connection between the drive unit and the conveying unit.

In this context, it has proven to be advantageous if the anti-rotation lock has at least one resiliently designed securing hook which interacts in a form-fitting manner with at least one corresponding securing recess. Such a design enables a simple and safe anti-rotation lock of the connection. In this context, it is particularly advantageous if the securing hook is designed in a resilient manner in the radial direction. Furthermore, the securing recess can advantageously be adapted to the structural design of the securing hook in terms of its position and geometric shape.

In this context, it is further proposed that the securing hook has a securing lug for engaging in a corresponding securing recess. Such a securing lug enables a simple and effective anti-rotation lock. In particular, it can be advantageous when the geometry of the securing lug is adjusted to the geometry of the corresponding securing recess.

In this context, it has proven to be advantageous in terms of design when the at least one securing hook is arranged on the conveying unit and the at least one securing recess is arranged on the drive unit. Such an arrangement allows the conveying unit and the drive unit to be secured in a simple and safe manner against unintentional reversal and thus against unintentional loosening of the connection. In this context, it is also conceivable that the drive unit has a securing hook which is designed to cooperate with at least one anti-rotation lock arranged on the conveying unit to prevent it from turning back.

In this context, it is further proposed that the anti-rotation lock has a securing hook and a plurality of securing recesses into which the securing hook can engage depending on an mounting position. Such an arrangement enables the conveying unit and the drive unit to be connected in several mounting positions, wherein these can be secured against unintentional reversal. It has proven to be advantageous when the drive unit has at least two, preferably four and most preferably as many securing recesses around its circumference as there are connecting elements arranged on the drive unit or on the conveying unit. Moreover, it is readily conceivable that the conveying unit may have several securing recesses distributed around the circumference of the fastening area.

A further embodiment, which does not fall within the scope of the claims, provides that the connecting elements form a snap hook connection. Like a bayonet connection, such a design enables a simple and user-friendly latching connection of the drive unit to the conveying unit.

In this context, it is proposed that the connecting elements are resiliently designed latching tongues and/or corresponding recesses. In particular, the latching tongues can be designed in such a way that they can be inserted in a form-fit manner into the corresponding recesses. With regard to a simple connection, it has proven to be advantageous when the latching tongues are resiliently designed to be radial.

In this context, it is also proposed that the latching tongues have a latching area which is designed to interact in a form-fit manner with a corresponding latching area of the recesses. Such a design allows a simple and error-free latching connection between

the conveying unit and the drive unit. The latching connection can be generated by simply inserting the latching tongues into the corresponding recesses.

In addition, it is proposed that the latching tongues have an insertion slope for easy insertion into the recesses. This results in a user-friendly design of the latching tongues. The insertion slope can be designed as an inclined plane extending from the tip of the latching tongues in their axial direction. The edge of the recesses can be designed to interact with the insertion slope and support the compression of the latching tongues.

It is also proposed that the latching tongues are designed in such a way that they spring into the recesses transversely to their insertion direction during insertion and spring out when the connection position is reached, whereby the latching areas latch together. Such a design is advantageous with regard to simple connection of the drive unit to the conveying unit by insertion in the axial direction. Furthermore, the latched latching areas can also serve as an indicator of a successful connection of the conveying unit to the drive unit. For this purpose, the latching tongues can have contrasting colored markings, in particular at their tip, as a connection indicator, which are visibly arranged when correctly latched and indicate a successful connection. Defective mounting can thus be avoided.

In this context, it is also proposed that the latching tongues are designed in such a way that they spring in transversely to the insertion direction when a release force applied against the insertion direction is reached. Such a design enables the connection to be released easily. By applying the release force, the latching mechanism can be easily released. In a particularly advantageous manner, the release force to be applied for release is selected in such a way that it cannot easily occur during operation of the gear pump, whereby an unintentional release of the snap hook connection during operation can be prevented.

It is further proposed that the conveying unit has at least two latching tongues and the drive unit has at least two corresponding recesses for engagement of the latching tongues. This has proven to be advantageous with regard to a safe, symmetrical and resilient connection between the conveying unit and the drive unit. In this context, it is also conceivable that the drive unit has at least two latching tongues and the conveying unit has at least two corresponding recesses for engagement of the latching tongues.

It has also proven advantageous if the conveyor unit has three, four or five latching tongues for connection to three, four or five corresponding recesses arranged on the drive

unit. Such an arrangement is particularly advantageous for the mechanical load-bearing capacity of the connection between the conveying unit and the drive unit. It is particularly advantageous when the three, four or five latching tongues or the three, four or five corresponding recesses are arranged in a circle at a uniform distance from one another on the respective fastening area. It is also readily conceivable that the drive unit can have three, four or five latching tongues for connection to three, four or five corresponding recesses arranged on the conveying unit.

In a further development of the embodiment, which does not fall within the scope of the claims, guide elements are proposed for guiding the plug-in movements when connecting and/or releasing the snap hook connection. Such guide elements can simplify the production of the latching connection between the conveying element and the drive element. Furthermore, such guiding elements can serve as protection against incorrect mounting. It is particularly advantageous if the guide elements are designed as projections or recesses and have shapes that correspond to one another.

It can also be advantageous when the connecting elements are designed on at least one intermediate element, wherein the intermediate element is attached to the conveying unit and/or the drive unit. When using such an intermediate element, the connecting elements are indirectly connected to the drive unit and/or the conveying unit via the intermediate element. The intermediate element can be adjusted in the manner of an adapter to the requirements of the connection between the conveying unit and the drive unit. Different drive units and conveying units can therefore also be connected to one another by using different intermediate elements. This can be advantageous, for example, when replacing a less powerful drive unit with a more powerful one. The intermediate element can be designed in the form of a disc. In this context, it has proven to be advantageous if connecting elements are arranged in one piece on the conveying unit and corresponding connecting elements are formed on an intermediate element which is arranged on the drive unit. It has also proven to be advantageous when the intermediate element is detachably fastened to the conveying unit and/or the drive unit. In particular, a detachable fastening by means of fastening means such as screws or bolts may be preferred. Such an arrangement can enable the intermediate element to be changed quickly and easily. Furthermore, the intermediate element can thus be replaced in a simple manner. However, the intermediate element can also be permanently attached to the

conveying unit and/or the drive unit if this should prove advantageous for the respective application.

It is of structural advantage if the drive unit for driving the gears is operatively connected to the gears via an intermediate shaft. Such a design enables a quick and easy replacement of the drive unit.

It has proven advantageous if the intermediate element has a shaft bearing for supporting the intermediate shaft. Such an arrangement enables reliable mounting of the intermediate shaft in a simple manner. The shaft bearing is preferably formed centrally and in the manner of a cylindrical collar on a substantially disc-shaped intermediate element.

In this context, it is proposed that the shaft bearing has a shaft seal to seal the intermediate shaft. Such a shaft seal enables easy sealing of the intermediate shaft. Furthermore, such an arrangement makes it easy to specify the position of the shaft seal.

In an advantageous embodiment, the intermediate shaft has an actuation contour which can be positively connected to a corresponding actuation contour arranged on at least one of the gears. In this way, the intermediate shaft and the gear wheel can be connected to one another in a simple and user-friendly manner. This gear wheel is a driven gear wheel.

It is further proposed that at least one of the gears has a bearing contour for freely rotatable arrangement on a bearing axle. Such a bearing contour has proven to be advantageous for mounting the gear on the bearing axis. This gear wheel is a rotating gear wheel.

In this context, it is further proposed that the actuation contours can be connected to one another in a form-fitting manner. In particular, it is advantageous when the actuation contour of the intermediate shaft is designed to correspond to the actuation contour of at least one of the gears and can be connected thereto in a form-fit manner. Such a design enables simple connection and in a form-fit manner of the intermediate shaft to at least one of the gears. It is particularly advantageous when the driven gear wheel of the gear pump has an actuation contour.

Furthermore, it is proposed that the actuation contour of the intermediate shaft is not designed to be insertable into the bearing contour. Such a design makes it possible that the intermediate shaft cannot be connected to the non-driven gear, which has the

bearing contour. This also prevents defective mounting, as the intermediate shaft can only be connected to the driven gear wheel intended for this purpose.

It is proposed that the actuation contours are designed in the manner of a polygon, in particular a pentagon. Such a design has proven to be advantageous with regard to low-loss power transmission. Furthermore, a polygon is easy to manufacture. In particular, a polygon can be designed as the outer contour of a bolt or as the inner contour of a bore.

In this context, it has proven to be advantageous when the bearing contour is designed as a round bore. Such a round bore enables the non-driven gear to be easily and freely rotated on the bearing axis.

In order to facilitate installation, it is advantageous if the diameter of the round hole and the diameter of the polygon of the actuation contour are selected in such a way that they cannot be inserted into one another. This enables simple and error-free mounting of the gear pump. Defective mounting due to incorrect connection of the intermediate shaft and/or the bearing axle to the gears can be prevented.

Furthermore, it is proposed that the conveying unit has a plain bearing for bearing the intermediate shaft of the drive unit. In this context, it has been found to be advantageous when the plain bearing is arranged in the vicinity of the driven gear. Such a design arrangement can reduce friction and wear, as angular errors between the intermediate shaft and the gear wheel can be compensates by the plain bearing.

It has proven to be advantageous in terms of design when the gears are arranged in a gear chamber delimited by a wall of the conveying unit and the plain bearing is arranged in the wall. In such a design, the plain bearing is located in close proximity to the gears. Angular errors are effectively compensated.

It is further proposed that the gear pump has a connection indicator indicating the connection between the conveying unit and the drive unit. When correctly latched, this connection indicator can be arranged visible to the mounting personnel and indicate a successful connection. Defective mounting can thus be avoided.

In this context, the design suggests that the connection indicator is formed on the anti-rotation lock of the bayonet connection.

In addition, a pump arrangement with a gear pump and at least one valve unit according to patent claim 10 is proposed to solve the above-mentioned problem. The same advantages mentioned above with regard to the gear pump apply to the pump

arrangement. Such a pump arrangement makes it possible to control the fluid flow in an advantageous manner.

In this context, it is proposed that the conveying unit of the gear pump is connected to a valve unit via connecting elements which can be actuated without tools. Such a design enables a quick and user-friendly connection between the conveying unit and the valve unit.

In this context, it has proven to be advantageous when the connecting elements are designed as latching elements. This results in the same advantages already explained above with regard to the connection between the conveying unit and the drive unit.

According to the invention, the connecting elements form a bayonet connection as defined in claim 1. In particular, it is advantageous when the bayonet connection is designed according to the bayonet connection described above.

Not falling within the scope of claim 1, the connecting elements can also form a snap hook connection. In that case it is advantageous if the snap hook connection is designed according to the snap hook connection described above.

Furthermore, to solve the above-mentioned problem, a method according to patent claim 11 is proposed. In connection with the method, the same advantages arise as previously mentioned with regard to the gear pump and the pump arrangement. In particular, such a method enables a simple and error-free connection of the conveying unit to the drive unit.

In connection with the method, it is proposed that the gear pump is designed according to one or more of the features described above.

Further details and advantages of the invention are explained below with the aid of the accompanying drawings of exemplary embodiments. However, the invention is not limited to these exemplary embodiments.

The drawings show:

Figs. 1 and 2	perspective views of a gear pump according to the invention according to a first embodiment;
Fig. 3	a sectional view of the gear pump according to the representation in Fig. 2;
Fig. 4	a perspective exploded view of the gear pump according to Fig. 3;

Fig. 5	a cross-sectional view of the gear pump in the area of the conveying unit;
Figs. 6a to 6c	perspective views of the gears and an intermediate shaft of the gear pump;
Fig. 7	a schematic representation of the actuation and bearing contour;
Fig. 8a	a perspective, partially sectioned view of a gear pump;
Fig. 8b	an enlarged view of the detail labeled VIII b in Fig. 8a;
Figs. 9a to 9e	perspective views of the bayonet connection of a gear pump;
Figs. 10 and 11	perspective views illustrating the tolerance compensation of the bayonet connection of a gear pump;
Fig. 12a	a sectional view of the bayonet connection according to Fig. 10;
Fig. 12b	a sectional view according to the detail labeled XII b in Fig. 12a;
Fig. 13	a detailed perspective view of the bayonet connection according to Fig. 11;
Fig. 14	a further perspective detail view of the bayonet connection according to Fig. 11;
Fig. 15 to 17	perspective views of a gear pump according to a second embodiment, which does not fall within the scope of the claims;
Fig. 18 to 20	detailed views of the snap hook connection of the gear pump according to Fig. 15 to 17; and
Fig. 21 to 23	perspective views of various pump arrangements with a gear pump and several valve units.

The illustrations in Fig. 1 and Fig. 2 show a gear pump 1 with a conveying unit 2 for conveying a fluid and a drive unit 3 designed as an electric motor. The drive unit 3 serves to operate the conveying unit 2, through which the fluid to be conveyed, which can be drinking water, for example, can flow via two connections 26 serving as inlet and outlet.

The drive unit 3 is detachably connected to the conveying unit 2. Several connecting elements 7, 8 are provided for this purpose. The connecting elements 7, 8 are designed as latching elements and therefore allow a simple and error-free latching connection of the conveying unit 2 and the drive unit 3.

The latching elements 7, 8 face one another and act together in a latching manner of a bayonet connection 50, see Fig. 2. Details of the bayonet connection 50 will be explained in more detail below with reference to the representations in Figs. 9a to 14.

The connecting elements 7 are arranged on one end face of the conveying unit 2 and interact in a latching manner with the connecting elements 8 arranged on the drive unit 3. While the connecting elements 7 are arranged directly on the conveying unit 2, the connecting elements 8 are arranged indirectly on the drive unit 3 via a disc-shaped intermediate element 6. The indirect arrangement of the connecting elements 8 on the drive unit 3 has the advantage that the intermediate element 6 can be used as an adapter for connecting different drive units 3, for example with different operating principles, different performance, or the like, to one and the same conveying unit 2, depending on the application.

Alternatively, it would also be conceivable that the drive-side connecting elements 8 are arranged directly on the drive 3. It would also be conceivable for the connecting elements 7 to be designed on an intermediate element connected to the conveying unit 2, which is not shown in the figures.

While the representation in Fig. 1 shows a disconnected state, the representation in Fig. 2 shows the mounted gear pump 1, in which the drive unit 3 and the conveying unit 2 are detachably connected to one another by mutual latching via the bayonet connection 50. In the mounted state, the end faces of the conveying unit 2 and the intermediate element 6 of the drive unit 3 lie flush and planar against one another and form a connecting area 5.

Details of the drive unit 3, the intermediate element 6 and the conveying unit 2 are explained below, in particular with reference to the representations in Figs. 3 and 4.

The drive unit 3 of the gear pump 1 has an essentially cylindrical geometry and is designed as an electric motor. The drive unit 3 has electrical connections 3.1. When the drive unit 3 is energized, a driving shaft 3.2 is set in rotation, which is utilized to drive the conveying unit 3.

In the exemplary embodiment, the drive unit 3 is a commercially available standard electric motor in a wide variety of designs, such as those available as brushless or brushed electric motors in various performance classes. An intermediate shaft 14 extending between the drive unit 3 and the conveying unit 2 is provided to transmit the rotary movement of the drive unit 3 generated by the drive unit 3 to the conveying unit 2. In the

embodiment, the intermediate shaft 14 is designed as a separate component. On one side, the intermediate shaft 14 is connected to a driving shaft 3.2 of the drive unit 3, which is designed as a short axle stub, and on the other side it is connected to the conveying unit 3. Alternatively, it would also be conceivable that the intermediate shaft 14 is connected in one piece to the driving shaft 3.2. In this case, however, a standard motor could not be used.

As is clear from the illustration in Fig. 4, the intermediate shaft 14 has a shaft connection 14.2 for connection to the drive unit 3. The shaft connection 14.2 is cylindrical and sleeve-like and is an integral part of the intermediate shaft 14. The shaft connection 14.2 is pressed onto the drive shaft 3.2 of the drive unit 3 in order to connect it to it. In particular, the intermediate shaft 14 can be made of a stainless steel with a minimum chromium content of 16%, which is approved for use in the food industry or for driving gear pumps 1 for conveying drinking water. The driving shaft 3.2 of the drive unit 3 does not come into contact with the fluid to be conveyed due to the intermediate shaft 14 pressed on in the manner of a shaft extension.

On one end face, the drive unit 3 has a disc-shaped intermediate element 6, which is detachably fastened to the drive unit 3 via fastening means 23 designed as screws and corresponding bores 24. The intermediate element 6 is designed to be essentially round. The intermediate element 6 has the connecting elements 8 on the drive side, which are recesses 8. In addition, the intermediate element 6 has a shaft bearing 13 for bearing the intermediate shaft 14. The shaft bearing 13 is designed in the manner of a cylindrical collar and extends in the center of the intermediate element 6 substantially perpendicular to its surface.

The conveying unit 2 is essentially designed in a cuboid shape and has a housing 2.1 and a lid 2.2, which are connected to one another by means of cylindrical, dumbbell-shaped insertion connecting elements 22. The insertion connecting elements 22 are inserted into correspondingly shaped recesses 33 for connection and overlap the flat contact area between the housing 2.1 and lid 2.2 on the lower and upper sides of the latter, see also Figs. 4 and 9a. The lid 2.2 has two tubular connections 26 serving as inlet and outlet, via which the conveying unit 2 can be connected to other components, not shown, of the respective hydraulic system. On the side opposite the connections 26, the conveying unit 2 has a flat fastening area B, on which the connecting elements 7 are designed in one piece. The connecting elements 7 are designed as bayonet hooks as shown in Fig. 1.

In the present exemplary embodiment, the bayonet hooks 7 are arranged directly on the fastening area B. Alternatively, it is also conceivable that they are arranged indirectly, via an intermediate element 6 on the fastening area B. An inverse arrangement would also be conceivable, i.e. arranging the bayonet hooks 7 on the drive side and the recesses 8 on the conveying side.

The housing 2.1 and the lid 2.2 of the conveying unit 2 as well as the intermediate element 6 and all elements arranged thereon are preferably made of plastic using suitable methods, in particular injection molding methods. All components that come into contact with the fluid to be pumped are suitable for use in the food or drinking water sector.

The arrangement of the gears 4.1 and 4.2 in the conveying unit 2 and their drive are explained in more detail below with reference to the representations in Figs. 3 to 7.

A gear chamber 35 is arranged inside the housing 2.1. The gear chamber 35 is sealed against the lid 2.2 by means of a seal 25 in the form of an O-ring. Two gear chambers 4.1 and 4.2 are rotatably arranged in the gear chamber 35. The teeth of the wheel gear 4.1 engage with the corresponding gaps of a second, rotating gear 4.2. The rotating gear wheel 4.2 is rotatably borne parallel to the axis of the driven gear wheel 4.1 on an axle 21 arranged in the housing 2.2. The fluid to be conveyed flows around both gears 4.1, 4.2. A rotary movement of the driven gear wheel 4.1 causes the rotating gear wheel 4.2 to rotate in the opposite direction. This creates a pressure gradient that can be used to convey the fluid, via which the fluid flows from an inlet 31 to an outlet 32. Connections 26 are connected to the inlet 31 and the outlet 32, which can be routed through the cover 2.2 or arranged on the side walls of the housing 2.1.

The driven gear wheel 4.1 is insertion-connected to the intermediate shaft 14 to drive the conveying unit 2. The transmission of the drive force from the intermediate shaft 14 to the driven gear wheel 4.1 takes place via corresponding actuation contours 14.1 and 16.1. In the present exemplary embodiment, the actuation contour 14.1 is designed as a pentagon, which is arranged as an outer contour at the end of the intermediate shaft 14 opposite the drive unit 3, see Fig. 6c. The driven gear wheel 4.1 has a corresponding pentagonal contour designed as an inner contour as actuation contour 16.1, see Fig. 6b. The actuation contour 14.1 is inserted into the actuation contour 16.1 to drive the driven gear 14.1. The pentagonal design enables effective transmission of the torque.

In order to prevent possible incorrect mounting of the intermediate shaft 14 on the rotating gear wheel 4.2, the rotating gear wheel 4.2 does not have an actuation contour,

but a bearing contour 16.2 designed as a round bore, see Fig. 6a. The geometries of the actuation contour 14.1 and the bearing contour 16.2 are selected in such a way that the actuation contour 14.1 of the intermediate shaft 14 cannot be inserted into the bearing contour 16.2 of the rotating gear wheel 4.2, see Fig. 7. This ensures that the intermediate shaft 14 can only be connected to the driven gear wheel 4.1. The bearing contour 16.2 is designed in such a way that the rotating gear wheel 4.2 can only be connected to the corresponding axle 21 provided for this purpose, see also Fig. 8b.

A shaft sealing ring 15 is provided to seal the intermediate shaft 14 against the gear space 35 arranged in the housing 2.1 of the conveyor unit 2, see Fig. 4. In the present embodiment, the shaft sealing ring 15 is designed as a radial shaft sealing ring. In order to achieve the hardness of the intermediate shaft 14 of at least 45 HRC required for sealing with the shaft sealing ring 15, the intermediate shaft 14 has a corresponding coating in the area of the shaft sealing ring 15 or has been hardened to the corresponding hardness specification by means of Kolsterizing. In order to prevent the risk of damage to the shaft seal ring 15 during assembly, the edges of the pentagonal actuating contour 14.1 are rounded.

The mounting of the gears 4.1 and 4.2 in the conveying unit 2 is explained below with reference to the representations in Figs. 8a and 8b. Fig. 8b shows an enlargement of section VIII b according to Fig. 8a.

The driven gear wheel 4.1 is, as previously explained, placed on the actuation contour 14.1 of the intermediate shaft 14. A plain bearing 17 is arranged in the immediate vicinity of the gear wheel 4.1 in the housing 2.1 of the conveying unit 2. The arrangement of the plain bearing 17 in the wall 2.3 of the conveyor unit 2 near the gear 4.1 enables additional guidance of the intermediate shaft 14. The plain bearing 17 can be designed as a recess in the wall 2.3, provided that the wall is made of a suitable material. Alternatively, the slide bearing 17 can be inserted into the wall 2.3 as a separate component and, for example, be designed as a slide bearing bush. The possible effects of angular misalignments, e.g. due to angular tolerances of the drive unit 3, which become greater the greater the distance to the slide bearing 17, can thus be reduced in the area of the gear 4.1. This enables the gear pump 1 to run smoothly, which can also reduce the wear of the gears 4.1 and 4.2. Similarly, the axle 21 of the rotating gear 4.2 is also borne in the area of this gear 4.2 by means of a slide bearing. The slide bearing of the rotating gear wheel 4.2

can also be integrally mounted on the gear wheel 4.2 or inserted into it as a separate slide bearing.

In the following, the design of the bayonet connection 50 provided in the first exemplary embodiment is explained with reference to the representations in Figs. 9a to 14.

The representation in Fig. 9a indicates the fastening area B arranged on one side of the conveying unit 2. Four bayonet hooks 7 are arranged at a certain radial distance from the center of the fastening area B. The bayonet hooks 7 are arranged at equal distances point-symmetrically to a central round bore of the fastening area B, so that there is an angle of 90° between each of the bayonet hooks 7. The bayonet hooks 7 are designed in one piece with the housing 2.1. Based on the representation in Fig. 14, it can be seen that the bayonet hooks 7 are essentially L-shaped with a rectangular floor area and have a base 7.1 and a latching part 7.2. The base 7.1 extends perpendicularly from the surface of the fastening area B. At a certain distance from the surface of the fastening area B, the latching part 7.2 extends transversely to the base 7.1. The lower edge of the latching part 7.2 extends parallel to the surface of the fastening area B. The outer edges of the bayonet hook 7 are bevelled or have chamfers, which can facilitate insertion into corresponding recesses 8.

As explained, the intermediate element 6 attached to the drive unit 3 in the present exemplary embodiment is designed in the form of a flat round disc, see Fig. 9b. The intermediate element 6 has four continuous recesses 8, which are designed in the manner of circular ring segments 34. The recesses 8 are designed so that they can interact with the bayonet hooks 7 to connect the conveying unit 2 to the drive unit 3. The recesses 8 are arranged point-symmetrically on a common circular path around a central round bore. The angular spacing of the recesses is therefore 90°.

The recesses 8 each have a insertion area 8.1, see Fig. 10. This insertion area 8.1 is adjusted to the geometry of the latching part 7.2 of the bayonet hook 7 and enables the bayonet hook 7 to be inserted. The insertion area 8.1 extends in the circumferential direction over approximately half the circumferential length of the recess 8. A securing area 8.2 is arranged in the other half of the circumference of the recess 8. This securing area 8.2 is designed to interact with the latching part 7.2 of the bayonet hook 7. It extends flat and web-like from the outer radius of the recess 8 to about one third of its radial length, see Fig. 10. The securing area 8.2 is arranged in the lower area of the recess 8, its thickness

corresponds approximately to half the thickness of the intermediate element 6, see Fig. 12a. The recesses 8 have chamfers for easy connection to the bayonet hooks 7.

To establish the connection by means of the bayonet connection 50, the conveying unit 2 and the drive unit 3 are designed to rotate relative to one another, wherein the axis of rotation D corresponds to the driving axle A, see also Fig. 3. The mutual rotation causes the securing area 8.2 of the recess 8 and the latching part 7.2 of the bayonet hook 7 to engage with one another, see Fig. 12a. No additional tools are required to establish the bayonet connection 50. In the connected state according to Fig. 11, the four bayonet hooks 7 engage behind the securing areas 8.2 of the recesses 8, whereby these are latched in a form-fit manner.

To prevent unintentional or accidental releasing of the connection, the bayonet connection 50 has an anti-rotation lock 10 to prevent reverse rotation. In particular, the anti-rotation lock 10 serves to prevent unwanted releasing due to vibrations or shocks during operation of the gear pump 1. For this purpose, the conveying unit 2 has a securing hook 10.1, see Fig. 9a. The securing hook 10.1 is arranged radially on the outside of the fastening area B and is designed as a spring arm articulated on one side and resilient in a radial direction. Furthermore, the securing hook 10.1 has a projecting securing lug 10.2, which extends at the free end of the securing hook 10.1 essentially perpendicular to the surface of the fastening area B. In the correctly mounted state, the securing lug 10.2 engages in a correspondingly shaped recess 10.3 of the intermediate element 6, see Figs. 9d and 9e. To release the bayonet connection 50, the securing hook 10.1 can be manually disengaged from the recess 10.3. Alternatively or additionally, a sufficient release force for releasing the bayonet connection 50 can be generated by turning the conveying unit 2 relative to the drive unit 3.

The anti-rotation lock 10 has a dual function. It not only serves to prevent unintentional releasing, but as a connection indicator 36 that can be read from the outside, it also indicates a correctly latched bayonet connection 50 between the conveying unit 2 and the drive unit 3. This is because the securing lug 10.2, which is visible from the outside, and the recess 10.3 are only engaged with one another when the bayonet connection 50 is correctly latched.

In the exemplary embodiment, the intermediate element 6 has a total of four recesses 10.3, which are arranged at an even distance around the circumference of the intermediate element 6, see e.g. Fig. 9e. The one securing lug 10.2 can engage in any of

these recesses 10.3. Thus, the drive unit 3 can be connected to the conveying unit 2 in any of four orientations or mounting positions, which differ in the rotational position of the drive unit 3 about its driving axle A.

Furthermore, the securing areas 8.2 each have an compensating ramp 9 to offset tolerance. The compensating ramp 9 is designed so that it can interact with the latching part 7.2 of the corresponding bayonet hook 7. The compensating ramp 9 is arranged over approximately two thirds of the length of the securing area 8.2 in the circumferential direction on the latter and essentially covers its entire width in the radial direction. The compensating ramp 9 is designed as an inclined plane that rises in the circumferential direction and extends in the mounted state in the direction of the latching part 7.2 of the bayonet hook 7, see also Fig. 12b. Together with the latching part 7.2 of the bayonet hook 7, the compensating ramp 9 can serve to offset tolerances and ensure a backlash-free connection between conveying unit 2 and drive unit 3. For this purpose, the compensating ramp 9 is designed in such a way that it can deform reversibly in the event of a tolerance overlap.

The illustrations in Fig. 15 to 20 show a second embodiment, which does not fall within the scope of the claims and which, in contrast to the first embodiment, does not have a bayonet connection 50 but rather a snap hook connection 60, but otherwise corresponds to the first embodiment in all relevant features.

The snap hook connection 60 differs from the previously described bayonet connection 50 essentially in the structural design of the connecting elements 11, 12.

The illustration in Fig. 15 shows a fastening area B arranged on one side of the conveying unit 2. Four recesses 12 are arranged at a certain radial distance from the center of the fastening area B. The recesses 12 are arranged at even distances and tangentially to a central round bore of the fastening area B, so that there is an angle of 90° between each of the recesses 12. The recesses 12 are designed as essentially rectangular openings on the fastening area B, see Fig. 19. The recesses 12 each have a latching area 12.1, which is arranged in the manner of an edge on the rear side of the fastening area B, see also Fig. 20. Further, also rectangular openings are arranged on the fastening area B between the recesses 12. Furthermore, the fastening area B has four guide elements 20, which are arranged as rectangular recesses in the form of notches on the edge of the central round bore. The guiding elements 20 are aligned with the recesses 12.

Similar to the first embodiment, four latching tongues 11 of the snap hook connection 60 are again designed on an intermediate element 6, see Fig. 18. The latching tongues 11 have a tab-like basic shape and extend essentially transversely to the surface of the intermediate element 6 in the same direction as the shaft bearing 13, which is designed as a cylindrical collar. The latching tongues 11 are resiliently designed in the radial direction in the manner of a resilient cantilever arm. The four latching tongues 11 are arranged at an even distance from one another on the same radius, so that they are aligned with the recesses 12 of the conveying unit 2 to create a latching connection, see Fig. 16. In the area of their tip, the latching tongues 11 have a latching area 11.1, which is designed in the manner of an edge transverse to the tab-like base body of the latching tongue 11. The tip of the latching tongues 11 is provided with an insertion slope 11.2, by means of which the insertion of the latching tongues 11 into the corresponding recesses 12 of the conveying unit 2 can be facilitated. Furthermore, the intermediate element 6 has four guiding elements 19, which are designed as rectangular, nose-like projections on the cylindrical collar of the shaft bearing 13. The guiding elements 19 are aligned with the latching tongues 11.

To produce the snap hook connection 60, the drive unit 3 is moved in the insertion direction R along the drive axis A towards the conveyor unit 2 and inserted into the recesses 12, see Fig. 15 and 16. When inserted, the tips of the latching tongues 11 in the area of the fastening area B abut against the edges of the corresponding recesses 12. As a result, the resiliently designed latching tongues 11 spring in the radial direction. The insertion slopes 11.2 facilitate insertion. When the connection position according to Fig. 17 is reached, the latching tongues 11 spring out transversely to the insertion direction R, wherein the latching areas 11.1 of the latching tongues 11 latch with the latching areas 12.1 of the recesses 12, see also Fig. 20. The conveying unit 2 and the drive unit 3 are thus latched together in the axial direction. Since the recesses 12 have essentially the same width as the tab-like latching tongues 11, a relative rotation of the drive unit 3 with respect to the conveying unit 2 is also blocked. No additional tools are required to produce the snap hook connection 60

In the connection position, the correspondingly designed guiding elements 19, 20 of the intermediate element 6 and the fastening area B also engage with one another. This enables additional protection against relative rotation of the conveying unit 2 with respect to the drive unit 3. The tip of the latching tongue 11 can have a suitable color

marking, which is visible from the outside in the latched connection position and is designed as a connection indicator 36. In particular, a marking can be arranged in an area between the insertion slope 11.2 and the latching area 11.1. This makes it easy to recognize whether the snap hook connection 60 has been made correctly. If the latching tongues 11 are incompletely latched with the recesses 12, one edge of the recess 12 obscures the colored marking, allowing the mounting personnel to detect a defective mounting.

The representations in Figs. 21 to 23 show various pump arrangements 100, which are described below.

The pump arrangements 100 each have a conveying unit 2, a drive unit 3 connected thereto and one or more valve units 18.

The conveying unit 2 has at least two connecting elements 27, 28 for detachably connecting the conveying unit 2 to a valve unit 18. The connecting elements 27, 28 can be arranged directly on the conveying unit 2 or indirectly via an adapter-like intermediate element 37. According to the invention, the connecting elements 27, 28 are designed as bayonet hooks and corresponding recesses and are arranged laterally on the conveying unit 2, so that the valve unit 18 can be connected to the drive unit 3 by means of a bayonet connection 70 in a direction transverse to the latter. The housing of the drive unit 3 and the valve housings of the valve units 18 can extend in the same direction (see Fig. 21) or in the opposite direction (see Fig. 22), or perpendicular to one another (see Fig. 23).

Alternatively, but then not falling within the scope of the claims, the connecting elements for connecting the conveying unit 2 to the valve unit 18 can also be designed as lacthing tongues and corresponding recesses for producing a snap hook connection.

The bayonet connection 70 and the snap hook connection can be designed in accordance with the previously described latching connections between the conveying unit 2 and the drive unit 3.

The valve units 18 can also be connected to one another by means of corresponding connecting elements 29, 30, see Fig. 23. This allows series arrangements of valves to be created to carry out various switching operations. Alternatively, the valve units 18 can be connected to one another via intermediate elements 37. The connecting elements 29, 30 of the valve units 18 are designed as latching elements and can be designed in particular as bayonet hooks and corresponding recesses or as latching tongues and corresponding recesses.

Preferably, the connecting elements 27, 28, 29, 30 are designed corresponding to the connecting elements 7, 8, 11, 12 of the conveying unit 2 or the drive unit 3.

A method for tool-free, detachable connection of the conveying unit 2 and the drive unit 3 is described below.

First, a method for connecting the conveying unit 2 and the drive unit 3 via a bayonet connection 50 according to the first embodiment will be described.

For connecting, the drive unit 3 is moved axially aligned in the insertion direction R along the driving axle A towards the conveying unit 2, wherein the intermediate shaft 14 engages in a corresponding round bore of the fastening area B. Furthermore, the bayonet hooks 7 engage in the insertion areas 8.1 of the respective recesses 8, see Fig. 9c. As soon as the intermediate element 6 and the conveying unit 2 lie flat against one another, the drive unit 3 and thus the intermediate element 6 are rotated clockwise relative to the conveying unit 2. The latching parts 7.2 of the bayonet hooks 7 latch with the securing areas 8.2 of the respective recesses. Furthermore, when the connection position is reached, the securing lug 10.2 of an anti-rotation lock 10 latches into a corresponding securing recess 10.3 of the intermediate element 6, see Fig. 9e. In addition, tolerance offset is carried out when the conveying unit 2 and the drive unit 3 rotate relative to one another by the compensating ramps 9, which can deform to offset for tolerances, see Fig. 12b.

When the conveying unit 2 is connected to the drive unit 3, the actuation contour 14.1 of the intermediate shaft 14 comes into engagement with the corresponding actuation contour 16.1 of the driven gear 4.1.

The releasing of such a bayonet connection 50 between conveying unit 2 and drive unit 3 is carried out with the same steps described above in reverse order. Furthermore, the rotational and insertion directions are reversed accordingly.

Finally, a method for connecting the conveying unit 2 and the drive unit 3 via a snap hook connection 60 according to the second embodiment, which does not fall within the scope of the claims, is described.

For connecting, the drive unit 3 is moved towards the conveying unit 2 in the insertion direction R along the driving axle A, wherein the intermediate shaft 14 engages in a corresponding round bore of the fastening area B. Furthermore, the tips of the latching tongues 12 engage in the recesses 11, see Fig. 17. During further insertion, the insertion slopes 11.2 of the latching tongues 11 come into contact with the edges of the recesses

12, whereby the latching tongues 11 spring radially inwards during further axial displacement. When the connection position is reached, the latching tongues 11 automatically spring out and the latching area 11.2 of the latching tongues 11 latches with the latching area 12.1 of the respective recess 12, see Fig. 20.

When the conveying unit 2 is connected to the drive unit 3, the actuation contour 14.1 of the intermediate shaft 14 comes into engagement with the corresponding actuation contour 16.1 of the driven gear.

The release of such a snap hook connection 60 between conveying unit 2 and drive unit 3 is carried out by applying a release force against the insertion direction R. As a result, the latching areas 11.2 of the latching tongues 11 can disengage from the latching areas 12.1 of the recesses 12 and the connection can be released.

The gear pump 1 described above, the pump arrangement 100 and the method for connecting the conveying unit 2 and the drive unit 3 of a gear pump 1 are characterized by a simple and error-free connection of the drive unit 3 to the conveying unit 2, which can also be carried out safely by inexperienced assembly personnel.

Reference numerals:

1	Gear pump
2	Conveying unit
2.1	Housing
2.2	Lid
2.3	Wall
3	Drive unit
3.1	Connection
3.2	Driving shaft
4.1	Gear
4.2	Gear
5	Connecting area
6	Intermediate element
7	Connecting element; bayonet hook
7.1	Base
7.2	Latching part

8	Connecting element; recess
8.1	Insertion area
8.2	Securing area
9	Compensating ramp
10	Anti-rotation lock
10.1	Securing hook
10.2	Securing lug
10.3	Securing recess
11	Connecting element; latching tongue
11.1	Latching area
11.2	Insertion slope
12	Connecting element; recess
12.1	Latching area
13	Shaft bearing
14	Intermediate shaft
14.1	Actuation contour
14.2	Shaft connection
15	Shaft sealing ring
16.1	Actuation contour
16.2	Bearing contour
17	Slide bearing
18	Valve unit
19	Guiding element
20	Guiding element
21	Axle
22	Fastening means; insertion connecting element
23	Fastening means
24	Fastening bore
25	Seal
26	Connection
27	Connecting element; bayonet hook
28	Connecting element; recess
29	Connecting element

30	Connecting element
31	Infeed
32	Outflow
33	Recess
34	Circular ring segment
35	Gear chamber
36	Connection indicator
37	Intermediate element
50	Bayonet connection
60	Snap hook connection
70	Bayonet connection
100	Pump arrangement
A	Driving axle
B	Fastening area
D	Axis of rotation
R	Insertion direction

Patentkrav

1. Tandhjulspumpe til transport af en fluid med en transportenhed (2) med mindst to tandhjul (4.1, 4.2) og en drivenhed (3), der driver tandhjulene (4.1, 4.2), som er aftageligt forbundet med hinanden via forbindelseselementer (7, 8), der kan aktiveres uden værktøj,
kendetegnet ved,
at forbindelseselementerne (7, 8) er udformet som låseelementer og danner en bajonetforbindelse (50), som har en anti-rotationslås (10), hvor anti-rotationslåsen (10) har mindst én fjedrende udformet sikringskrog (10.1), som samvirker på en formtilpasset måde med mindst en tilsvarende sikringsudsparing (10.3).

2. Tandhjulspumpe ifølge krav 1, **kendetegnet ved, at** forbindelseselementer (7) er anbragt på transportenheden (2), og forbindelseselementer (8) er anbragt på drivenheden (3), og er udformet til at svare til hinanden.

3. Tandhjulspumpe ifølge krav 1, **kendetegnet ved, at** forbindelseselementerne (7, 8) er udformet som bajonetkroge og/eller tilsvarende udsparinger.

4. Tandhjulspumpe ifølge krav 3, **kendetegnet ved, at** bajonetkrogene (7) har en i det væsentlige rektangulær form med en base (7.1) og en låsedel (7.2), der strækker sig vinkelret fra basen.

5. Tandhjulspumpe ifølge krav 3 eller 4, **kendetegnet ved, at** udsparingerne (8) har et indføringsområde (8.1) til indsættelse af bajonetkrogene (7) og et sikringsområde (8.2) til låsning af bajonetkrogene (7).

6. Tandhjulspumpe ifølge krav 5, **kendetegnet ved, at** sikringsområderne (8.2) har en udligningsrampe (9) til toleranceudligning, som er udformet til at

samvirke med låsedelene (7.2) af de respektive bajonetkroge (7).

7. Tandhjulspumpe ifølge et af de foregående krav, **kendetegnet ved, at** forbindelseselementerne (7, 8) er udformet på mindst et mellemelement (6), hvor mellemelementet (6) er fastgjort til transportenheden (2) og/eller drivenheden (3).

8. Tandhjulspumpe ifølge et af de foregående krav, **kendetegnet ved, at** drivenheden (3) til at drive tandhjulene (4.1, 4.2) er operativt forbundet med tandhjulene (4.1, 4.2) via en mellemaksel (14).

9. Tandhjulspumpe ifølge et af de foregående krav, **kendetegnet ved** en forbindelsesindikator (36), der angiver forbindelsen mellem transportenheden (2) og drivenheden (3).

10. Pumpeindretning med en tandhjulspumpe (1) og mindst én ventilenhed (18),
kendetegnet ved,
at tandhjulspumpen (1) er udformet ifølge et af de foregående krav.

11. Fremgangsmåde til aftageligt at forbinde en transportenhed (2) og en drivenhed (3) af en tandhjulspumpe (1) via forbindelseselementer (7, 8), som kan aktiveres uden værktøj,
kendetegnet ved,
at forbindelseselementerne (7, 8) bliver låst sammen og danner en bajonetforbindelse (50), som har en anti-rotationslås (10), der har mindst én fjedrende udformet sikringskrog (10.1), som samvirker på en formtilpasset måde med mindst en tilsvarende sikringsudsparing (10.3).

Fig. 1

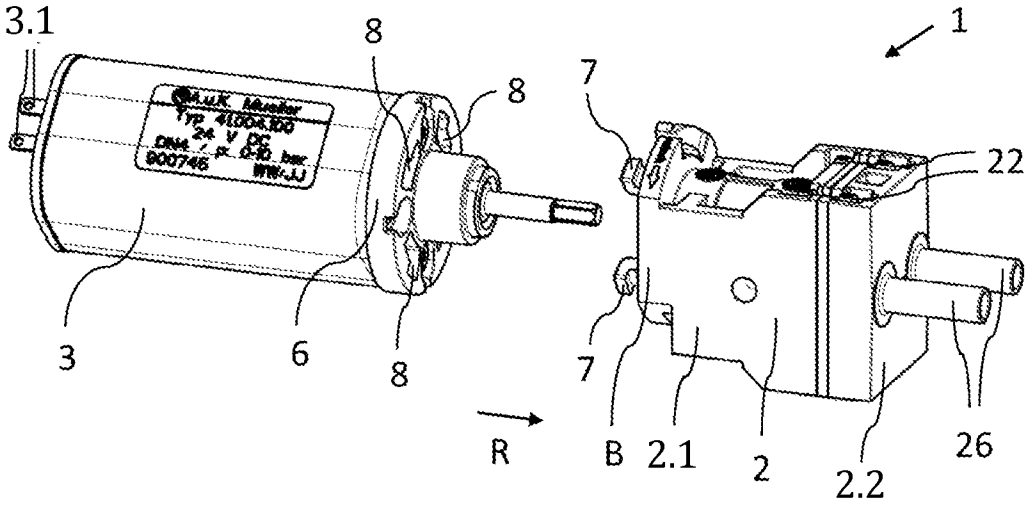

Fig. 2

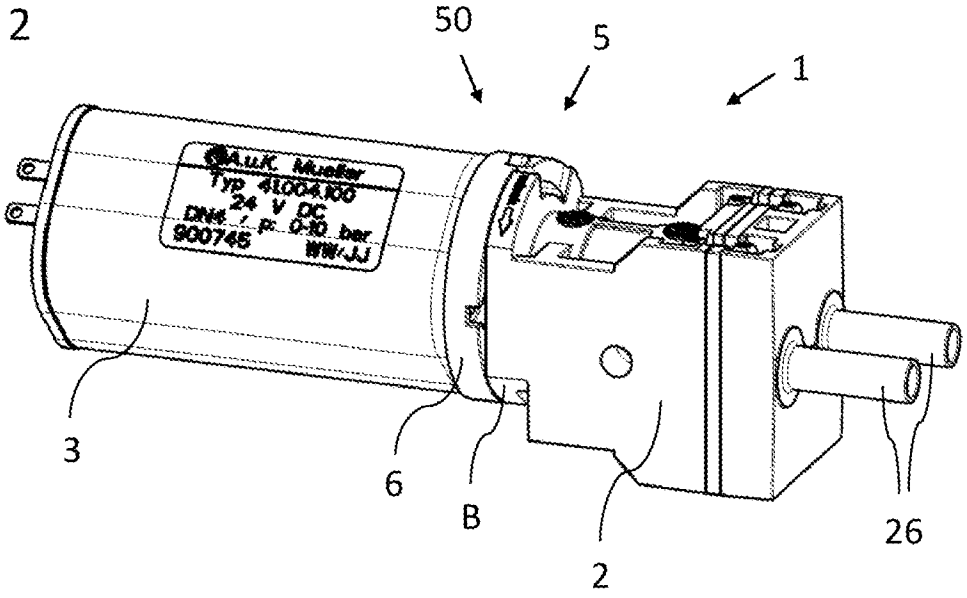

Fig. 3

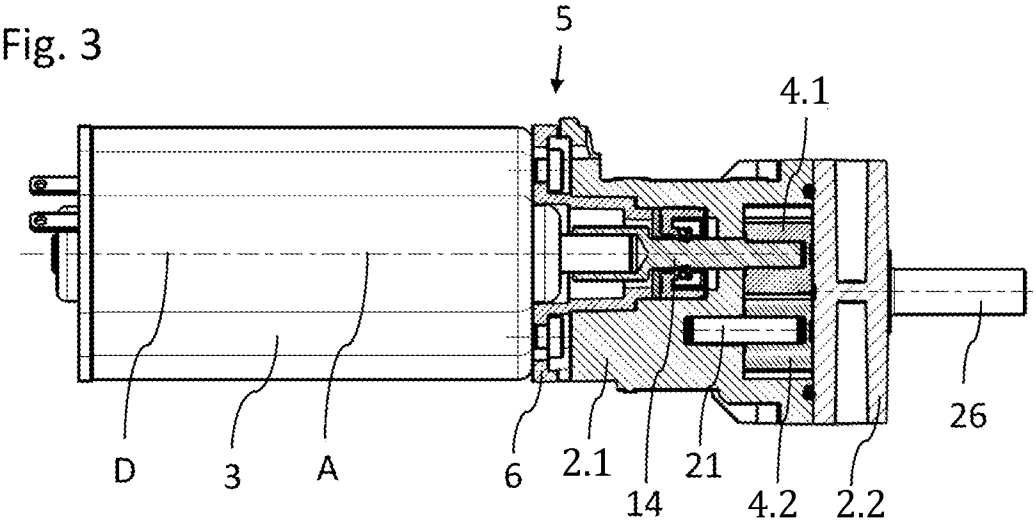
5
4.1
D
3
A
6
2.1
14
21
4.2
2.2
26

Fig. 4

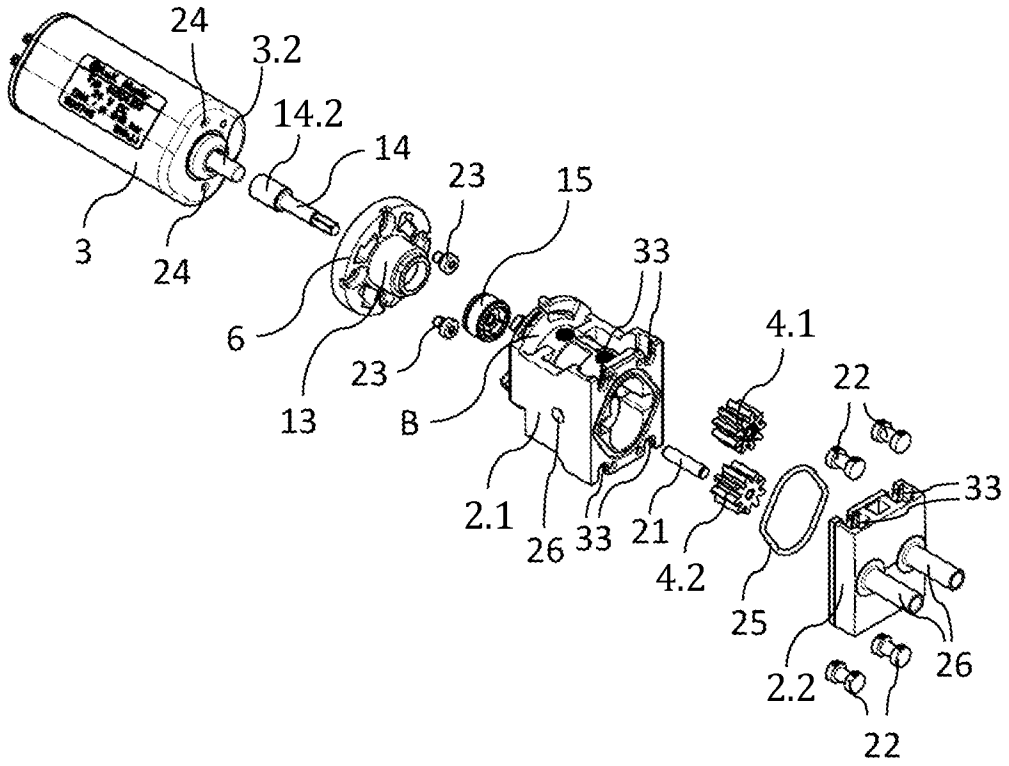
24
3.2
14.2
14
23
15
33
4.1
22
3
24
6
23
B
13
2.1
26
33
21
4.2
25
33
26
2.2
22

Fig. 5

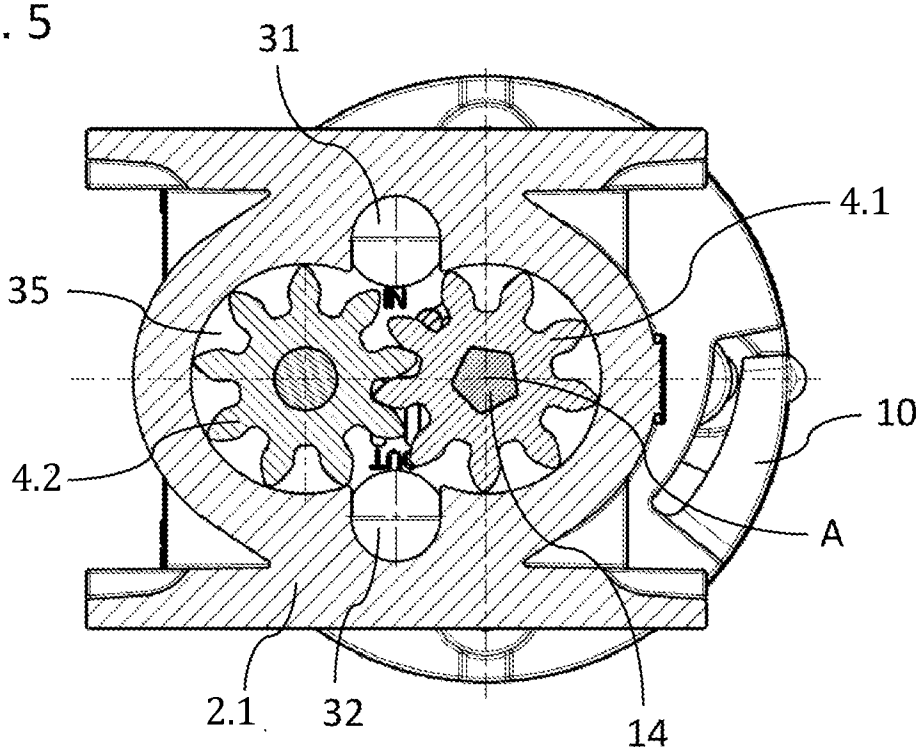

Fig. 6a

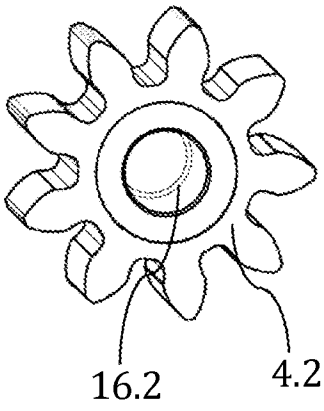

Fig. 6b

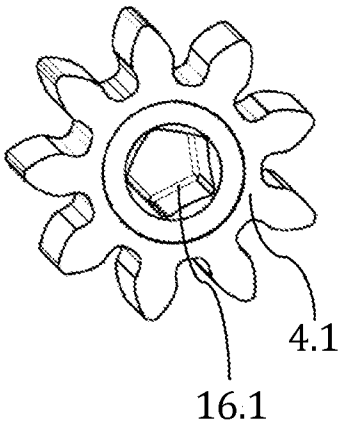

Fig. 6c

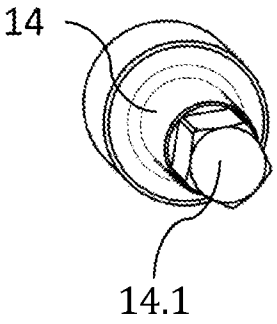

Fig. 7

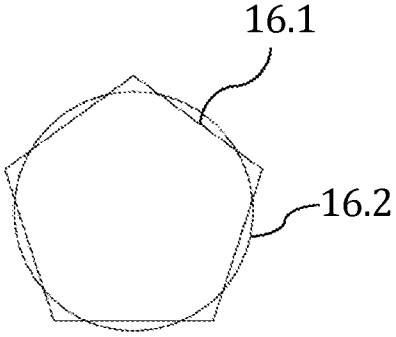

Fig. 8a

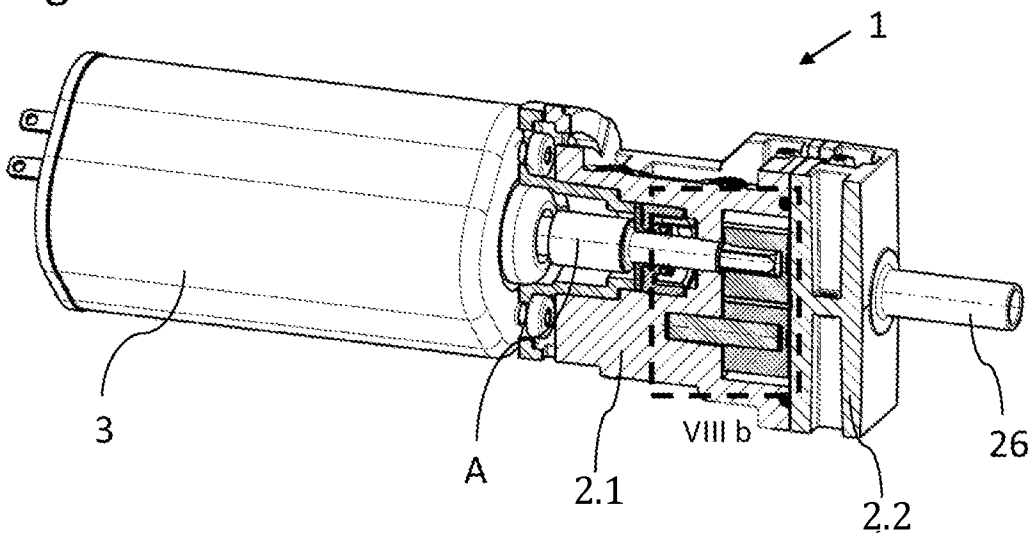

Fig. 8b

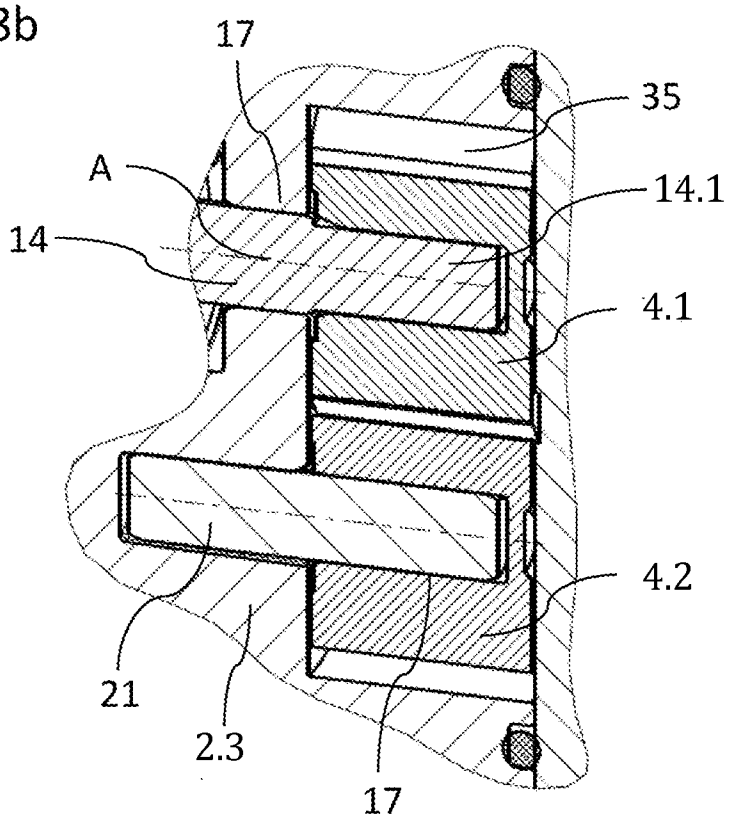

Fig. 9a

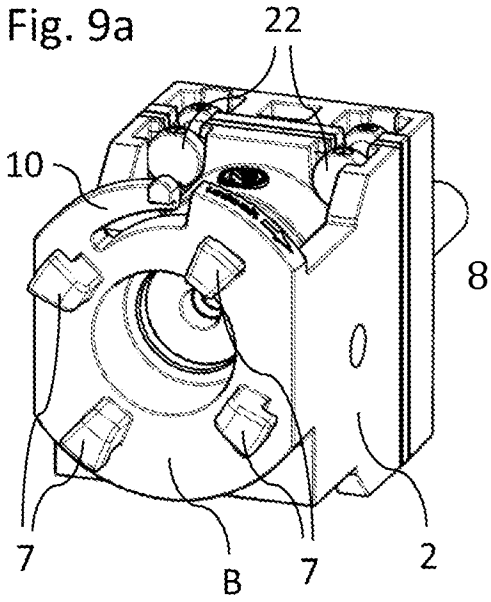

Fig. 9b

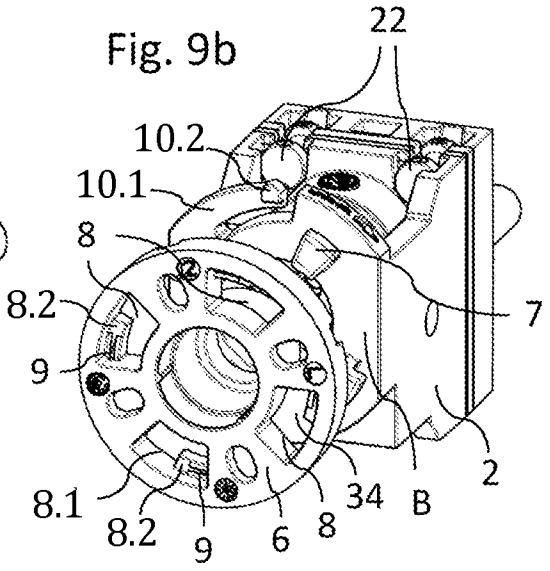

Fig. 9c

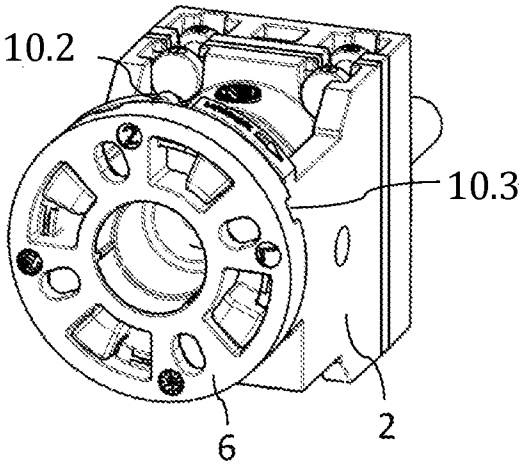

Fig. 9d

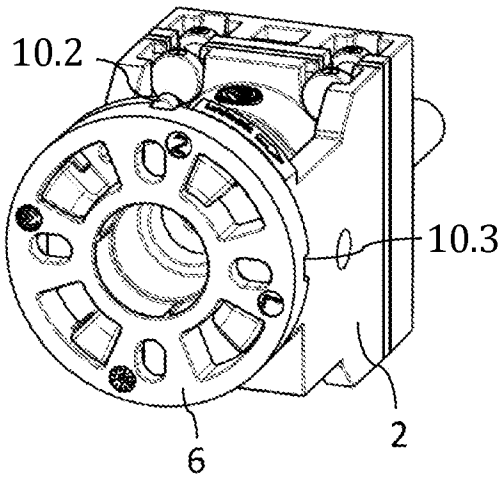

Fig. 9e

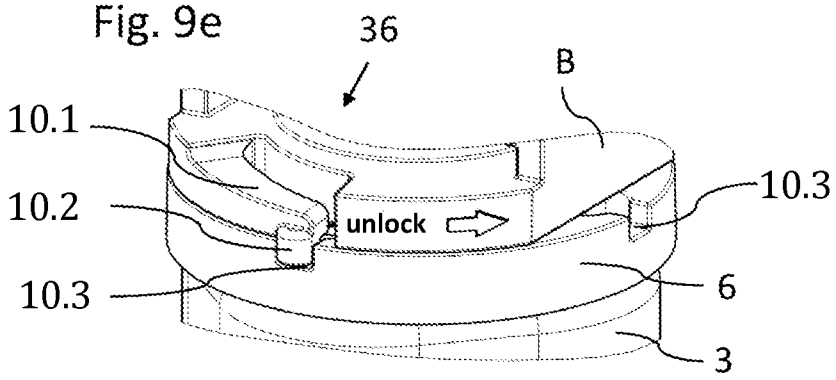

Fig. 10

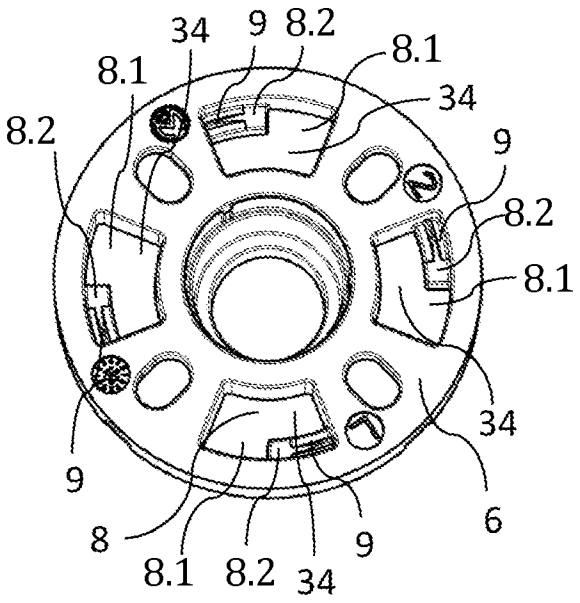

Fig. 11

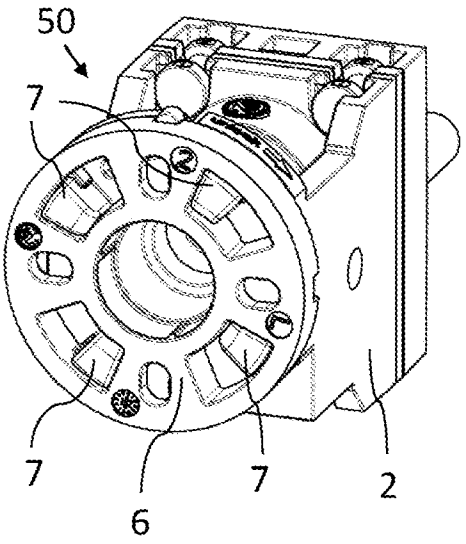

Fig. 12a

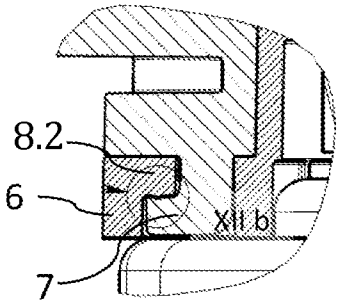

Fig. 12b

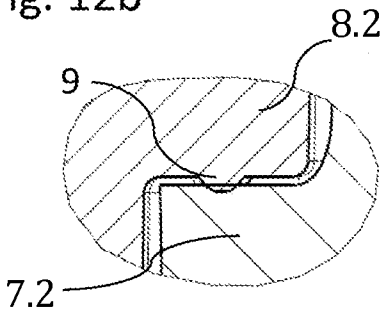

Fig. 13

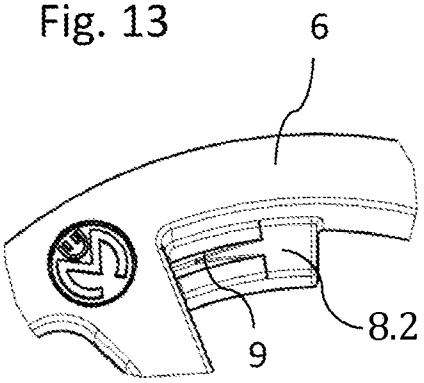

Fig. 14

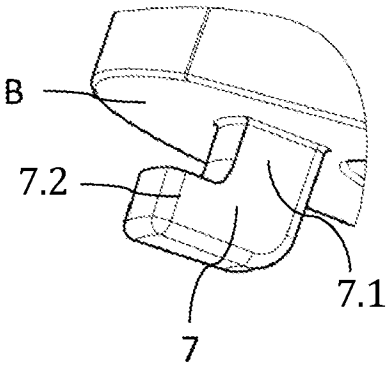

Fig. 15

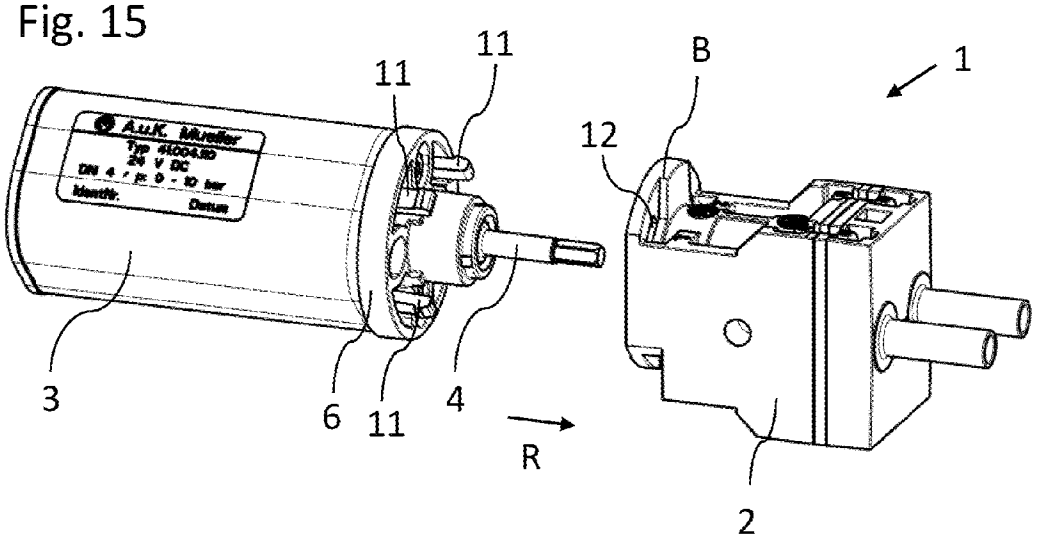

Fig. 16

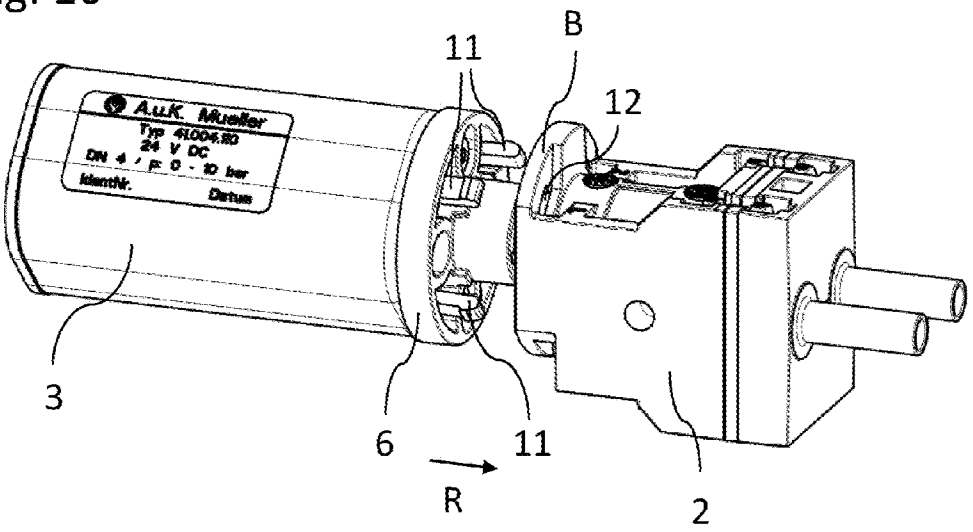

Fig. 17

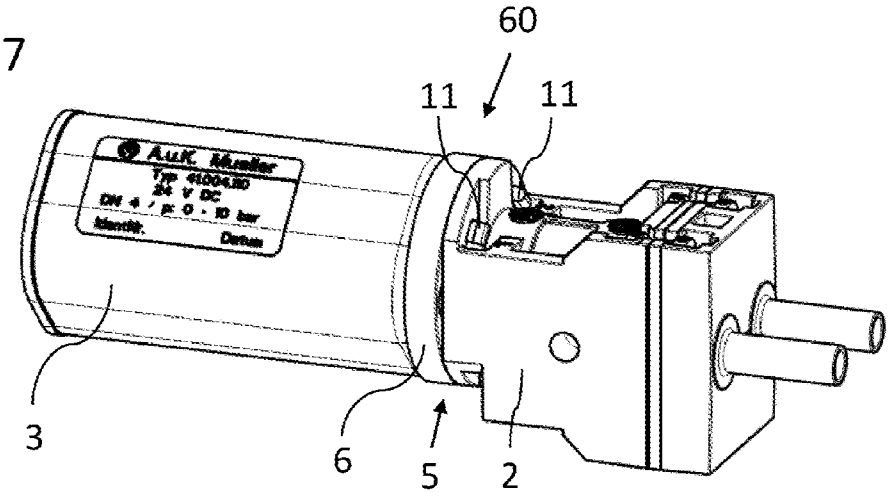

Fig. 18

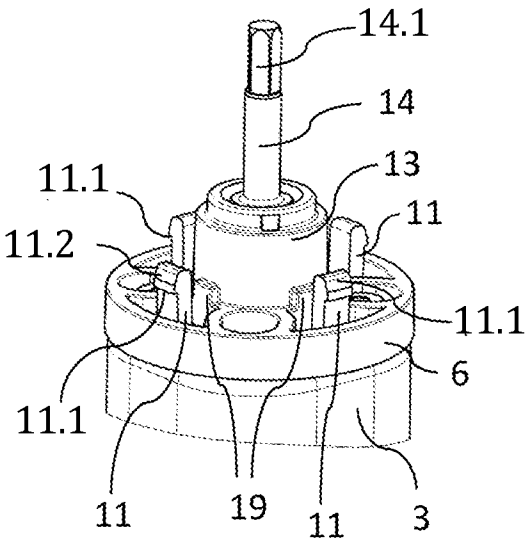

Fig. 19

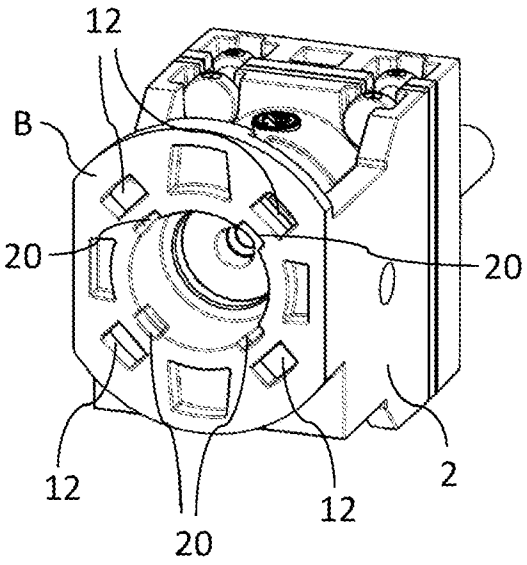

Fig. 20

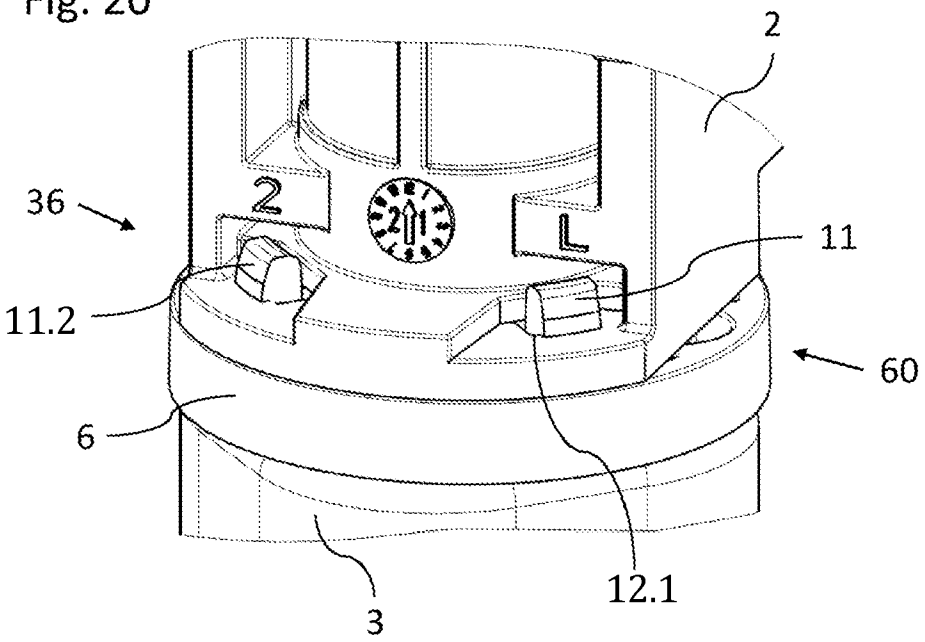

Fig. 21

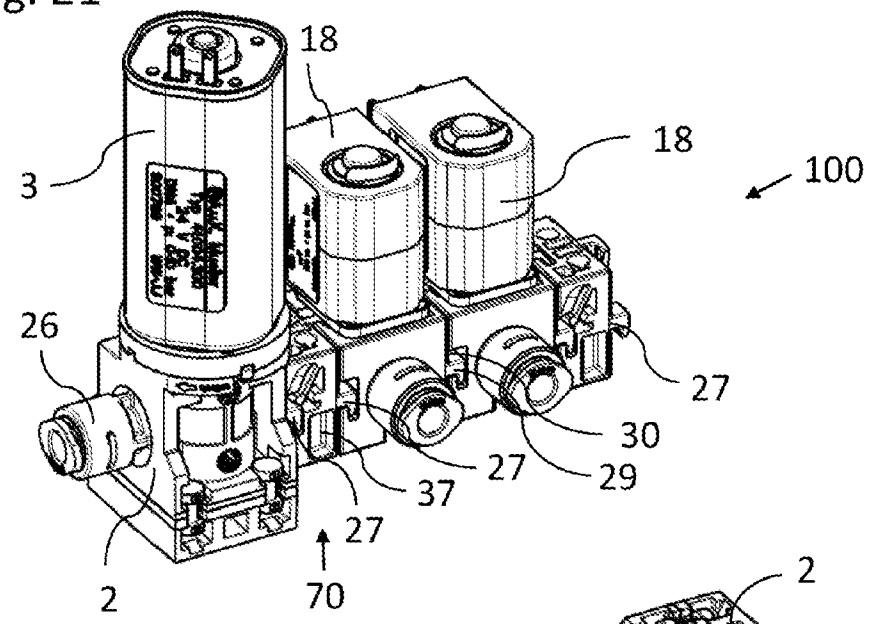

Fig. 22

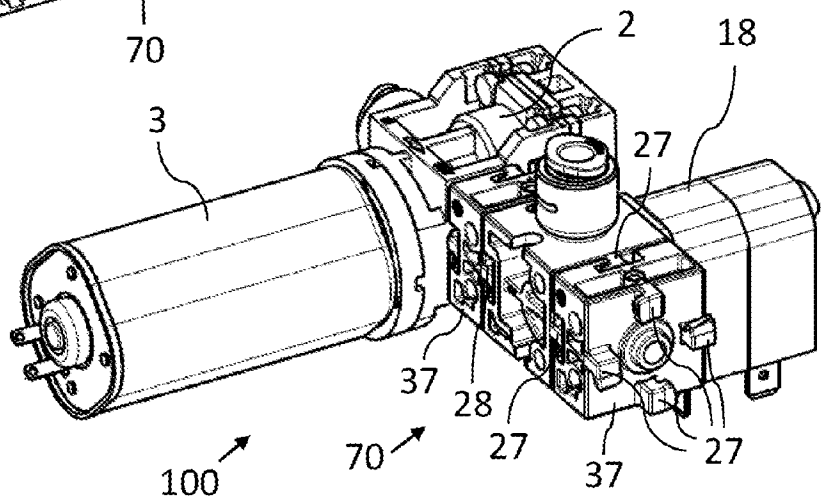

Fig. 23