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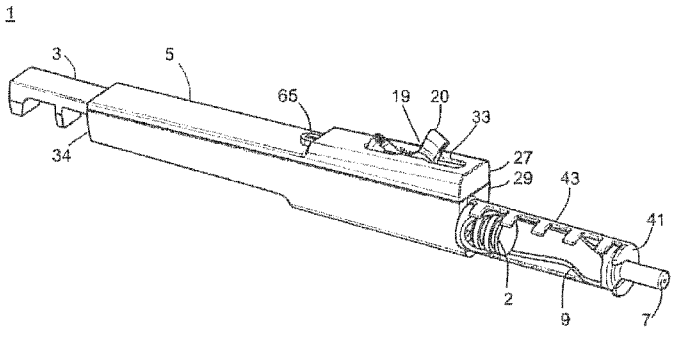

Fig. 1

(57) Abstract: Presented is an injection and/ or aspiration device (1), in particular for a three-stage injection and/or aspiration device, for ejecting and/or aspirating of a gas or a liquid, comprising a longitudinal housing (5), in which a piston rod (3) can be guided in an axially displaceable mariner, and a position for a nozzle or a nozzle (7) at a front end of the housing (5), towards which the piston rod (3, 103) can be displaced and/or from which the piston rod (3) can be retracted, a displacement mechanism for moving the piston rod (3) forwards and/ or backwards along the longitudinal housing extension, and an actuating element (19) for manual actuation of the displacement mechanism. The injection and/ or aspiration device (1) is characterised in that the displacement mechanism includes a transmission mechanism, by means of which the actuating element (19) and the piston rod (3) are or can be placed in an articulated driving connection, and the injection and/ or aspiration device comprises a ratchet mechanism for interacting with the piston rod (3).

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Injection and/or aspiration device, in particular for ejecting and/or aspirating of a gas and/or a liquid

TECHNICAL FIELD OF THE INVENTION

The field of the present invention includes injection and/or aspiration devices, in particular for ejecting and/or aspirating of a gas and/or a liquid.

BACKGROUND OF THE INVENTION

In various medical applications in the field of but not limited to ear-nose-throat surgery, neurosurgery, cardiovascular surgery, ophthalmology, dentistry, oncology, dermatology, or plastic surgery, pharmaceutics or mechanically operating substances such as but not limited to gasses or liquids need to be injected into human or animal body for permanent or temporary disposition.

In some applications, the amount of injected quantity of pharmaceutical or mechanically operating media needs to be exactly dosed to ensure an intended effect. The amount of needed media could be defined prior treatment or injection by the medical indication or could be variable dependent on doctors' evaluation during the treatment or injection. As some treatments do not allow the applicator to visibly see the syringe or injector during treatment, other than visible verification of injected quantity could be required.

Additionally to the quantity of injected amount, it could be necessary to ensure the injection is done against existing pressure or liquid within human or animal body. Furthermore some applications require injection of media ensuring no uncontrolled passive or active aspiration after the injection.

Conventional injectors for gas and/or liquid media such as syringes often comprise scales to help to determine the amount of injected media. The printed scale on a syringe refers directly or indirectly to the quantity. The achievement of accurate dosage

depends on manual skills of the user. Previous teachings allow single or multiple injection of predefined dosages (US 3949748 A, US3727614 A, US5226896 A).

In further inventions ratchets integrated allow unidirectional use of the injector preventing passive or active aspiration done by the injector or syringe (US 4413760 A, US 5531691 A, US 5380295 A). A drawback of those teachings is the enhanced force needed to move the piston of the syringe to the next dosage step. In particular, the barrier (position of increased force) is mechanically directly linked to the shaft moving the piston, therefore the injection force increases towards a step an decreases after a step considerably.

Some teachings provide acoustic and/or haptic feedback to a user dependent on the movement of the syringe (WO 2016120312 A1, US 20080132852 A1). The haptic and/or acoustic feedback ensures that the user is aware of the injected amount.

Devices often are designed to supply/inject one dosage per manual activation (US3727614 A, US5226896 A, US 20070225656 A1, US 8939959 B2). Other devices described are devices which are designed to execute multiple injections in a row dependent on user requirement and movement time (US 5380295 A). The movement time can include a time delay due to a pressure release step in-between two consecutive pressure application steps for two injections.

Thus, there exist many different devices having different functionalities and therefore having many different applications. This often brings about the difficulty that different tasks require different devices.

OBJECT

An object of the present invention is to provide a device which combines a multitude of functionalities which may be employed singularly or in combination and in-between which may be switched according to the requirements of a situation and the needs of a patient. Such functionalities are e.g. ejection, aspiration, fine dosing, providing one or multiple dosages, providing one or multiple variable dosages, alternating between

aspiration and ejection, injection of a variable part of a predefined cartridge. Furthermore, an object of the present invention is to provide an alternative injector and aspirator, in particular for example a syringe like device for ejection and/or aspiration. In particular, an object is to develop an injection and/or aspiration device which allows to apply flexible apportioning and/or multiple dosing. Especially it is desired to enable counting or measuring of the amount ejected or aspirated during the process of ejecting or aspirating, even without visible control. Moreover, single-handed operation of the injection and/or aspiration device preferably shall be possible (i.e. one-handed operation). Therefore, a further important aspect is a low force sensation. Thus, a further object is to reduce as far as possible the force to be applied or at least the force sensation during the ejection and/or aspiration. Preferably, excessive tremor of the hand in the case of one-handed operation of the injection and/or aspiration device should be prevented as a whole. Preferably, the injection and/or aspiration device should be relatively simple and, therefore, can be manufactured at low cost. In particular the driving force shall be achieved without the support of an inbuilt driving force (such as e.g. an inbuilt driving spring or an inbuilt electrical motor) when ejecting or aspirating gas and/or liquid.

SUMMARY OF THE INVENTION

This invention satisfies the aforementioned requirements, in that it provides an injection and/or aspiration device, in particular a three-stage injection and/or aspiration device, for ejecting and/or aspirating of a gas or a liquid. The injection and/or aspiration device comprises

- a longitudinal housing, in which a piston rod can be guided in an axially displaceable manner,
- a position for a nozzle or a nozzle at a front end of the housing, towards which the piston rod can be displaced and/or from which the piston rod can be retracted,
- a displacement mechanism for moving the piston rod forwards and/or backwards along the longitudinal housing extension,
- an actuating element for manual actuation of the displacement mechanism, and

which injection and/or aspiration device is further characterised in that

- the injection and/or aspiration device comprises a ratchet mechanism for interacting with the piston rod.

Preferably, the injection and/or aspiration device is further characterised in that the displacement mechanism comprises a transmission mechanism, by means of which the actuating element and the piston rod can be placed in an articulated driving connection.

Advantageously, the ratchet mechanism is positioned at the secondary side of the transmission mechanism. Thus, the pawl interacts with a ratchet rack which is formed at the piston rod.

Optionally, the injection and/or aspiration device is further characterised in that an operating region for the actuation of the actuating element is provided (is formed) at a longitudinal side of the housing.

Optionally, the injection and/or aspiration device comprises a lever for switching between two or more settings of the ratchet mechanism. Preferably, the injection and/or aspiration device is characterised in that two or more settings of the ratchet mechanism are selected from the group consisting of a ratchet mechanism activated setting allowing ejection of a gas and/or liquid, a ratchet mechanism activated setting allowing aspiration of a gas and/or liquid and a ratchet mechanism deactivated setting.

Advantageously, depending on the setting of the ratchet mechanism
- the piston rod is movable forwards for the purpose of ejecting a gas and/or liquid and is movable in the opposite direction, i.e. backwards, for the purpose of aspirating a gas and/or liquid by appropriate actuation direction of the actuating element (19), and
- the direction of the piston rod movement is invertible by inverting the direction of the movement of the actuation element.

Advantageously, for the purpose of dosing, the ratchet mechanism is outfitted for effecting audible clicks when the piston rod moves along the longitudinal housing extension. An operator (e.g. a doctor or nurse) perceives the audible clicks as dosage information, while the piston rod is moved and, consequently, enabling the operator to

dose the amount of ejected or aspirated gas and/or liquid during the action of ejecting or aspirating. With each audible click a certain increment volume is ejected or aspirated. The injection and/or aspiration device may be constructed such that said increment volume is in the range of milliliter or even microliter.

Advantageously, the injection and/or aspiration device comprises a ratchet mechanism setting lever with at least two setting positions, which allows to activate and deactivate the ratchet mechanism. Thus, the ratchet mechanism comprises at least two settings between which the user may switch manually, these are at least an inactivated pawl position and an activated pawl position. Conveniently, the injection and/or aspiration device comprises a ratchet mechanism setting lever with at least two setting positions, which allows to switch between the two or more ratchet mechanism settings.

Advantageously, the ratchet mechanism comprises at least a first linear ratchet rack structure on the piston rod and a first pawl attached to the housing. Preferably, the linear rack is constructed on the piston rod along the longitudinal extension of the piston rod.

Furthermore, advantageously, the ratchet mechanism comprises a second linear ratchet rack structure on the piston rod and a second pawl attached to the housing. Preferably, the second linear rack is constructed on the piston rod along the longitudinal extension of the piston rod, essentially parallel with the first linear rack.

Optionally, the ratchet mechanism comprises at least three settings between which the user may switch manually, these are at least an inactivated pawl position, a first activated pawl position for inhibiting movement of the piston rod backwards towards the proximal end of the housing and a second activated pawl position for inhibiting movement of the piston rod forwards towards the distal end of the housing. In order to achieve this, for example, the ratchet mechanism comprises at least a first linear rack structure on the piston rod and a first pawl for interacting with the first linear rack and a second linear rack structure on the piston rod and a second pawl for interacting with the second linear rack. Both pawls attached to the housing, preferably such that one or the other pawl can be set to lock with its rack. Whereby one of the pawls locks against its rack to inhibit backward movement of the piston rod and the other pawl locks

against its rack to inhibit forward movement of the piston rod. The two pawls can be said to be opposing pawls, in that they may be set to lock against movement in two different, i.e. opposing directions.

Optionally, the lever comprises a rotatable two pawl carrying axis, with the two pawls, i.e. the first pawl and the second pawl, radially protruding from the axis in a mutually divergent manner, the first pawl designed to interlock with a first linear ratchet rack and the second pawl designed to interlock with a second linear ratchet rack. In practice preferably, both racks are arranged on the piston rod in parallel along the longitudinal extension of the piston rod. In particular, lever is designed that the first pawl interlocks with the first linear rack in a first lever setting and the second pawl interlocks with the second linear rack in a second lever setting. By means of a handle which is integrated in said lever an operator can switch between said two settings manually.

For safety reasons, it is convenient if the ratchet mechanism is outfitted for the purpose of inhibiting movement of the piston rod in direction opposite the direction of intentionally actuated movement (i.e. for example for inhibiting a backwards movement or a forwards movement of the piston rod) in-between two consecutive actuation strokes.

Preferably, the piston rod is provided at its tip with a thread, e.g. screw tread, for the purpose of fixing a plunger to the piston rod. The plunger may be part of a syringe receptacle. Advantageously, the plunger is slidably fitted in the syringe barrel. If piston rod tip and plunger are firmly connected (e.g. screwed together) ejection and aspiration is executable by means of actuation of the piston rod which pulls or pushes the plunger in the syringe barrel

The guided piston rod in particular is displaceable along the longitudinal extension of the housing towards the nozzle at the front end of the housing and backwards away from the nozzle. Advantageously, the displacement mechanism is a transmission mechanism, preferably a gear mechanism, through which the actuating element and the piston rod are arranged in an articulated driving connection, in particular in a force and/or movement transmitting connection. The displacement mechanism serves for driving or pushing the piston rod forward towards the nozzle and backwards away

from the nozzle. By means of the actuating element the displacement mechanism may be actuated manually. At the operating region at a longitudinal side of the housing the actuating element is accessible for the purpose of manual operation of the piston rod.

The injection and/or aspiration device is in this connection preferably held like a ballpoint pen and the actuating element is moved by an operator with his/her finger, for example the index finger. The operating region is in particular in the front section of the housing, i.e. in the semi-section of the housing that is closest to the nozzle.

Preferably, the transmission mechanism is a gear mechanism, in particular a gear train.

The actuating element can be operated by manually pushing or pulling in the longitudinal direction of the housing.

Advantageously, the gear train is a rack gearing, in particular including at least one gear rack and at least one first toothed gear, whose teeth act on one another so as to transmit force.

Preferably, the teeth of the gear rack and of the first toothed gear act directly on one another, in particular by inter-engagement of the teeth.

It is preferred that the gear rack is a part, in particular an integral part, of the piston rod.

Advantageously, the first toothed gear, can be driven via the actuating element.

Preferably, the actuating element is fastened as an operating lever (for example designed as a finger wheel) to the first toothed gear.

For example, the at least one first toothed gear can be implemented as a spur gear.

The actuating element can be designed as a finger grip. For this purpose, preferably, the actuating element is designed as a wheel with multiple spikes, preferably three or more spikes. In particular, the spikes protrude radially from the central rotational axis of the actuating element.

Advantageously, the operating region has at least one opening in the housing, by virtue of which the actuating element is accessible for manual actuation, preferably wherein at least a part of the actuating element projects through the opening and from the housing.

Preferably, the actuating element can be operated by manually pushing or pulling in the longitudinal direction of the housing.

Preferably, the transmission mechanism is implemented so that a manual pulling movement on the actuating element effects a forward movement of the piston rod (in the direction towards the nozzle), i.e. substantially opposed to the manual pulling movement.

Alternatively, the transmission mechanism is implemented so that a manual pushing movement on the actuating element effects a backward movement of the piston rod (in the direction away from the nozzle), substantially parallel to and substantially in the same direction as the manual pushing movement.

Expediently, the housing comprises a receptacle or a recess for accommodating a receptacle. The receptacle, such as e.g. a syringe barrel, is arranged or can be arranged in the recess, e.g. exchangeably (e.g. in the form of an exchangeable cartridge) or fixedly (e.g. integrated in the injection and/or aspiration device e.g. as a part of the housing).

Expediently, the receptacle comprises a loading space for gas and/or liquid, a proximal opening for inserting the piston rod and a distal opening (orifice), e.g. formed as nozzle, for taking in and expel the gas and/or liquid.

Optionally, the housing comprises a proximal opening, through which the piston rod can by pushing be introduced into the housing. Preferably, the housing comprises a (distal) through passage, through which the piston rod is guided, preferably via the receptacle or the recess, towards the position for a nozzle or the nozzle. By actuation of the actuating element the piston rod can be moved forth and back, i.e. forward towards and backward away from the nozzle thereby moving the plunger forward and backward likewise.

Advantageously, the position for a nozzle, i.e. a nozzle notch, or rather the nozzle is arranged at a distance from the through passage, wherein the distance between the nozzle notch (41) and the through passage is dimensioned so that the receptacle (9) is arranged or can be arranged in-between, in particular in the recess between the through passage and the nozzle notch or nozzle.

Advantageously, the injection and/or aspiration device is designed for single-handed operation.

Preferably, the actuating element is designed so that a movement for the actuation of the actuating element occurs substantially along the length of the piston rod, in particular preferably in the direction of the piston rod movement or alternatively in the opposite direction to the piston rod movement.

Preferably, the displacement mechanism, in particular the transmission mechanism, is a manually operating mechanism, i.e. designed for manual operation.

Preferably, the ratchet mechanism is designed for manual operation. For example, in that a ratchet mode setting lever is available which may be set into different modes, for example one or more ratchet mechanism activated modes and one or more ratchet mechanism deactivated modes.

The aforementioned optional features can be accomplished in any desired combination so long as they are not mutually exclusive.

Additional advantages of the present invention follow from the following description.

DESCRIPTION OF THE INVENTION

The injection and/or aspiration device includes a longitudinal housing, in particular formed as a housing, with a receptacle or a support for a receptacle at distal position of the longitudinal housing for a gas and/or liquid, said receptacle having a nozzle through which the gas and/or liquid can be ejected. Furthermore, the injection and/or aspiration device comprises a piston rod that is movable supported (displacable or

slideable mounted) on or in the housing. A ratchet mechanism is coupled to the displaceable piston rod for the purpose of acoustically signalling incremental advancement of the piston rod in forward and/or backward direction and if required inhibiting undesired movement into respective opposite direction. The injection and/or aspiration device comprises for example a transmission mechanism, such as in particular a gear train or rack gearing, by means of which the piston rod can be moved, i.e. displaced, for the purposes of ejecting or aspirating gas and/or liquid, in particular in that the piston rod can be driven forwardly and/or backwardly through a receptacle.

To eject gas and/or liquid from the injection and/or aspiration device according to the invention the gas and/or liquid, which is initially located in the receptacle of the injector, is ejected from the receptacle through the nozzle into e.g. a human or animal body by means of the piston rod.

To aspirate gas and/or liquid into a receptacle which is integrated in or attached to the housing of the injection and/or aspiration device according to the invention the gas and/or liquid is aspirated through the nozzle into e.g. receptacle by means of the piston rod.

According to the invention, preferably the drive of the piston rod is effected via the transmission mechanism, in particular a gear train or a rack gearing, by means of which the piston rod can be driven forwardly. Preferably, the transmission mechanism is operating manually, thus, preferably the transmission mechanism is driven by manual force and therefore the displacement of the piston rod and in particular the forward and/or the backward movement of the piston rod, respectively, is effected manually, i.e. by brawn of the human operator only. For this purpose, the injection and/or aspiration device can be held by one hand and operated at the same time by the same hand. A driving force (such as e.g. a spring drive) other than human brawn is not required for driving the plunger rod.

Ejection or aspiration of the gas and/or liquid on driving the forward or backward movement of the piston rod, respectively, by the transmission mechanism proceeds in a controlled manner, while the treating physician simply needs one hand to hold the

injection and/or aspiration device and eject the gas and/or liquid. The second hand is free to carry out other manipulations if required.

Present invention is able to provide single dosages per click or multiple dosages in a row. Compared to previous mentioned teachings, present invention only supply limited amount of dosages in a row. To inject further dosages, the user needs to reposition the finger actively. Having the capability of single dosages, multiple dosages, and additionally limiting the amount of dosages per movement, supplies additional safety during usage. The media container size of the invented product could be selected dependent application. The correctly selected size can limit the amount of injected media during a multi-dose movement to a total quantity not being harmful for the patient/animal.

Moreover, the operational mode, e.g. only injection with active acoustic feedback or only aspiration with active acoustic feedback or injection and aspiration enabled without acoustic feedback, can be selected and can be changed during use of the invention.

When the ratchet mechanism is connected acoustic clicks of the sliding pawl of the ratchet mechanism give information about the number of incremental dosage portions ejected or aspirated. Thus, by counting the clicks an operator of the device determines the exact dosage effectively ejected or aspirated.

The transmission gear can be built to indirectly move the piston rod, for the purpose of reducing the force before and after a movement "click". Advantageously, the transmission gear is built to provide a gear ratio, so that the driving force at the actuation element is a fraction of the actual injection force at the piston tip. For example, due to a gear ratio of for example 1:4, the actuation force is only one quarter of the actual injection force. Therefore, the effective difference in movement force before and after a movement "click" of the ratchet mechanism is reduced or negligible in contrast to a directly moved piston rod with no under-drive.

In a way, present invention comprises a three-stage (micro-) dosable injection and/or aspirating device. Application of different combinations of elements of the device

allow for operation of the device in one or the other of the stages. The first stage dosage is a single dosage of the size of the volume of the receptacle. The first stage dosage process comprises application of the piston rod in combination with the receptacle which may be loaded into the injection and/or aspirating device. The second stage dosage is a multiple dosage, each dosage of the size of a partial volume of the receptacle. The second stage dosage process comprises application of the piston rod in combination with the receptacle and in combination with the activating element of the transmission mechanism, which allows in a few strokes for ejection or aspiration of a maximum volume of the size of the receptacle. Each stroke accounts for one of the multiple dosages. For example, an actuation element in the shape of a wheel with four wings represents a subdivision into four subunits. In the second stage the operator of the device meters out the applied dosage through tactile signals received via his/her fingers actuating the actuation element. The third stage dosage is a multiple dosage, each dosage of the size of an incremental partial volume of the receptacle. The third stage dosage process comprises application of the piston rod in combination with the receptacle, in combination with the activating element of the transmission mechanism, and in combination with the pawl of the ratchet mechanism which allows for acoustically signalling each incremental advancement of the piston rod by means of a click sound. Each click accounts for one of the multiple incremental dosages. In the third stage the operator of the device meters out the applied dosage through acoustic signals received during ejection or aspiration movement of the piston rod when actuating the actuation element.

Present invention is especially useful in the following applications:

1. Irrigation:
   - Ophthalmology: injection of pharmaceutically or mechanically effective media under the retina or into retinal blood vessels (such as e.g. air, subretinal fluids for relining and/or repositioning the retina, pharmaceuticals, adhesives (e.g. fibrin))
   - Dermatology: mesotherapy (e.g. hyaloron), botox, etc.
   - Spine: e.g. infiltration therapy
2. Aspiration:
   - Ophthalmology: Aspiration of previously injected or existing subretinal fluids.

Exemplarily, in a first embodiment, the injection and/or aspiration device comprises at least a ratchet mechanism for inhibiting a backwards movement of the piston rod. Preferably the ratchet mechanism comprises a linear rack structure on the piston rod and a pawl attached to the housing. Pawl and linear rack may be engaged preventing motion of the piston rod in a backward direction but allowing motion of the piston rod in a forward direction. At the same time, for dosing purposes during forward motion a clicking sound at regular advances of the piston rod is audible and allows an operator to count and add up the applied increment dosages and consequently to pause or halt injection at a desired dosage amount. For this purpose it is preferred that the teeth of the linear rack of the ratchet mechanism are asymmetrical, preferably each tooth having a moderate slope on one edge for unhindered movement of the linear rack in one direction (forward direction) and a much steeper slope on the other edge for restriction of movement of the linear rack by the pawl in the other direction (backward direction). The pawl e.g. is a pivoting, optionally spring-loaded finger. Advantageously, the injection and/or aspiration device comprises a ratchet mechanism setting element, e.g. in the form of a lever for setting the pawl in a position where pawl and rack are engaged and thus the ratchet mechanism active. The ratchet mechanism comprises at least two settings an inactivated pawl position and an activated pawl position. The pawl engages the teeth of the linear rack, when the ratchet mechanism is activated. If the ratchet mechanism is inactivated, then a forward and a backward movement of the piston rod is possible depending on the operators finger movement on the actuating element (finger wheel). If the ratchet mechanism is activated, then substantially a forward movement of the piston rod is possible only (a backward movement by and large is prevented due to the lock setting of the ratchet mechanism). Such device allows e.g. variably dosed injection.

Exemplarily, in a second embodiment, the injection and/or aspiration device comprises at least a ratchet mechanism for inhibiting a forward movement of the piston rod. Preferably the ratchet mechanism comprises a linear rack structure on the piston rod and a pawl attached to the housing. Pawl and linear rack may be engaged preventing motion of the piston rod in a forward direction but allowing motion of the piston rod in a forward direction. At the same time, for dosing purposes during backward motion a clicking sound at regular advances of the piston rod is audible and

allows an operator to count and add up the sucked in increment dosages and consequently to pause or halt aspiration at a desired dosage amount. For this purpose it is preferred that the teeth of the linear rack of the ratchet mechanism are asymmetrical, preferably each tooth having a moderate slope on one edge for unhindered movement of the linear rack in one direction (backward direction) and a much steeper slope on the other edge for restriction of movement of the linear rack by the pawl in the other direction (forward direction). The pawl e.g. is a pivoting, optionally spring-loaded finger. Advantageously, the injection and/or aspiration device comprises a ratchet mechanism setting element, e.g. in the form of a lever for setting the pawl in a position where pawl and rack are engaged and thus the ratchet mechanism active. The ratchet mechanism comprises at least two settings an inactivated pawl position and an activated pawl position. The pawl engages the teeth of the linear rack, when the ratchet mechanism is activated. If the ratchet mechanism is inactivated, then a forward and a backward movement of the piston rod is possible depending on the operators finger movement on the actuating element (finger wheel). If the ratchet mechanism is activated, then substantially a backward movement of the piston rod is possible only (a forward movement by and large is prevented due to the lock setting of the ratchet mechanism). Such device allows e.g. variably dosed aspiration.

Exemplarily, in a third embodiment, the injection and/or aspiration device comprises at least a ratchet mechanism for inhibiting a backwards movement of the piston rod and alternatively for inhibiting a forward movement of the piston rod. Preferably the ratchet mechanism comprises a double linear rack structure on the piston rod and two mutually opposed pawls attached to the housing. Interlocked the first pawl and the first linear rack may be engaged to prevent motion of the piston rod in a backward direction but allowing motion of the piston rod in a forward direction. Interlocked the second pawl and the second linear rack may be engaged to prevent motion of the piston rod in a forward direction but allowing motion of the piston rod in a backward direction. For dosing purposes during forward and backward motion a clicking sound at regular advances of the piston rod is audible and allows an operator to count and add up the applied increment dosages and consequently to pause or halt injection or aspiration at a desired dosage amount. Advantageously, the injection and/or

aspiration device comprises a ratchet mechanism setting element, e.g. in the form of a lever for setting the pawl in several positions: a position where the first pawl and the first rack are engaged and thus the ratchet mechanism active and allowing forward movement of the piston for the purpose of ejection; a position where the second pawl and the second rack are engaged and thus the ratchet mechanism active and allowing backward movement of the piston for the purpose of aspiration. Thus, the ratchet mechanism comprises at least two settings, first, a first activated pawl position where the first pawl is activated to interlock with the first rack (but the second pawl is idle), thus, allowing forward movement of the piston rod only; second, a second activated pawl position where the second pawl is activated to interlock with the second rack (but the first pawl is idle), thus, allowing backward movement of the piston rod only. Preferably, the ratchet mechanism comprises at least a third setting with both pawls in an inactivated pawl position, thus, allowing forward and backward movement of the piston rod. If the ratchet mechanism is in said third setting, then a forward and a backward movement of the piston rod is possible depending on the operators finger movement on the actuating element (finger wheel). In this embodiment it is possible to switch from an ejection mode to a aspiration mode by selecting the respective ratchet mechanism setting. Such device may be used in many different applications, since it allows variably dosed injection and aspiration.

BRIEF DESCRIPTION OF THE FIGURES

Further advantages and features of the invention follow from the following detailed description of an exemplary embodiment of the invention and with reference to the schematic representations, which are not true to scale, in which:

Fig. 1 is an oblique view of an injection and/or aspiration device according to the invention;

Fig. 2 is an exploded view of an injection and/or aspiration device according to the invention;

Fig. 3 is a sectional view of an injection and/or aspiration device according to the invention, with the piston rod and the plunger in a first position (backward position);

Fig. 4 is a sectional view of an injection and/or aspiration device according to the invention, with the piston rod and the plunger in a second position (forward position);

Fig. 5 is a sectional view of an injection and/or aspiration device with the ratchet setting in a disengaged position according to the invention and an enlarged partial view (B) of the area around the ratchet mechanism;

Fig. 6 is a sectional view of an injection and/or aspiration device with the ratchet setting in an engaged position according to the invention and an enlarged partial view (C) of the area around the ratchet mechanism;

Fig. 7 is a further sectional view of an injection and/or aspiration device with the ratchet setting in an engaged position according to the invention and an enlarged partial view (C) of the area around the ratchet mechanism;

Fig. 8 is an oblique view of a demounted pawl carrying ratchet lever;

Fig. 9 is a sectional view of an injection and/or aspiration device with an alternative ratchet mechanism with the ratchet setting in forward disengaged position and in backward engaged position according to the invention and an enlarged partial view (A) of the area around the ratchet mechanism;

Fig. 10 is a further sectional view of an injection and/or aspiration device with the alternative ratchet mechanism of Fig 9 and an enlarged partial view (A) of the area around the ratchet mechanism;

Fig. 11 is an oblique view of a further demounted pawl carrying ratchet lever;

Fig. 12 shows different views of the demounted pawl carrying ratchet lever of Fig. 11.

DETAILED DESCRIPTION OF THE FIGURES

In the following the same reference numerals apply to the same or similar elements in different figures.

In a first exemplary embodiment Fig. 1 shows schematically in an oblique view an injection and/or aspiration device 1 with a syringe barrel 9 for a gas and/or liquid. The syringe barrel is shown as partially cut open to reveal its plunger 2. In Fig. 2 the injection and/or aspiration device is illustrated in an exploded view. Fig. 3 and Fig. 4 show in each case a sectional view of the injection and/or aspiration device 1 with the piston rod 3 and the plunger 2 in different positions, thus in Fig. 3 in backward position and in Fig. 4 in forward position, respectively. Fig 5 and Fig. 6 show in each case a sectional view of the injection and/or aspiration device 1 revealing the ratchet mechanism. In Fig. 5 the ratchet mechanism is disengaged, while in Fig. 6 the ratchet mechanism is engaged to allow forward movement of the piston rod 3 but inhibit backward movement of the piston rod 3. During the forward movement of the piston rod 3 the engaged ratchet mechanism produces acoustic clicks. Fig. 7 shows a further sectional view from another angle revealing the ratchet mechanism in an engaged position similar as in Fig. 6. Fig. 8 shows a view of the demounted pawl carrying ratchet lever 65.

The injection and/or aspiration device 1 (see e.g. Fig. 1) includes a longitudinal housing 5 with a holder 43 for a receptacle 9, such as a cylindrical syringe barrel. The receptacle 9 comprises a plunger 2 on one end and an outlet nozzle 7 on the other end. The plunger is slideable within the receptacle 9 in direction of the longitudinal extension of the receptacle 9. At the same time, the plunger 2 seals against the inner wall of the receptacle 9 preventing a discharge flow-through of gas and/or liquid between plunger 2 and receptacle 9. The receptacle 9 may be mounted onto the holder 43. Alternatively the receptacle 9 may be integral in or fixedly attached to the housing 5. The receptacle 9 may comprise a gas and/or liquid or at least is suitable to hold a gas and/or liquid. The holder 43 is designed such that the receptacle 9 is attached in longitudinal extension of the housing 5, such that the nozzle 7 of the receptacle 9 is located at the distal end forming the front part of the injector and/or aspiration device 1. A displaceable piston rod 3 is supported in the housing 5, the piston rod 3 can be

driven forwardly into the receptacle 9 towards the nozzle 7 in order to eject gas and/or liquid through the nozzle 7 (Fig. 3). Preferably, the plunger 2 seals the receptacle 9. The gas and/or liquid can be ejected from the receptacle 9 and through the nozzle 7 by driving or pushing the piston rod 3 and therewith the plunger 2 forward towards the nozzle 7. Alternatively, by driving or pulling the piston rod 3 and therewith the plunger 2 from the vicinity of the nozzle outlet 7 backwards through the receptacle body, gas and/or liquid may be sucked up, i.e. aspirated, into the receptacle 9. The receptacle 9 is preferably designed as a cartridge fitting into the holder 43. By mounting the cartridge to the housing 5 gas and/or liquid may be inserted into the injection and/or aspiration device 1. The cartridge can be formed for example as syringe barrel 9 with plunger 2 and nozzle 7.

In Fig. 2 a gear rack (i.e. a linear gear) 13, which cooperates with a toothed gear (i.e. a pinion, preferably a circular gear) 15, is formed on the piston rod 3. The gear rack 13 and the toothed gear 15 form a transmission mechanism, in particular a rack gearing. By manually actuating the toothed gear 15 the piston rod 3 can be moved backwards and forwards since the teeth of the gear train 13 and tooth gear 15 engage with one another. In the rack gearing the gear rack is a linear machine element with a row of elevations, i.e. the teeth, in which a tooth gear (i.e. pinion) engages. The toothed gear 15 is preferably manually driven by means of at least one actuating element 19, which is firmly connected to the toothed gear 15. The actuating element 19 is formed as a lever, suitably as a lever wheel enlarged compared to the diameter of the toothed gear 15, and in particular as an impeller (or butterfly wheel) with radially projecting gripping parts 20.

The toothed gear 15 comprises a rotation axis or shaft 17. The actuating element 19 advantageously has the same rotation axis or shaft 17. Preferably the rotation shaft 17 is an integral part of both the toothed gear 15 and the actuating element 19, thus, they are fixedly attached to one another and form an integral element. The rotation shaft 17 is supported in the housing 5. An indentation 21 for example is provided in the housing 5 for supporting the rotation shaft 17 of the toothed gear 15 and the actuating element 19. The actuating element 19 and in particular the individual gripping parts 20 of the actuating element 19 project at least partially from the housing 5, while the

toothed gear 15 is preferably positioned entirely within the housing circumference and within the housing 5. The housing 5 is optionally formed around the toothed gear 15 so as preferably to completely accommodate the transmission mechanism in the housing 5. The housing has however an opening 33 for the actuating element 19 and in particular its gripping parts 20, so that the actuating element 19 can be manually operated.

The toothed gear 15 is on account of its function arranged on the teeth row side of the gear rack 13 (i.e. on the gear rack side), optionally at an extension of the gear rack displacement path, over the row of teeth of the gear rack 13, so that the teeth of the toothed wheel 15 engage or can engage in the teeth of the gear rack 13. Access to the actuating element 19 is enabled on account of the structure of the housing 5 on the gear rack side. Accordingly, in the here depicted embodiment (Fig. 2 and 3) with only one toothed gear 15 the actuating movement for driving the piston rod 3 forwards is a tractive movement. The tractive movement of a human operator's finger and the resulting forward drive movement of the piston rod 3 are opposed to one another.

The housing 5 may comprise a proximal opening 34 via which the piston rod 3 may be mounted and/or via which the piston rod 3 can be displaced manually to a desired start position. From such start position the piston rod 3 can be displaced further in a controlled manner by means of the actuating element 19.

The housing 5 is advantageously composed of for example at least one first housing part and a second housing part, preferably an upper housing part 27 and a lower housing part 29, which can be assembled, in particular interlocked (see e.g. Fig 2). The rotation shaft 17 of the toothed gear 15 is preferably supported in an indentation 21 in the lower housing part 29. Furthermore, the upper housing part 27 displays opening 33 for the actuating element 19 and in particular the gripping parts 20 of the actuating element 19. The lower housing part 29 advantageously comprises or forms a receptacle 37 for the piston rod 3, in which the piston rod 3 can be inserted, e.g. before or optionally after the upper housing part 27 with the toothed gear 15 is mounted on top. The point of access to the actuating element 19 is provided on the upper housing part and is identified by the operating region 36 (Fig. 2).

In the present embodiment the holder 43 for the receptacle 9 is formed on or extends from the lower housing part 29. Alternatively, an arrangement of the holder on the upper housing part is conceivable. The holder 43 for the receptacle 9 preferably comprises a nozzle notch 41. This allows accurate insertion of the receptacle 9.

The piston rod 3 can be provided at its tip 45 with a thread. The tip 45 of the piston rod 3 serves for pushing and/or pulling the plunger 2. Especially for the purpose of pulling the plunger backward, advantageously the piston rod 3 and the plunger are attached to each other firmly, for example by means of a screw fitting.

In its injection mode the injection and/or aspiration device is used for example for the purpose of injecting a gas and/or liquid into a human or animal body. In this connection gas and/or liquid, which is initially located in the receptacle 9 of the injector, can be ejected by means of a piston rod 3 and plunger 2 from the receptacle 9 through the nozzle 7. According to the invention the drive of the piston rod 3 is effected via a toothed wheel 15, which engages on a gear rack 13 and moves the piston rod 3 forwards. The injection and/or aspiration device 1 in this case can be held with one hand (e.g. like a ballpoint pen) and the toothed wheel 15 and in particular its actuating element 19 is moved with a finger of the same hand (for example with the index finger). In the embodiment e.g. according to Fig. 3 and Fig. 4 the actuating element 19, which is for example formed as an impeller, can be turned with the finger in several pulling movements so that the gear rack 13 and thus the piston rod 3 with plunger 2 moves forward (in particular opposite to the pulling movement of the finger) towards the nozzle 7.

In this exemplary embodiment the ejection of the gas and/or liquid on driving the forward movement of the piston rod 3 via the gear train proceeds in a controlled manner, while the manipulating operator simply requires one hand to hold the injection and/or aspiration device and at the same time to eject the gas and/or liquid. The second hand is free for other manipulations on the patient. Fine pulling movements of a finger on the butterfly wheel are sufficient to introduce the gas and/or liquid into a human or animal body or aspirate gas and/or liquid from a human or animal body.

In its aspiration mode the injection and/or aspiration device is used for example for the purpose of aspirating a gas and/or liquid from a crevice of a human or animal body. In this connection gas and/or liquid can be sucked up by means of a piston rod 3 and plunger 2 through the nozzle 7 into the receptacle 9. Also for this purpose the injection and/or aspiration device 1 may be held with one hand (e.g. like a ballpoint pen) and the toothed wheel 15 and in particular its actuating element 19 is moved with a finger of the same hand (for example with the index finger). The actuating element 19, which is for example formed as an impeller, can be turned with one finger of the device holding hand in several pushing movements so that the gear rack 13 and thus the piston rod 3 with plunger 2 moves backward (in particular opposite to the pushing movement of the finger), thus away from the nozzle 7.

Optionally, multistage transmission mechanisms may be formed by adding further toothed gears (for example intermediate toothed gears). If for example a second toothed gear were inserted between the first toothed gear 15 and the gear rack 15 (not shown in figures), the actuating element 19, in particular the butterfly wheel, would now have to be moved forwards, i.e. pushed, in order to drive the piston rod 3 forwards (i.e. to the nozzle 7). The drive movement could be accomplished with a finger by pushing the butterfly wheel 19 forwards. The manual displacement movement would thus correlate to the piston movement. Thus, fine pushing movements of a finger on the butterfly wheel would be sufficient to introduce the gas and/or liquid into a human or animal body or fine pulling movements of a finger on the butterfly wheel would be sufficient to aspirate gas and/or liquid from a human or animal body.

The dimension of the plunger 2, in particular the diameter of the plunger 2, usually is larger than the passage through the nozzle 7. Therefore, the movement is halted when the plunger 2 contacts the entry into the through passage of the nozzle 7.

In practice during use of an injection and/or aspiration device 1 the actuating element 19 often is actuated by several consecutive strokes of one single finger (i.e. one of the surgeon's finger). Thereby the actuating element 19 is moved in an interrupted manner, as the actuating element 19 is released by the finger in-between two strokes. While the actuating element 19 is released (i.e. as soon as the pressure applied via the

actuating element 19 is omitted), it may occur that the piston rod 3 slides back e.g. due to a resilience in the plunger 2 or more likely due to a counter-pressure or resistance in the tissue into which gas and/or liquid is injected or from which gas and/or liquid is aspirated, respectively, and in consequence the piston rod 3 is moved into the opposite direction. During manual operation of an injector, in particular during manual driving or pushing of the gas and/or liquid by means of a gear transmission, such rebound effect, may be problematic, especially since dosage precision is required during injection. Such rebound effect and therewith a back movement of the piston rod 3 into the opposite direction and a respective movement of the actuating element can be reduced or prevented e.g. by employing a ratchet mechanism, in particular by integrating a ratchet mechanism as described herein below.

In Figs. 5-7 details of the injection and/or aspiration device are illustrated. Figs. 5, and 6 show in each case a top view of the injection and/or aspiration device 1 with a different setting of a ratchet mechanism, Fig. 5. With the ratchet mechanism inactivated and Fig. 6 with the ratchet mechanism activated. Fig. 7 further shows a further view of the device with the ratchet mechanism activated from an angle below. In any of these either the upper or lower housing part 27 or 29 is removed for better illustration of the internal features, in particular of the features of the ratchet mechanism. Each partial Figure B_I, B_{II} or A shows an enlarged detailed view of the ratchet mechanism in activated or inactivated position, respectively.

The ratchet mechanism in activated position as shown in Figs. 6 and 7, allows a linear motion of the piston rod 3 in one direction only, i.e. a forward movement of the piston rod 3 towards the nozzle 7, while preventing motion of the piston rod 3 in the opposite direction, i.e. rearward direction. The ratchet mechanism comprises e.g. a linear rack 67 (ratchet rack) with teeth and a pawl (or click) 69, e.g. designed as a pivoting, spring-loaded arm, which engages the teeth of the rack 67. The ratchet rack 67 is a structure formed on the piston rod 3. With regard to the piston rod tip 45, the ratchet rack 67 preferably is placed parallel to the gear rack 13 but leading further back than the gear rack 13. The pawl 69 is fixedly attached to the housing 5, so that pawl 69 and rack 67 can be engaged at the same time when gear rack 13 and actuating element 19 of the transmission mechanism are engaged. When the piston rod 3 and therefore the ratchet

rack 67 is moving in the unrestricted direction (i.e. forward in direction towards the nozzle 7), the pawl 69 easily slides over the teeth of the rack 67, spring force forcing the pawl 69 against the rack 67 into the depression in-between the teeth as the pawl 69 passes the tip of each tooth of the ratchet rack 67, producing a typical audible racket noise (e.g. with a click shortly after each passage of a tooth tip). In the restricted direction the pawl 69 bears against the teeth in such a way that any backward motion of the piston rod 3 causes the pawl 69 to jam against the teeth of the racket 67 and thus prevent any further backward motion.

Advantageously, the pawl 69 is fixed on rotatable pawl carrying ratchet lever 65, which allows to manually inactivate (or activate) the ratchet mechanism by disengaging (or engaging, respectively) pawl 69 and rack 67. The lever 65 of the ratchet mechanism preferably is placed further away from the nozzle 7 than the actuating element 19 of the transmission mechanism, thus behind the actuating element 19 of the transmission mechanism.

Preferably the ratchet rack 67 is integrated into or fixedly attached to the piston rod 3. The ratchet rack 67 extends in the direction of the longitudinal extension of the piston rod 3. Thus, the piston rod 3 comprises a ratchet rack 67, whereby ratchet rack 67 and pawl 69 are designed to interlock with each other for the purpose of inhibiting any unintended backward sliding of the piston rod 3 during ejection.

In an alternative embodiment ratchet rack and pawl may be designed to interlock for the purpose of inhibiting any unintended forward sliding of the piston rod during aspiration.

The pawl carrying ratchet lever 65 (Fig. 8) comprises an axis 71, a pawl 69 and a handle 63. The handle 63 is firmly attached to the axis 71 and project radially from the axis 71 which further carries the pawl 69. The axis 71 is pivotably mounted in the housing 5, in particular such that the lever 65 or, more precisely, the handle 63 of the lever 65 is accessible from outside the housing 5 by an operator (Fig. 5, Fig. 6 and Fig. 7). For this purpose the axis may be set into bearings 72 (one bearing shown only), which is formed in the housing 5. At least one, preferably two or more setting positions 73 are available for selecting and setting at least one, preferably two or more operation

modes. For this purpose the setting lever 65 of the ratchet mechanism comprises outskirts with multiple notches 73 which may be locked against a structure at the housing, such as a pin 75 protruding from the housing. The pawl 69 projects radially from the axis 71. Advantageously, the pawl 69 forms an arm of a spring-loaded material. Preferably the arm is bent within a plane perpendicular to the longitudinal extension of the axis 71, so that the pawl may engage to its ratchet rack 67. Mounted onto the housing 5, by switching the lever 65 from one position to another position the pawl 69 may be set to engage or disengage with the rack 67. When the pin 75 locks into the notch, sufficient resistance is created so that the pawl 69 is held in position.

In present invention, e.g. according to Figs. 1-8 the ratchet mechanism can be activated or deactivated during use. Therefore, the operational mode can be selected and can be changed during use of the invention, i.e. either only injection with active acoustic feedback or injection and aspiration enabled without acoustic feedback.

Fig 9 and Fig. 10 show in each case a sectional view of a further injection and/or aspiration device 101 comprising an alternative pawl carrying ratchet lever 165. This alternative pawl carrying ratchet lever 165 comprises two pawls 169 and 170. Depending on the chosen setting position 173, either the first pawl 169 or the second pawl 170 may be set to engaged with a ratchet rack. In Fig. 9, especially as depicted in its detail A, the second pawl 170 is shown to engage with its ratchet rack 168, inhibiting forward movement of the piston rod 103 towards the nozzle 7 but allowing backward movement for the purpose of e.g. aspirating a gas and/or liquid. Fig. 10 shows the same setting position, however, from a different angle. Fig. 11 shows an oblique view of the demounted pawl carrying ratchet lever 165. Fig. 12 shows views of the same pawl carrying ratchet lever 165 from 5 different sides.

This alternative pawl carrying ratchet lever 165 having a first pawl 169 and a second pawl 170 allows for at least two ratchet modes. First, the ratchet mechanism may be set to inhibit backward movement of the piston rod 103 in that the first pawl 169 is set to engage with the first ratchet rack 167 (i.e. the first mode) or, second, the ratchet mechanism may be set to inhibit forward movement of the piston rod 103 in that the second pawl 170 is set to engage with the second ratchet rack 168 (i.e. the second mode). A user may, when changing the setting mode from the first mode to the second

mode or vice-versa, reverse the direction of piston rod operation; thus, he may switch from ejection to aspiration or vice-versa.

In Figs. 9 and 10 the ratchet mechanism is set to above described second mode, thus, allowing backward movement but inhibiting forward movement of the piston rod 3. In this second mode individually regulated aspiration of gas and/or liquid is possible, while ejection of aspirated gas and/or liquid is inhibited.

Optionally, the mutual constructive arrangement of the two pawls 169 and 170 is such that a third mode may be set at a setting position in-between the first mode setting and the second mode setting, with said third mode presenting an idle state wherein at the same time both pawls 169, 170 are disengaged from their ratchet racks; and thus forward and backward movement, i.e. ejection and aspiration, may be executed by respective activation of the activation element 19 in direct succession. According to this optional embodiment, depending on the chosen setting position 173, either the first pawl 169 or the second pawl 170 may be set to engage with a ratchet rack or none of the two pawls 169, 170 is set to engage.

Preferably both ratchet racks 167 and 168 are integrated into or fixedly attached to the piston rod 103. Both racks 167 and 168 extend parallel to each other and in the direction of the longitudinal extension of the piston rod 103. Thus, piston rod 103 comprises two racks 167 and 168, whereby preferably one of the two ratchet racks, i.e. the first ratchet rack 167, is designed to interlock with the first pawl 169 for the purpose of inhibiting any unintended backward sliding of the piston rod 103 during ejection, and the other one of the two ratchet racks, i.e. the second ratchet rack 168, is designed to interlock with the second pawl 170 for the purpose of inhibiting any unintended forward sliding of the piston rod 103 during aspiration.

The two pawl carrying ratchet lever 165 (Fig. 11 and Fig. 12) comprises an axis 171, two pawls 169 and 170 and a setting handle 163. The handle 163 is firmly attached to the axis 171 and projects radially from the axis 171 which further carries the two pawls 169 and 170. The axis 171 is pivotably mounted in the housing 105, in particular such that the lever 165 or, more precisely, the handle 163 is accessible from outside the housing 105 by an operator (Fig. 9 and Fig. 10). For this purpose the axis 171 may be set into

bearings 172 (one bearing shown only), which are formed in the housing 105. At least one, preferably two or more setting positions 173 are available for selecting and setting at least one, preferably two or more operation modes. For this purpose the lever 165 comprises outskirts with multiple setting notches 173 which may be locked against a structure at the housing, such as a pin 175 protruding from the housing. The two pawls 169 and 170 project radially from the axis 171, preferably essentially in two opposing directions. Advantageously, each pawl 169 and 170 forms an arm of a spring-loaded material. Preferably each arm is bent within a plane perpendicular to the longitudinal extension of the axis 171, in such a way that a plane along the extension of the axis 171 forms a mirror plane of symmetry with regard to the bending directions. The first pawl 169 pawl and the second pawl 170 are mutually offset in direction of the longitudinal extension of the axis 171, so that each pawl may engage to its own ratchet rack, i.e. to the first rack 167 and the second rack 168, respectively. Mounted onto the housing 105, by switching the lever 165 from one position to another position the first pawl 169 and/or the second pawl 170 may be set to engage or disengage with the respective rack 167 or 168. For example, by switching the lever 165 from a first position to a second position the first pawl 169 may be set to disengage from the first rack 167, while at the same time the second pawl 170 may be set to engage with the second rack 168. Or for example, by switching the lever 165 from a first position to a second position the first pawl 169 may be set to disengage from the first rack 167, so that both pawls are disengaged, and further by switching the lever 165 from a second position to a third position the second pawl 170 may be set to engage with the second rack 168 while the first pawl 169 remains disengaged.

Optionally, in an alternative embodiment (not shown in the figures), the constructional relation of the two pawls is such, that the angle between the two pawls at their clamping side is such that at any time and at or in-between any ratchet setting position either the first pawl or the second pawl or both pawls engage with their respective rack or racks. In this embodiment there is no third mode setting as described above; thus, disengagement of the two pawls from their respective racks at the same time is not possible. However, such constructional implementation could account for a lock mode, where neither ejection nor aspiration is possible. According to this optional embodiment, depending on the chosen setting position, either the first pawl, or the

second pawl, or the first pawl and the second pawl at the same time, may be set to engage with a ratchet rack. Whereas hereinbefore specific embodiments have been described, it is obvious that different combinations of the illustrated realisation possibilities can be employed insofar as they are not mutually contradictory.

Whereas the invention has been described hereinbefore with reference to specific embodiments, it is obvious that changes, modifications, variations and combinations can be made without departing from the concept of the invention.

LIST OF REFERENCE NUMERALS:

1	Injection and/or aspiration device, also called dosing device
2	Plunger, piston
3	Piston rod
5	Housing
7	Syringe nozzle
9	Receptacle, e.g. syringe barrel, for liquid or gas
13	Gear rack
15	Toothed gear
17	Rotation axis of the toothed gear
19	Actuating element
20	Gripping parts of the actuating element
21	Indentation in the housing
27	First or upper housing part
29	Second or lower housing part
33	Openings in the upper housing part for the actuating element
34	Proximal opening in the housing, in particular in the lower housing part
36	Operating region
37	Receptacle for the piston rod
41	Nozzle holder, e.g. notch
43	Holder, recess, support or fixation for a receptacle
45	Piston rod tip
48	Through passage
63	Lever handle
65	Ratchet mechanism setting lever (rotatable pawl carrying ratchet lever)
67	Ratchet rack
69	Pawl
71	Axis
72	Bearing
73	Setting positions (here three indents, each for setting a different position)
75	Pin
101	Injection and/or aspiration device, also called dosing device

103	Piston rod
105	Housing
127	First or upper housing part
129	Second or lower housing part (partial cut)
163	Lever handle
165	Ratchet mechanism setting lever (rotatable two pawl carrying ratchet lever)
167	First ratchet rack
168	Second ratchet rack
169	First pawl
170	Second pawl
171	Axis
172	Bearing
173	Setting positions (several indents, each for setting a different position)
175	Pin

CLAIMS

1. Injection and/or aspiration device (1, 101), in particular a three-stage injection and/or aspiration device, for ejecting and/or aspirating of a gas or a liquid, comprising
- a longitudinal housing (5, 105), in which a piston rod (3, 103) can be guided in an axially displaceable manner, and
- a position for a nozzle or a nozzle (7) at a front end of the housing (5, 105), towards which the piston rod (3, 103) can be displaced and/or from which the piston rod (3, 103) can be retracted,
- a displacement mechanism for moving the piston rod (3, 103) forwards and/or backwards along the longitudinal housing extension,
- an actuating element (19) for manual actuation of the displacement mechanism,
characterised in that
- the displacement mechanism includes a transmission mechanism, by means of which the actuating element (19) and the piston rod (3, 103) are or can be placed in an articulated driving connection, and
- the injection and/or aspiration device comprises a ratchet mechanism for interacting with the piston rod (3, 103).

2. Injection and/or aspiration device according to claim 1, characterised in that the injection and/or aspiration device comprises a lever (65, 165) for switching between two or more settings of the ratchet mechanism.

3. Injection and/or aspiration device according to claim 2, characterised in that two or more settings of the ratchet mechanism are selected from the group consisting of a ratchet mechanism activated setting allowing ejection of a gas and/or liquid, a ratchet mechanism activated setting allowing aspiration of a gas and/or liquid and a ratchet mechanism deactivated setting.

4. Injection and/or aspiration device according to any one of claims 1-3, characterised in that depending on the setting of the ratchet mechanism
- the piston rod (3, 103) is movable forwards for the purpose of ejecting a gas and/or liquid and is movable in the opposite direction, i.e. backwards, for the

purpose of aspirating a gas and/or liquid by appropriate actuation direction of the actuating element (19), and
- the direction of the piston rod (3, 103) movement is invertible by inverting the direction of the movement of the actuation element (19).

5. Injection and/or aspiration device according to any one of claims 1-4, characterised in that the ratchet mechanism is outfitted for the purpose of effecting audible clicks when the piston rod moves along the longitudinal housing extension.

6. Injection and/or aspiration device according to any one of claims 1-5, characterised in that the ratchet mechanism comprises a first linear rack structure (67, 167) on the piston rod (3, 103) and a first pawl (69, 169) attached to the housing (5, 105).

7. Injection and/or aspiration device according to claim 6, characterised in that the ratchet mechanism comprises a second linear rack structure (168) on the piston rod (103) and a second pawl (170) attached to the housing (105).

8. Injection and/or aspiration device according to any one of claims 1-7, characterised in that the ratchet mechanism comprises at least two settings between which the user may switch manually, these are at least an inactivated pawl position and an activated pawl position.

9. Injection and/or aspiration device according to any one of claims 1-8, characterised in that the ratchet mechanism comprises at least three settings between which the user may switch manually, these are at least an inactivated pawl position, a first activated pawl position for inhibiting movement of the piston rod backwards towards the proximal end of the housing and a second activated pawl position for inhibiting movement of the piston rod forwards towards the distal end of the housing.

10. Injection and/or aspiration device according to any one of claims 1-9, characterised in that the lever (165) comprises a rotatable two pawl (169, 170) carrying axis (171), with the two pawls (169, 170), i.e. the first pawl (169) and the

second pawl (170), radially protruding from the axis (171) in a mutually divergent manner, the first pawl (169) designed to interlock with a first linear rack (167) in a first lever setting and the second pawl (170) designed to interlock with a second linear rack (168) in a second lever setting.

11. Injection and/or aspiration device according to any one of claims 1-10, characterised in that the piston rod (3, 103) is provided at its tip (45) with a thread (47), e.g. screw tread, for the purpose of fixing a plunger (2) to the piston rod (3, 103).

12. Injection and/or aspiration device according to any one of claims 1-11, characterised in that the actuating element (19) can be operated by manually pushing or pulling in the longitudinal direction of the housing (5, 105).

13. Injection and/or aspiration device according to any one of claims 1-12, characterised in that the transmission mechanism is a rack gearing, in particular including at least one gear rack (13, 113) and at least one first toothed gear (15), whose teeth act on one another so as to transmit force.

14. Injection and/or aspiration device according to any one of claims 1-13, characterised in that the gear rack (13, 113) is a part, in particular an integral part, of the piston rod (3, 103).

15. Injection and/or aspiration device according to any one of claims 1-14, characterised in that the first toothed gear (15), can be driven via the actuating element (19).

16. Injection and/or aspiration device according to any one of claims 1-15, characterised in that the actuating element (19) is fastened as an operating lever to the first toothed gear (15).

17. Injection and/or aspiration device according to any one of claims 1-16, characterised in that the first toothed gear (15) is implemented as a spur gear.

18. Injection and/or aspiration device according to any one of 1-17, characterised in that the actuating element (19) is designed as a finger grip (20), in particular as a wheel with multiple spikes, preferably three or more spikes.

19. Injection and/or aspiration device according to claim 1-18, characterised in that an operating region (36) for the actuation of the actuating element (19) is formed at a longitudinal side of the housing (5, 105).

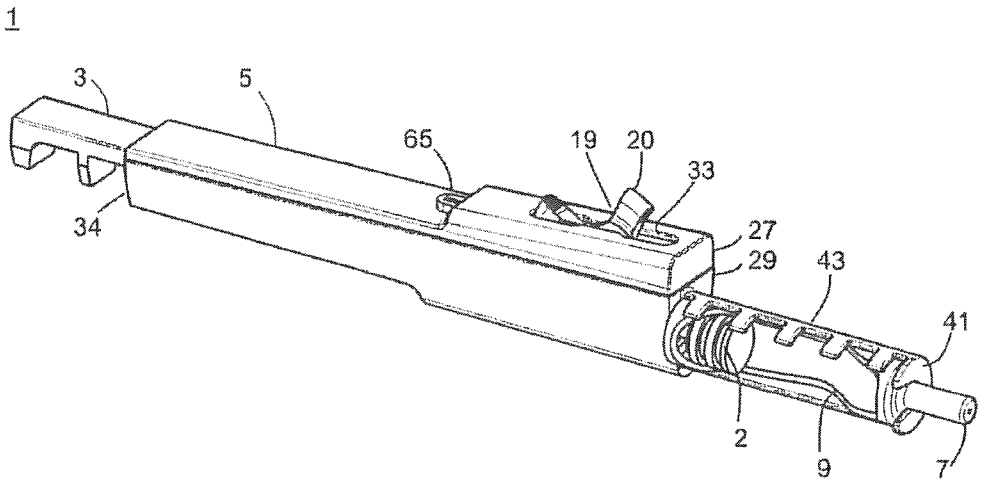
20. Injection and/or aspiration device according to any one of claims 1-19, characterised in that the housing (5, 105) comprises a receptacle (9) or a recess (43) for accommodating a removable receptacle (9).

21. Injection and/or aspiration device according to any one of claims 21, characterised in that the receptacle (9) comprises a loading room for a gas and/or liquid, a proximal opening for inserting the piston rod (3, 103) and distal opening (*orifice*) or nozzle (7) for taking in and expel the gas and/or liquid.

22. Injection and/or aspiration device according to any one of claims 1-21, characterised in that the displacement mechanism, in particular the transmission mechanism, is a manually operating mechanism, i.e. designed for manual operation.

23. Injection and/or aspiration device according to any one of claims 1-22, characterised in that ratchet mechanism is designed for manual operation.

24. Injection and/or aspiration device according to any one of claims 1-23, characterised in that the injection and/or aspiration device is designed for single-handed operation.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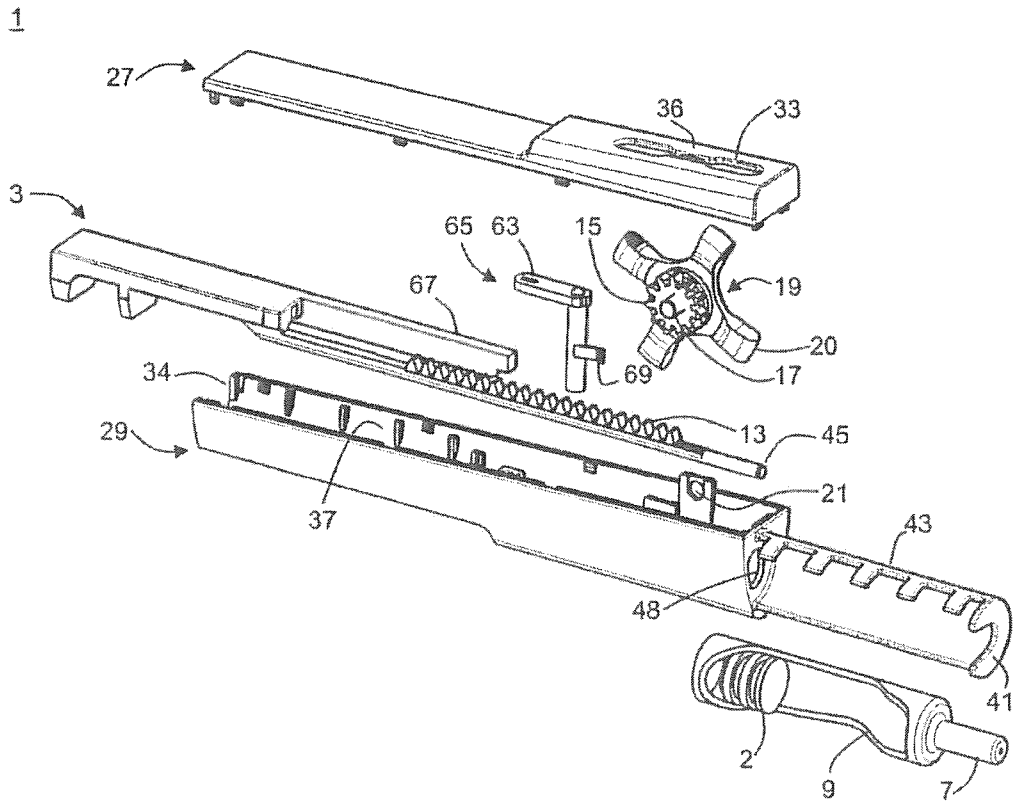
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Fig. 2

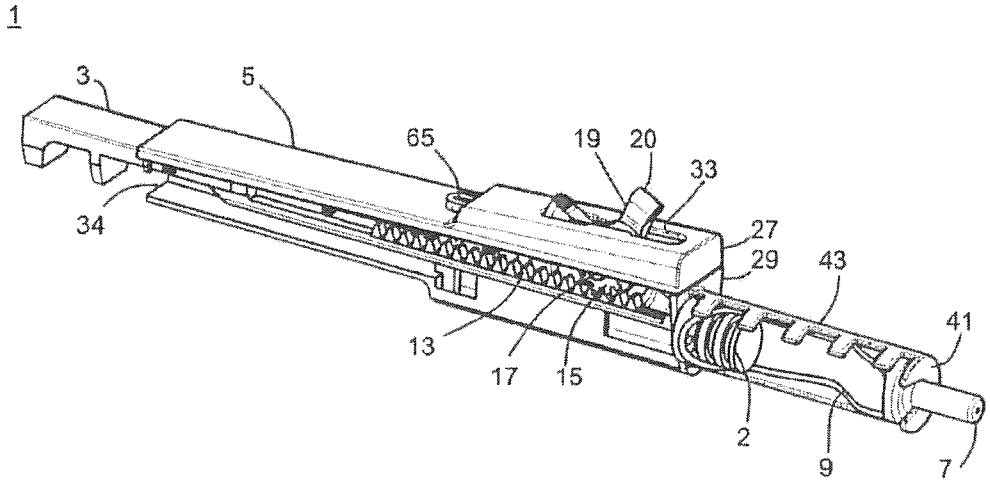
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Fig. 3

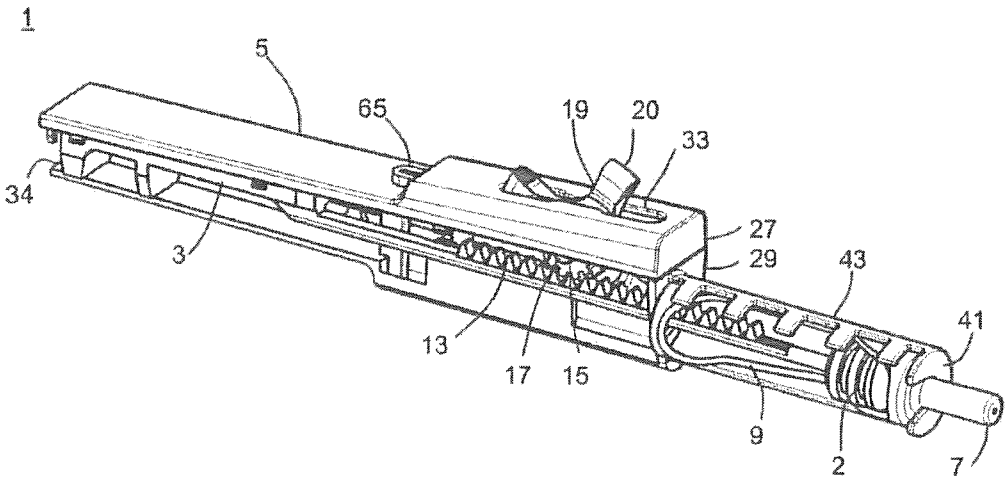
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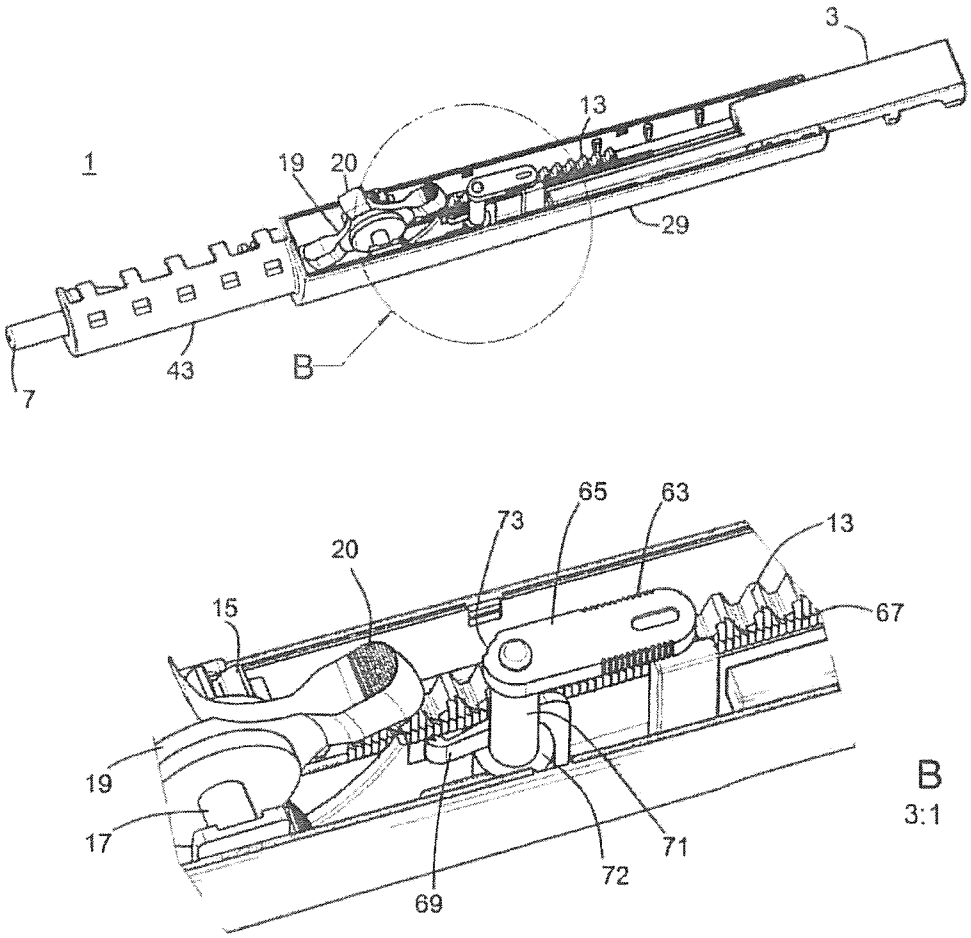
Fig. 4



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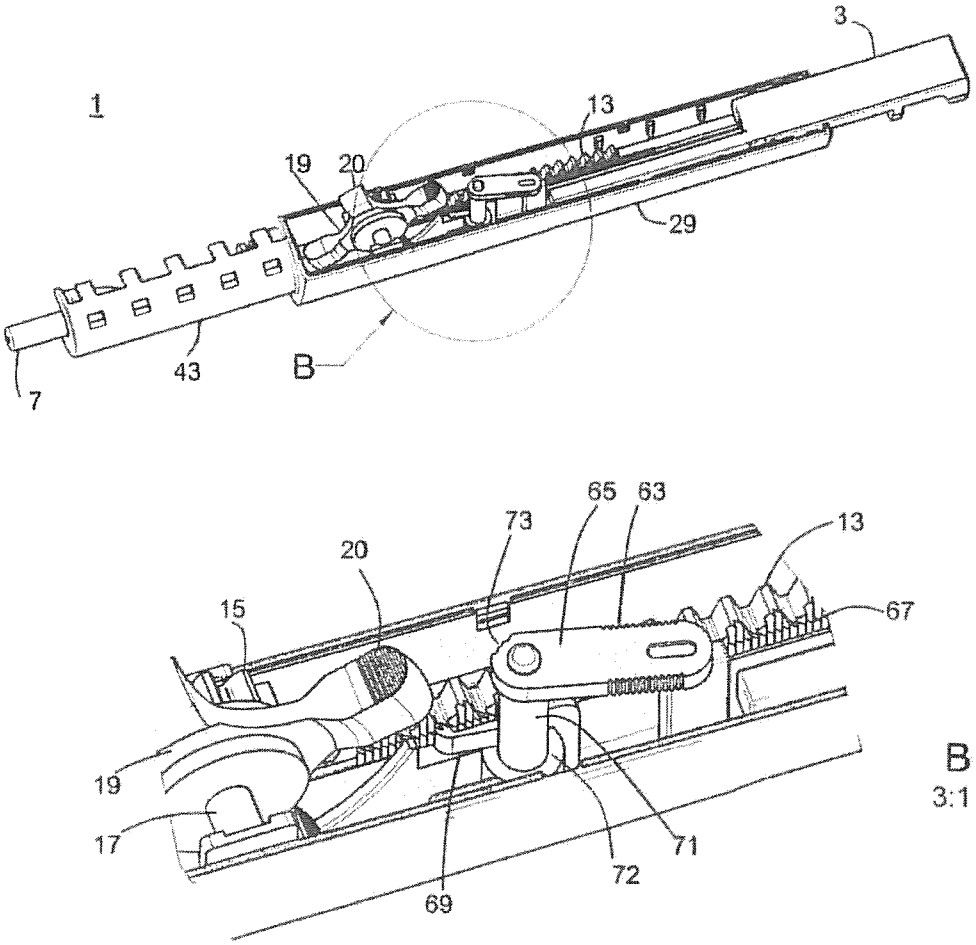

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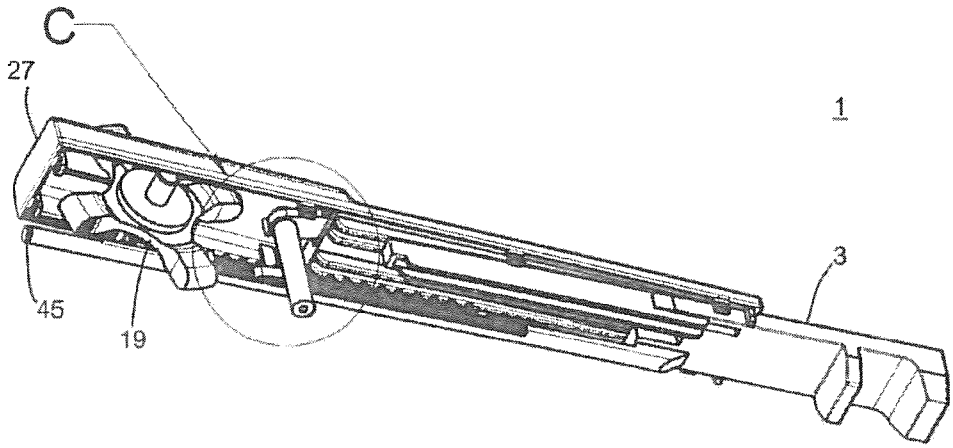

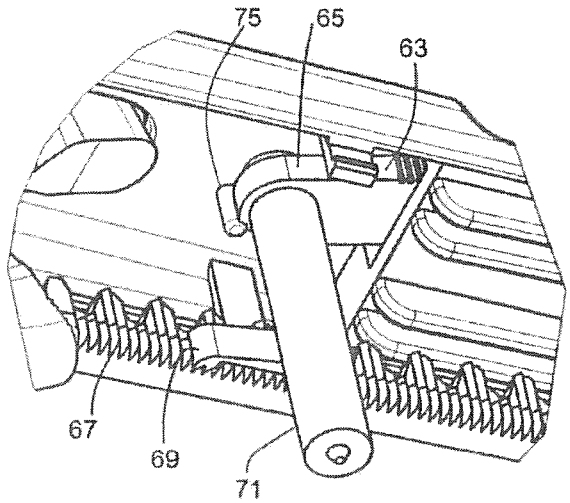

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Fig. 7

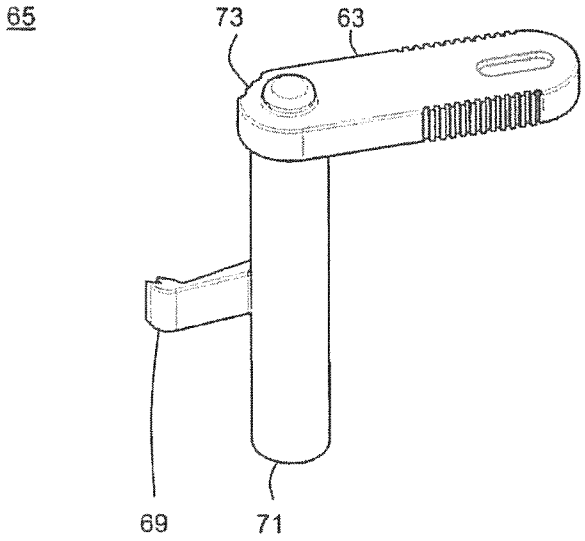
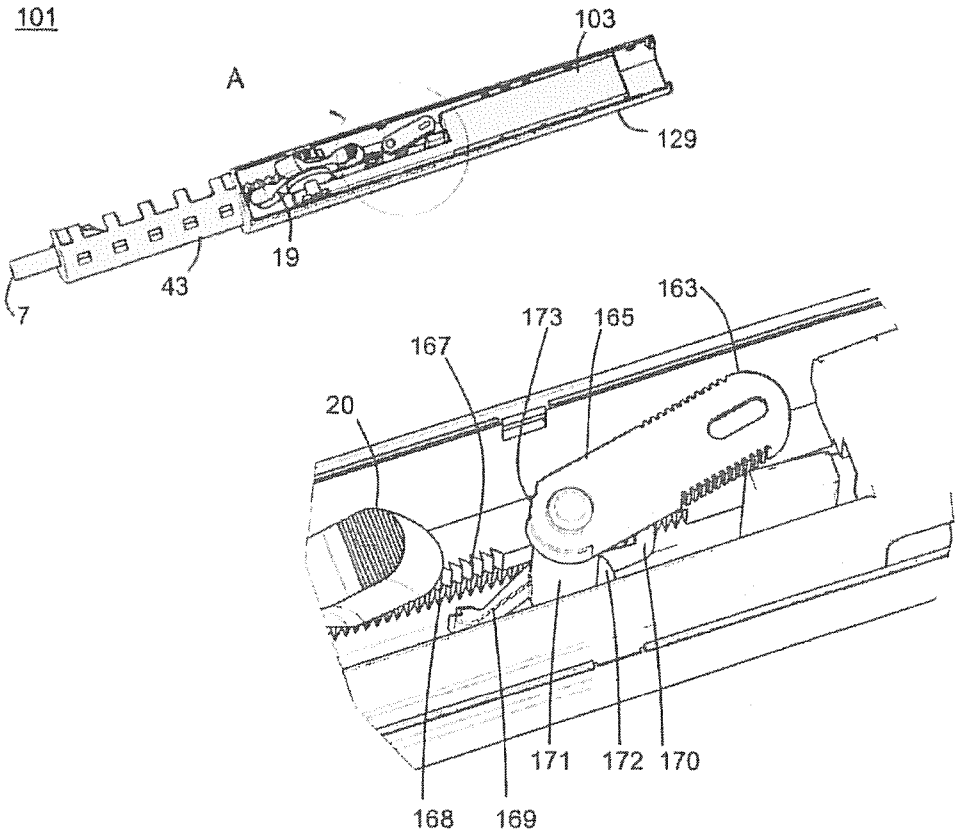


Fig. 8



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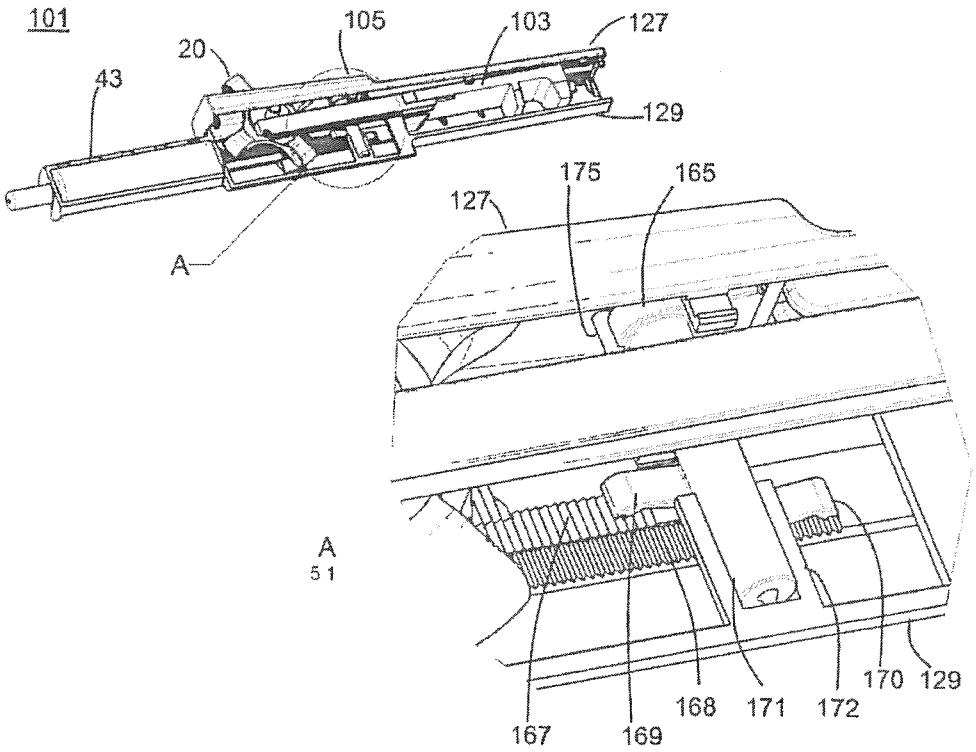
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Fig. 10

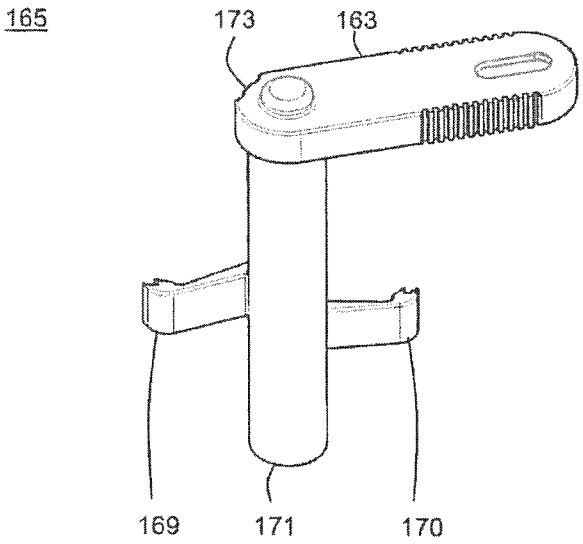

Fig. 11

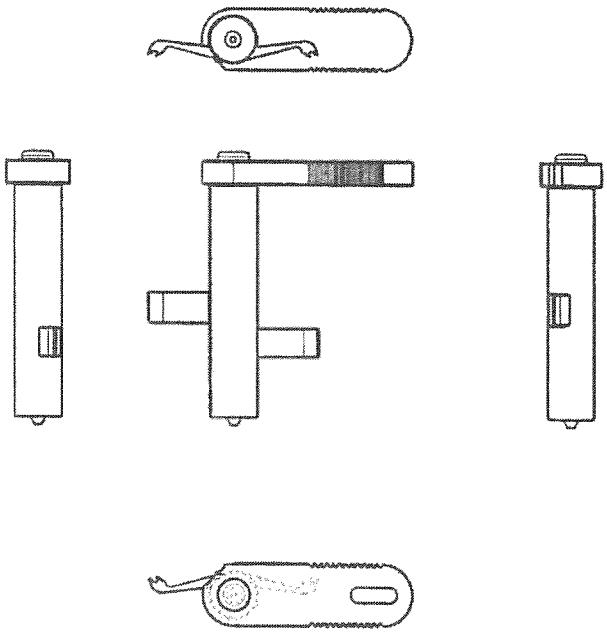

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/CH2017/000019

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M5/315
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61M

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 264 305 A (RASMUSSEN JACK D ET AL) 28 April 1981 (1981-04-28) figures 1-7 column 4, line 26 - column 5, line 41	1-24
X	US 2008/114305 A1 (GERONDALE SCOTT J [US]) 15 May 2008 (2008-05-15) figures 8-10 paragraphs [0012] - [0015], [0048] - [0053]	1-12,18, 20-24
X	US 4 820 287 A (LEONARD HENRY [FR]) 11 April 1989 (1989-04-11) figures 1-4 column 4, lines 24-43 column 5, lines 23-33 column 6, lines 27-33	1-12, 18-24

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 May 2017	13/06/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	López García, Mónica

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/CH2017/000019

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 2005/165363 A1 (JUDSON JARED A [US] ET AL) 28 July 2005 (2005-07-28) figures 1-3 paragraphs [0053], [0071] - [0073] -----	1,5,6, 12-18, 20-22,24
A	EP 1 462 134 A1 (MATSUSHITA ELECTRIC IND CO LTD [JP]) 29 September 2004 (2004-09-29) figure 8 paragraphs [0144], [0145] -----	1-24
A	US 2015/342726 A1 (DEACON JIM [US] ET AL) 3 December 2015 (2015-12-03) figures 25-28 paragraphs [0084] - [0088] -----	1-24

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/CH2017/000019

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