(19) DANMARK

(10) **DK/EP 4200500 T3**

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: ***E 05 B 19/00 (2006.01)*** ***E 05 B 35/00 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2025-01-20**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-12-04**

(86) Europæisk ansøgning nr.: **21765905.1**

(86) Europæisk indleveringsdag: **2021-08-19**

(87) Den europæiske ansøgnings publiceringsdag: **2023-06-28**

(86) International ansøgning nr.: **EP2021073069**

(87) Internationalt publikationsnr.: **WO2022038236**

(30) Prioritet: **2020-08-20 DE 102020121876** **2021-06-01 DE 102021114239**

(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: **ASSA ABLOY Sicherheitstechnik GmbH, Bildstockstrasse 20, 72458 Albstadt, Tyskland**

(72) Opfinder: **Daubitz, Matthias, , 14163 Berlin, Tyskland**
WAHL, Markus, , 13587 Berlin, Tyskland
FISCHER, Ulrich, , 15366 Hönow, Tyskland
FRITZ, Michael, , 14089 Berlin, Tyskland
MIHAILOVIC, Philip, , 10405 Berlin, Tyskland

(74) Fuldmægtig i Danmark: **Budde Schou A/S, Dronningens Tværgade 30, 1302 København K, Danmark**

(54) Benævnelse: **NØGLE MED NØGLEHOVED, NØGLESKAFT OG GENERATOR**

(56) Fremdragne publikationer:
EP-A1- 1 039 074
DE-A1- 102020 115 201
DE-A1- 3 208 818
DE-C1- 19 918 817
JP-A- 2013 002 139
JP-A- 2013 199 744

Key with a key head and with a key shank and a generator

[0001] The invention relates to a key with a key head and with a key shank according to the features of the preamble of claim 1.

[0002] Keys with key electronics for transmitting a coded opening signal to a locking cylinder are known in practice. These are keys for operating a so-called e-cylinder, wherein the coding of the key or e-cylinder is easily electronically programmable. Such keys or locking cylinder systems require either replaceable batteries or complex wiring of the locking cylinder through the lock or through a door.

[0003] A locking cylinder with a generator is known from DE 3208818. When the key is inserted into the locking cylinder, the generator arranged in the locking cylinder is driven to generate electrical energy. For this purpose, a toothed rack is embossed on the key shank, which drives a pinion arranged in the locking cylinder to actuate the generator.

[0004] An electronic vehicle key is known from DE 19918817 C1, wherein the key has a key housing in which a generator is arranged. A mass is assigned to the generator in order to use the mechanical energy generated when moving the key to drive the electrical generator. This is a mass oscillator in the form of a pendulum to convert mechanical energy into electrical energy.

[0005] The applicant has voluntarily restricted the application for Germany with reference to DE 10 2020 115 201 A by submitting separate patent claims for Germany.

[0006] It is the object of the invention to provide a key that is sustainable from an environmental point of view, while offering a high level of security and reliability. In particular, the key should have a long service life and be easy to use.

[0007] According to the invention, this object is solved by a key with a key head and a key shank according to the features of claim 1. The object is further achieved according to the invention by a method for actuating a mechatronic locking cylinder by means of a key according to the features of claim 14.

[0008] According to the invention, a key with a key head and with a key shank for actuating a locking cylinder is proposed, in particular for a mechatronic lock-key system, comprising key electronics which transmit a coded opening signal to a locking cylinder and a generator arranged in the key head for supplying the key electronics and/or locking cylinder electronics with electrical energy, the generator being driven by a movable component.

[0009] It is essential here that the movable component comes into contact with the locking cylinder when the key shank is inserted into a locking cylinder and drives the generator, in particular rotates it, when the key shank is further inserted into the locking cylinder.

[0010] The invention further comprises a method for actuating a mechatronic locking cylinder by means of a key, wherein the locking cylinder is rotated by the key in the opening direction or in the closing direction during actuation, and

wherein the key comprises a key shank for insertion into a key channel of the locking cylinder, a key head and key electronics, and
wherein the locking cylinder comprises an electrically switchable blocking member for releasing or blocking rotation of the locking cylinder as well as locking cylinder electronics switching the blocking member. It is essential here that the key has a generator which is rotationally driven by a rotor when the key shank is inserted into the key channel in order to generate electrical energy for supplying the key electronics and/or the locking cylinder electronics.

[0011] One advantage of the invention is that the generator, which is arranged in the key head and is automatically driven when the key is inserted into the locking cylinder, provides power to supply the key electronics. Advantageously, no further power source other than the generator is required, so that no battery or rechargeable battery is needed. This eliminates the need to replace disposable batteries or defective rechargeable batteries over the course of the key's service life. This increases the reliability of the key and avoids waste.

[0012] Another advantage is that the arrangement of the generator in the key head means that the key can be used universally for different locking cylinders, as the key has its own power supply.

[0013] In particular, actuation of the locking cylinder, especially mechanical actuation of the locking cylinder, is understood to mean a rotation of the locking cylinder or the locking cylinder core by the key. To do this, the key shank is inserted into a key channel of the locking cylinder. The locking cylinder is designed in particular as a so-called e-locking cylinder and has locking cylinder electronics and an electronically switchable blocking element. The electronically switchable blocking element usually blocks operation of the locking cylinder. Only after the locking cylinder electronics or the locking cylinder has received a

correct or valid opening signal from the key or the key electronics is the electronically switchable blocking element released and the locking cylinder can be operated by turning the key.

[0014] In particular, the locking cylinder is intended for installation in a lock of a building door, for example a mortise lock with a single or multi-point locking system. The locking cylinder can be designed as a locking cylinder according to a DIN standard or as a so-called Swiss locking cylinder or as a locking cylinder according to a Scandinavian standard. These locking cylinders differ in their external dimensions.

[0015] Preferably, a locking cylinder is understood to be a mechatronic locking cylinder or a so-called e-locking cylinder. In addition to the mechanics of a locking cylinder, these locking cylinders have locking cylinder electronics to read and preferably evaluate an electronically coded opening signal. The locking cylinder electronics only enable the locking cylinder to be operated if the opening signal is valid.

[0016] Preferably, a mechanical coding can be attached to the key shank. This mechanical coding can be scanned by the key shank when it is inserted into the locking cylinder and used as a security feature in addition to the coded opening signal.

[0017] Preferably, in alternative embodiments, it can be provided that the key shank has no mechanical coding, but the opening authorization is provided solely by the electronically coded opening signal.

[0018] In particular, a mechatronic lock-key system is understood to be a system that has a lock with a locking cylinder that is insertable into the lock and

a key. The term mechatronic indicates that the key is used for mechanical operation by turning the locking cylinder. Furthermore, an electronically coded opening signal is transmitted or exchanged between the key and the locking cylinder in order to check the opening authorization of the key.

[0019] Preferably, an electronically coded opening signal is understood to be a signal that has a coding or encryption. The opening signal can be generated by the key electronics or stored in the key electronics via parameterization or programming. The opening signal can then be encrypted, e.g. RSA-encrypted or DES-encrypted or AES-encrypted.

[0020] Different opening signals can be provided or generated in the key electronics. For example, group opening signals or individual opening signals or master opening signals can be provided. An individual opening signal is authorized to actuate a single locking cylinder. A group opening signal is authorized to actuate several locking cylinders, i.e. a group of locking cylinders. A master opening signal can actuate all locking cylinders in a locking system, similar to a master key.

[0021] The coded opening signal can be transmitted to a locking cylinder by wire. Alternatively or additionally, the coded opening signal can also be transmitted wirelessly. For example, the key electronics can have a wireless interface, preferably ZigBee or Bluetooth or an RFID interface.

[0022] Preferably, the movable component can be designed as a rectilinear or linear movable component. The movable component can be movably mounted on the key shank and/or the key head.

[0023] In an embodiment, it may be provided that the movable component comes into contact with the locking cylinder when the key shank is inserted into a locking cylinder and drives the generator, in particular drives it by rotation, when the key shank is further inserted into the locking cylinder. In particular, the linear movement of the key shank being inserted into the locking cylinder is converted into a rotational movement to drive the generator. One advantage is that inserting the key shank into the locking cylinder causes a continuous movement that sets the generator in rotation. Depending on the speed or force with which the key is inserted into the key channel of a locking cylinder, the generator is continuously set in rotation. The faster the key is inserted, the higher the rotation speed of the generator can be.

[0024] In an embodiment, it may be particularly provided that the key has a toothed rack, with the support of which the linear movement of the key is converted into a rotational movement for driving a generator and for generating electrical energy when the key is inserted into a locking channel of a cylinder core mounted in a locking cylinder, wherein the displacement of the toothed rack is effected by a movable component which is part of the key shank, wherein the movable component is a slider or slide which is mounted in the key shank and engages with a toothed rack arranged in a key head connected to the key shank, which toothed rack is in turn coupled to the generator via a gear.

[0025] In particular, it may be provided that the movable component interacts with a gear element in order to convert a linear movement of the movable component into a rotational movement for rotationally driving the generator.

[0026] In an advantageous embodiment, it may be provided that the movable component is designed as a linearly movable component mounted on the key head and/or the key shank, in particular as a slider, or as a plunger, or as a

slide. Preferably, the movable component can be designed as a magnet and/or have a magnet.

[0027] By designing the movable component as a component which is movably mounted directly on the key shank, a mechanically robust design of the key can be achieved. If the movable component is designed as a slide or a slider, this results in a reliable and mechanically robust design by having the movable component interact directly and mechanically with the locking cylinder. In particular, when the key is inserted into the locking cylinder, it comes into contact with the locking cylinder.

[0028] In an alternative embodiment, the movable component can be designed as a magnet or have a magnet. In this embodiment, there is no direct mechanical interaction with the locking cylinder. Instead, there is a contactless magnetic interaction between the movably mounted component and the locking cylinder. This can be more resistant to soiling.

[0029] It may be provided that the magnet or the slider or the plunger protrudes out of the key head parallel to the key shank.

[0030] In particular, the slide is mounted on the key head and/or on the key shank so that it can be moved linearly and parallel to the key shank.

[0031] In an advantageous embodiment, it may be provided that the slide or the plunger or the slider is connected to the gear element in such a way that tensile forces and/or compressive forces are transmitted between the gear element and the slide or plunger or slider. It is advantageous if the drive of the generator via the gear element and the slide or slider connected to the gear element are constructed in two parts. This two-part design means that the gear element

assigned to the generator can be accommodated in the key head and the slide or slider can be arranged as a movable component outside the key head on the key shank. It is essential that the slide or the plunger or the slider is connected to the gear element in order to transmit both tensile forces and compressive forces between the gear element and the slide or plunger or slider. This ensures, with simple production of the key, a high level of functional reliability and a connection between the gear element on the one hand and the slide or plunger or slider on the other hand, which cannot be released under normal conditions.

[0032] Advantageously, it may be provided that the gear element is connected to a spindle drive or a connecting rod drive or a belt drive, or that the gear element is designed as a spindle drive or a connecting rod drive or a belt drive. The linear movement of the movable component can be converted into a rotary movement to drive the generator via the spindle drive or connecting rod drive or belt drive.

[0033] In particular, it may be provided that the gear element is part of a gear device. In particular, part of a gear device comprising the gear element and a transmission for transmitting the rotational movement of the gear element to the generator at a different rotational speed. The transmission ratio of the gear device can be selected in such a way that the generator is driven at the optimum rotational speed for converting the mechanical energy into electrical energy.

[0034] Advantageously, the gear element can be arranged within the key head, preferably the gear device can be arranged within the key head.

[0035] In order to achieve a particularly compact design, it may be provided that the key electronics are arranged inside the key head.

[0036] In an embodiment, it may be provided that the gear element has a toothed rack interacting with the movable component.

[0037] In particular, a freewheel clutch can be provided between the generator and the movable component. Preferably in such a way that the movable component is only engaged with the generator when the key is inserted into a locking channel of a locking cylinder, while the freewheel clutch disengages the movable component when the key is pulled out, so that the generator can only be driven in one rotation direction. The freewheel clutch can be constructed in the same way as a bicycle freewheel. This means that as long as the movable component is moved in the direction of the key head, the movable component is in drive engagement with the generator. When the movable component brakes or stops towards the end of its way, the freewheel clutch disconnects the connection between the movable component and the generator. This allows the generator to continue rotating even if the movable component is braked or stands still. Furthermore, the movable component can move in the opposite direction to the drive direction when the key is removed from the locking cylinder without adversely affecting the rotation of the generator.

[0038] In particular, it may be provided that the movable component is spring-loaded for resetting, in particular spring-loaded in the direction of the key tip. The spring can be designed as a torsion spring or a coil spring, in particular as a linear coil spring or a torsion bar spring. The spring ensures that the movable component is always arranged in its initial position, i.e. in the front position, i.e. facing the tip of the key shank, when the key is removed from the locking cylinder.

[0039] In an advantageous embodiment, it may be provided that the generator and the gear element and the gear device are designed together as an assembly unit that can be inserted into the key head, in particular that the gear, the generator and the toothed rack are designed together as an assembly unit that can be inserted into the key head.

[0040] Furthermore, the key electronics can be designed as an assembly unit or as a module. In particular, the key electronics can have a circuit board on which the components of the key electronics, preferably all components of the key electronics, are arranged.

[0041] In particular, an assembly unit is understood to mean a modular design. This means that the generator and/or the key electronics are designed as an assembly unit or module and can be inserted as such into the key or the key head. This makes it easier to manufacture the key, as the components of the assembly unit, i.e. the generator, the gear element and the gear device, do not have to be inserted separately and connected to each other.

[0042] In order to further increase convenience and operational safety, it may be provided that an optical display, preferably comprising an LED, is provided on the key head, wherein the optical display is supplied with electrical energy by the generator. The visual optical display allows error messages or status messages, for example, to be optically visualized to a user.

[0043] In an advantageous embodiment, it may be provided that the key electronics comprise an energy storage. In particular, it has a capacitor as an energy storage for the electrical energy generated by the generator and enables intermediate energy storage. The electrical energy generated by the generator

can be stored or temporarily stored via the energy storage. This makes it possible to use the electrical energy generated by the generator efficiently. For example, the energy storage can be used to supply the key electronics with electrical energy over a longer period of time than the generator supplies electrical energy.

[0044] In particular, it may be provided that the key electronics do not require or have any other power source apart from the generator.

[0045] Advantageously, it may be provided that the generator or energy storage supplies both the key electronics and the locking cylinder with electrical energy. In particular, it supplies a locking cylinder electronics and an electrically switchable blocking element of the locking cylinder with electrical energy. This eliminates the need for a separate power supply for the locking cylinder, in particular a mains power supply.

[0046] Advantageously, it may be provided that an electrical contact is arranged on the key shank in order to connect the key electronics to a locking cylinder electronics and that the generator is designed to supply a locking cylinder electronics with electrical energy via this contact. Preferably, the key shank is designed to be electrically conductive and the electrical contact is designed to be insulated from the key shank. This allows an electrical circuit with two poles to be created in which, for example, the key shank serves as the ground and the electrical contact as the second pole. This means that when the key is fully inserted into a locking cylinder, a circuit can be closed with the locking cylinder by means of the electrical contact. This makes it possible to supply the electronics of the locking cylinder, i.e. the locking cylinder electronics, with electrical energy from the generator located in the key or from the key's energy storage. This completely eliminates the need to wire the locking cylinder to the

lock or through the door. One advantage is that there is no need for power supply units. This means that the resulting power consumption of the lock-key system is zero, which means, for example, that no CO2 is released during operation. Furthermore, no rechargeable or replaceable battery is required to power the locking cylinder, meaning that no hazardous waste is produced when the lock-key system is in operation.

[0047] In particular, it may be provided that the electrical contact is designed to establish a wired data connection between the key electronics and locking cylinder electronics. Besides acting as a power supply, the electrical contact can therefore additionally be designed as a data interface, in particular a bidirectional data interface. This data interface can be used, for example, to exchange an encrypted, electronically coded opening signal between the locking cylinder electronics and the key electronics. Common encryption mechanisms such as AES encryption or RSA encryption can be used for encryption.

[0048] The invention also relates to a system comprising a key according to one of the embodiments described above. Here it is provided that the system comprises a mechatronic locking cylinder or a so-called e-cylinder, which has locking cylinder electronics. In particular, the locking cylinder electronics and the key electronics are programmed accordingly so that they can exchange and validate the opening signal with each other. When validating the opening signal, for example, the key electronics can generate a coded opening signal and transmit it to the locking cylinder electronics. The locking cylinder electronics check the opening signal and if it is a valid opening signal, the locking cylinder electronics release the switchable blocking element to actuate the locking cylinder.

[0049] In another embodiment it may be provided that the coded opening signal is exchanged bidirectionally between the locking cylinder electronics and the locking cylinder. For example, the key electronics can first check the locking cylinder electronics to see whether the locking cylinder electronics or the type of locking cylinder is approved for the corresponding key or for the corresponding lock-key system. Only after the locking cylinder has been validated the locking cylinder electronics will then generate a coded opening signal and transmit it to the locking cylinder or the locking cylinder electronics. The locking cylinder or the locking cylinder electronics will then check the coded opening signal and, if it is valid, release the locking cylinder for operation. The locking cylinder can then be operated by turning the key, i.e. it can be turned in the opening direction, for example, to open a lock, i.e. to pull the locking elements of a lock back into the lock housing and unlock a door.

[0050] In particular, it may be provided that the locking cylinder electronics are supplied with electrical energy by the generator and/or the energy storage of the key in order to check an opening signal exchanged between the key electronics and the locking cylinder electronics and, if an opening authorization is present, to release a blocking element in order to enable mechanical actuation of the locking cylinder.

[0051] Preferably, the generator can be used to supply the key electronics, the locking cylinder electronics and the blocking element with electrical energy.

[0052] In particular, the operation of the key with a locking cylinder or of the lock-key system can take place in such a way that when the key shank is inserted into the key channel, a movable component arranged on the key comes into contact with the locking cylinder and is displaced relative to the key

shank when the key shank is further inserted in order to drive the generator rotationally.

[0053] The key or lock-key system according to the invention can be used on locks for building doors. In other applications, however, the key-lock system can also be used for furniture doors, safe doors or vehicle doors. In particular, the key according to the invention can also be used for so-called furniture cylinders or padlocks.

[0054] An advantage is that the key according to the invention enables parallel operation with battery-powered keys in systems with locking cylinders. The locking cylinders do not require their own power supply as they are always supplied with energy by the key.

[0055] Further embodiments of the invention are shown in the figures and described below.

[0056] They show:

Fig. 1a-1c: key with a locking cylinder in different operating positions;

Fig. 2a: an embodiment of the key according to the invention with opened key head;

Fig. 2b: an embodiment of the key according to the invention as shown in Fig. 2a without key electronics;

Fig. 3a: an embodiment of the key according to the invention with connecting rod drive;

Fig. 3b: an embodiment of the key according to the invention with belt drive;

Fig. 3c: an embodiment of the key according to the invention with spindle drive;

Fig. 4a- 7b: an embodiment of the key according to the invention with a rack-and-pinion drive;

Fig. 8: an alternative embodiment of the key according to the invention with a modified movable component;

Fig. 9 an exploded view of an embodiment of the key according to the invention;

Fig. 10: a further exploded view as shown in Fig. 9;

Fig. 11a: a 3D view of the generator and the key electronics;

Fig. 11b: a side view of the generator and the key electronics;

Fig. 12: an enlarged view of the key shank with movable slide;

Fig. 13: a front view of the key according to the invention with opened key head and slide;

Fig. 14: a cross-section through the key shank in the area of the movably mounted slide;

Fig. 15: a schematic circuit diagram of the key according to the invention with a locking cylinder.

[0057] The figures show various embodiments of the invention. These should be understood as merely descriptive and not restrictive. In the figures, components with the same effect are marked with the same reference signs. Based on their technical skills, the person skilled in the art can vary or interchange different features of the illustrated embodiments without leaving the scope of the invention as defined by the claims.

[0058] Figures 1a, 1b and 1c show an embodiment of the invention. Here, the key 1 according to the invention is shown together with a locking cylinder 11 in different operating positions.

[0059] Figure 1a shows the key 1 and the locking cylinder 11 separately, i.e. before the key 1 is inserted into the locking cylinder 11. Figure 1b shows the key 1 partially inserted into the locking channel of the locking cylinder 11. Figure 1c shows the key 1 fully inserted into the locking channel of the locking cylinder 11. In this position shown in Figure 1c, it is possible to actuate the locking cylinder 11 using the key 1. When the locking cylinder 11 is actuated by the key 1, the key is turned in order to actuate the locking cylinder 11 in an opening direction or opposite in a closing direction. When actuated in the opening direction, if the locking cylinder 11 is inserted into a corresponding lock, for example a mortise lock of a building door, this is unlocked, i.e. the bolt elements of the bolt lock, for example a lock bolt and/or a lock latch, are retracted into the lock housing. When actuated in the closing direction, the lock is locked accordingly, i.e. the bolt elements, for example the lock bolt and/or a latch bolt, are extended from the lock housing into the locked position.

[0060] The key 1 has a key shank 3 and a key head 2 connected to the key shank 3. The key head 2 is designed as a housing with an installation space for accommodating components. A generator 9 is arranged inside the key head 3.

[0061] A movable component 4 is arranged on the key shank 3, which is drive-connected to a gear element 5 arranged in the key head 2. When the movable component 4 moves along the key shank 3, the generator 9 is driven via the gear element 5 to generate electrical energy. Here, a gear 6 or gear device 6 acting between gear element 5 and generator 9 is provided. The gear device 6 can be used to transmit a rotary movement so that the generator 9 is driven at a correspondingly adapted rotational speed.

[0062] In the embodiment shown in Figures 1a to 1c, the movable component 4 is designed as a slide 42 or slider 42 movably mounted on the key shank 3. Preferably, the terms slider 42 and slide 42 are used synonymously in this description and refer to the same component.

[0063] As shown in Figures 1a to 1c, the slide 42 or slider 42 comes into contact with the locking cylinder 11 when the key 1 is inserted into the locking cylinder and is displaced relative to the key shank when the key shank 3 is further inserted into the closing channel of the locking cylinder 11, thereby driving the generator 9 via the gear element 5 and the gear device 6. The generator 9 generates electrical energy to supply key electronics 7, shown for example in Figure 2a, with electrical energy.

[0064] The key electronics 7 shown in Figure 2a, for example, generate an electronically coded opening signal and transmit this via an electrical contact 32

arranged on the key shank to the locking cylinder 11 or to locking cylinder electronics 12 (shown in Fig. 15).

[0065] In the fully inserted position of the key shown in Fig. 1c, an electrical circuit between the locking cylinder electronics 12 and the key electronics 7 is closed via the electrical contact 32. Via this circuit, a coded opening signal and/or electrical energy can be exchanged between the key electronics 7 and the locking cylinder electronics 12. If a correct opening signal is present, the locking cylinder electronics 12 releases a blocking element of the locking cylinder 11 so that it can be turned by the key 1 or the key shank 3.

[0066] The locking cylinder 11 is designed as a so-called e-cylinder. This means the locking cylinder has a switchable blocking element 13 (Figure 15), which must be released to allow the locking cylinder 11 to rotate. For this purpose, a coded opening signal is generated by the key electronics 7 and transmitted to the locking cylinder electronics 12. This coded opening signal is checked and the blocking element 13 is only released after confirmation of a correct opening authorization. This electronic coding enables a high security standard to be achieved.

[0067] In addition to checking the coded opening signal sent by the key electronics 7, the key electronics 7 can check the locking cylinder electronics 12 to determine whether the locking cylinder 11 is a system associated with the key 1. Only after the locking cylinder 11 has been validated, so to speak, by the key electronics 7, a corresponding coded opening signal is generated by the locking cylinder electronics 7 and transmitted to the locking cylinder 11. In this way, safety can be significantly increased again.

[0068] Figure 2a shows the key 1 according to the invention with opened key head 2. The key electronics 7 are visible through the open housing of the key head 2. The generator 9 is arranged in a concealed position behind or under the key electronics 7.

[0069] The movable slide 42 or slider 42 mounted on the key shank 3 is arranged on the key shank 3 and connected to the gear element 5 arranged inside the key head 2. The gear element 5 is located between the key electronics 7 and the generator 9.

[0070] The movable slide 42 or slider 42 is moved from its front rest position or starting position arranged in the area of the key shank tip 35 along the key shank in the direction of the key head 2 when the key 1 is inserted into a locking cylinder. As a result, the generator 9 is driven by means of a gear device 6 arranged between the movable gear element 5 and the generator 9. The gear device 6 is used to transform the longitudinal movement of the slide 42 or the slider 42 into a rotational movement for driving the generator 9. At the same time, the gear device 6 adjusts the required rotational speed for the generator 9.

[0071] Furthermore, a return spring 62 is arranged in the key head 2. The return spring 62 can be designed as a component of the gear device 6 or as a separate return spring. In the embodiment shown, the return spring 62 is designed as a torsion spring 62 and serves to return the movable component 4 or the slide 42 or slider 42 to its rest position, i.e. to the position shown in Fig. 2a near the tip 35 of the key shank 3, when the key 1 is removed from a locking cylinder 11.

[0072] A detent pin 31 is arranged in the area of the key tip 35. The detent pin 31 is spring-loaded laterally to the key shank 3 and serves to hold it in the

locking cylinder in the position shown in Fig. 1c, i.e. in the fully inserted position, in particular to hold it against the force of the return spring 62.

[0073] An energy storage 81 is provided to efficiently use the electrical energy generated by the generator 9. The energy storage 81 is arranged on a circuit board together with the key electronics 7. The energy store 81 has several capacitors. As shown in Figure 2a, the energy store 81 comprises four capacitors 811, 812, 813 and 814. The capacitors 811, 812, 813 and 814 are designed as SMD electrolytic capacitors.

[0074] The energy generated by the generator 9 is stored in the energy storage 81 in order to supply the key electronics 7 and/or the locking cylinder electronics 12. This allows the energy generated by the generator 9 to be used efficiently. In particular, the duration of the power supply to the key electronics 7 and/or the locking cylinder electronics 12 can be extended, as the electrical energy is still available via the energy storage 81 when the generator 9 is no longer being driven.

[0075] Two spring pins 71 and 72 are provided to ensure electrical contact between the generator 9 and the key electronics 7 or energy storage 81. The spring pins 71 and 72 make contact with two conductive contact surfaces 731 and 732, which are shown in Fig. 2b. When the key electronics 7 or the circuit board 84 of the key electronics 7 is connected to the generator 9, a circuit is automatically closed between the generator 9 and the key electronics 7 via the spring pins 71 and 72. This means that no additional working step is required for the electrically conductive connection of generator 9 and key electronics 7.

[0076] Fig. 2b shows the key 1 as shown in Fig. 2a, wherein the key electronics 7 have been removed here for the sake of clarity. As can be seen in Fig. 2b, the

key head 2 has a cover 23 in the area of the transition to the key shank 3. The cover is used to cover the opening of the key head 2 located in the area of the key shank 3.

[0077] Fig. 2b also shows two connection pins 741 and 742. These two connection pins are used to electrically connect the key electronics 7 to the key shank 3. The first connection pin 741 connects the ground wire of the key electronics 7 to the key shank 3. The second connection pin 742 connects the key electronics to the electrical contact 32.

[0078] Fig. 3a shows an embodiment of the key 1 according to the invention. This key 1 mainly corresponds to the embodiments described so far. The key 1 in turn comprises a key shank 3, which is connected to the key head 2. A generator 9 is arranged in the key head 2. The generator is driven by the movable component 4 or the movable slide or slider 42 arranged on the key shank 3 by means of a gear device 6. In the embodiment shown in Fig. 3a, a connecting rod drive 53 is driven by the gear element 5. The connecting rod drive 53 has a connecting rod 531, which transforms the linear movement of the gear element 5 into a rotational movement on the pinion 61 for driving the generator 9.

[0079] Fig. 3b shows a further embodiment of the key 1 according to the invention. This key 1 also has a key shank 3 and a key head 2 connected to the key shank, in accordance with the embodiments described above. Also, a generator 9 is arranged inside the key head 2. A belt drive 42 for driving the generator 9 is driven via the movable component 4 or the movable slide 42 or slider 42 by means of the movable gear element 5. The belt drive 52 has a first deflection roller 523 and a second deflection roller 524. A drive belt 521 is guided around the two deflection rollers and drives a pinion 61, via which a gear

device 6 and the generator 9 are driven. The circumferential drive belt 521 is connected to the gear element 5 by means of a belt guide 522. When the slide 42 or slider 42, which is movably mounted on the key shank 3, is moved, the belt 521 is displaced and thus drives the pinion 61 to rotate. This rotational movement is transmitted by the gear device 6 in order to drive the generator 9 to produce electrical energy.

[0080] Fig. 3c shows a further embodiment of the key 1 according to the invention. In contrast to the previously described embodiments, the movable gear element 5 drives a spindle drive 51 here. The spindle drive 51 comprises a spindle nut 511 guided on a spindle 512. The spindle nut 511 is connected to the movable gear element 5 and is driven along the spindle 512 by the movable gear element 5 or by the slide 42 or slider 42. This causes the spindle 512 to rotate around its longitudinal axis. These rotations are translated to the rotational plane of the gear device 6 or the generator 9 by means of an angular gear 513 and transmitted to the generator 9.

[0081] Figures 4a to Fig. 7b show a further embodiment of the key 1 according to the invention. In this embodiment, a rack and pinion drive 54 is driven by the movable component, which is designed here as a toothed rack 55. The toothed rack 55 meshes with a pinion 61 of the gear device 6 in order to convert the linear movement of the slide 42 or slider 42 into a rotational movement for the generator 9.

[0082] Fig. 4a shows an freewheel clutch 63, which is arranged between the gear device 6 and the generator 9. The freewheel clutch 63 is used to uncouple the slide 42 or slider 42 or the movable component 4 from the generator 9 at the end of the drive movement. The freewheel clutch 63 works on the principle of a bicycle freewheel. This enables the slide 42 or slider 42 to be uncoupled from

the generator 9 as soon as the slide 42 or slider 42 comes to a stop at the end of the drive movement or is returned to its starting position near the tip of the key shank 35 by the return spring.

[0083] The freewheel clutch 53 is provided in all embodiments of the key 1 according to the invention. For the sake of clarity, however, the freewheel clutch 63 is not shown or labeled in the preceding embodiments.

[0084] Fig. 4b is a detailed view in the area of the rack and pinion drive 54. It can be seen here how the toothed rack 55 meshes with the pinion 61.

[0085] Figs. 5a and 5b show the key 1 according to the invention in the starting position from the side. The movable slide 42 or slider 42 is arranged in its front position in the area of the key tip 35. The slide 42 or slider 42 is directly connected to the gear element 5 or the toothed rack 55. As can be seen from the enlarged detailed view in Figure 5b, the toothed rack 55 meshes with the pinion 61 of the gear device 6 and transmits the rotary movement to the generator 9 by means of a further pinion 61a to generate electrical energy.

[0086] Figures 6a and 6b show the corresponding key 1 in the fully inserted position in a locking cylinder, but without a locking cylinder. It can be seen here that the slide 42 or slider 42 or the toothed rack 55 are arranged in the rear stop position close to the key head 2. In this position, the displacement of the toothed rack 55 transmitted a rotary movement to the generator 9, causing it to rotate and generate electrical energy. Figs. 7a and 7b show the corresponding position according to Figs. 6a and 6b in side view.

[0087] Fig. 8 shows a further embodiment of the key 1 according to the invention. This embodiment mainly corresponds to the embodiment of Figures

1a to 2b. In contrast to this key, however, the movable component 4 on the key shank 3 is designed here as a plunger 41 projecting from the key head parallel to the key shank. The plunger 41 is mounted on the cover 23 of the key head 2 so that it can move linearly. Analogous to the slide 42 or slider 42, the plunger 41 comes into contact with a locking cylinder 11 when the plunger shaft 3 is inserted into the latter and is displaced along the key shank 3 in the direction of the key head 2 in order to drive the movable gear element 5 or the generator 9 to generate electrical energy.

[0088] Fig. 9 shows an exploded view of the key 1 according to the invention. This key 1 mainly corresponds to the embodiments shown in Figures 1a to 2b. The exploded view shows that the key head 2 has two housing halves 21, 22. A first housing half 21 and a second housing half 22.

[0089] The key electronics 7 is arranged in the first housing half 21. The key electronics 7 has a circuit board 84, which is fixed in the first housing half. The generator 9 is located in the second housing half 22.

[0090] The key shank 3 engages between the two housing halves 21 and 22 and is connected to the key head 2 or to the two housing halves 21 and 22 by means of screws.

[0091] In an alternative embodiment, instead of screwing the key shank 3 to one of the two head halves 21, 22, the key shank can be connected by overmolding the metal shank 3 with the plastic material of the head halves 21, 22.

[0092] The cover 23 is used to cover the opening on the key head 2 in the area of the key shank 3. The cover 23 is pushed onto the key shank 3 from the front

and automatically holds onto the key head 2 after the two housing halves 21 and 22 have been attached to each other.

[0093] The slide 42 or slider 42 is shown in the removed position on the key shank 3. In the area of the key head 2, the key shank 3 has an insertion area 34. In this area, the material thickness of the key shank 3 is tapered so that the slide 42 or slider 42 can be placed on the key shank 3 or removed from the key shank 3 in this area.

[0094] Fig. 10 shows a further exploded view of the key 1 according to the invention, this time seen from the rear. It can be clearly seen here that both the key electronics 7 and the generator 9 are each designed as an assembly unit.

[0095] The key electronics 7 has a circuit board 84 as a supporting element. Both the components of the key electronics 7 and the components of the energy storage 81 are arranged on the circuit board 84. The key electronics 7 is assigned to the housing half 21 as an assembly unit. Opposite, the generator 9 is designed as an assembly unit. The generator 9 comprises the gear device 6 as well as the return spring 62 and the freewheel clutch 63. For the sake of clarity, these components of the generator are not shown or labeled individually in Fig. 10. The generator 9 is also designed as an assembly unit and is assigned to the second housing half 22 of the key head 2.

[0096] When manufacturing the key 1 according to the invention, the key electronics 7 is placed as an assembly unit in the first housing half 21. In particular, the housing half 21 has fitting marks which are complementary to fitting marks arranged on the key electronics 7 or the circuit board 84, so that the key electronics 7 or circuit board 84 can only be inserted into the housing half 21 in a predetermined position. The key electronics 7 is then connected to

the key shank 3. The key electronics 7 is conductively connected to the key shank 3 and the electrical contact 32. This is done via the first connection pin 741 and the second connection pin 742. These pins can, for example, be designed as a wire connection and connected to the circuit board 84 of the key electronics 7 by means of an electrically conductive adhesive or ultrasonic welding.

[0097] Furthermore, the generator 9 is assigned to the second housing half 22 of the key head as an assembly unit. Again, complementary fitting marks may be provided on the generator and the second housing half 22 to define the alignment of the generator 9 to the second housing half 22. When the two housing halves 21 and 22 are connected, the generator 9 automatically makes contact with the key electronics 7 via the two spring-loaded pins 71 and 72, which are shown in Fig. 11a.

[0098] Fig. 11b shows the space-saving, staggered design of the two connected assembly units of the generator 9 and the key electronics 7. The key electronics 7 is arranged together with the energy storage 81 on the circuit board 84. The energy store 81 has four capacitors 811, 812, 813 and 814. The capacitors 811, 812, 813 and 814 are relatively bulky components. Furthermore, the generator 9 comprises the gear device 6 and the return spring 62 projecting from the generator 9. To save installation space, the capacitors of the energy storage 81 are arranged on the circuit board 84 in such a way that they engage in the free spaces left by the generator 9, thus minimizing the overall height and thus the thickness of the key head 2. This makes optimum use of the space between the key electronics 7 and the generator 9.

[0099] Fig. 12 shows an enlarged view of the key shank 3 with the slide 42 or slider 42 mounted movably on it.

[0100] The slider 42 has a slider shoe 421 and a slider arm 43 projecting from the slider shoe 421. The slider shoe 421 is integrally formed with the slider arm 43.

[0101] A clutch 45 is provided at the end of the slider arm 43. This clutch is used to connect the slider or slider arm 43 to the movable gear element 5. For this purpose, the clutch 45 has a pin 46 arranged on the gear arm 5, which interacts with a receiving device 47 arranged at the end of the slider arm 43. The clutch is designed as a detent clutch and enables the connection between the slider 42 and the movable gear element 5 even when the key head 2 is closed. To do this, first the slider 42 is placed on the key shank 3. This is done by inserting the slider arm 43 through the cover 23 and placing the slider shoe 421 on the key shank 3 in the insertion area 34. The slider shoe 421 can then be moved on the key shank 3 in the direction of the key tip, i.e. forwards. The slider shoe 421 is mounted on or threaded into a slider guide 33. At the front end, the slider guide 33 has a stop 335 which prevents the slider 42 or the slider shoe 421 from being pushed forwards beyond the key shank 3 by the return spring.

[0102] To connect the slider 42 to the gear element 5, the slider 42 is inserted from the front position on the key shank 3 backwards into the housing of the key head 2. The movable gear element 5 is automatically positioned in the correct position relative to the slider arm 43 in the housing of the key head 2. When the slider 42 is moved back into the housing of the key head 2, the receiving device 47 comes into contact with the pin 46 of the clutch 45. The receiving device 47 has two elastic flaps such that when the slider 42 is pressed further in the direction of the movable gear element 5, the clutch 45 snaps into place by the two flaps or the receiving device 47 positively engaging around the pin 46 and

holding it in place. As a result, the slider 42 is connected to the movable gear element 5 by the clutch 45, without the housing of the key head 2 having to be open. This enables an advantageous and quick assembly of the key.

[0103] In an alternative embodiment, the pin 46 can be guided laterally into the clearance of the receiving device during assembly of the generator and can be positively received there. This movement direction is no longer available after assembly, so that the pin 46 remains positively engaged in the clearance 47.

[0104] Fig. 13 shows an embodiment of the key according to the invention with the first housing half 21 removed. Fig. 13 shows the key shank 3 from the front. It can be seen that the slider 42 with its slider shoe 421 or slider arm 43 is tapered. This means that the flanks of the slider shoe 421 or the slider arm 43 taper towards the edge of the key shank 3 or incline towards each other. On the one hand, this reduces the risk of a finger being caught in the area between the movable component 4 or the slider 42 and the key head 2 or the cover 23. On the other hand, an aesthetic appearance is achieved.

[0105] Fig. 14 shows a section through the key shank 3 in the area of the slider shoe 421. The slider shoe 421 is guided by the slider guide 33. It has two opposite grooves 333 and 334. The slider shoe 421 surrounds the slider guide 33 on both sides from the edge of the key shank 3 and is positively guided in the undercut grooves 333 and 334. In the grooves 333, 334, the slider shoe 421 is guided both upwards and downwards in the vertical axis and laterally. For this purpose, the slider shoe 421 grips the slider guide 33 on both sides and engages positively with its ends in the undercut grooves 333, 334. Furthermore, the slider guide 33 has surfaces with a first flank 331 and a second flank 332 on its opposite sides. These flanks taper towards the edge of the key shank 3, i.e.

they are pointed. The slider shoe 421 is complementary to the tapered flanks 331 and 332.

[0106] Fig. 15 shows a schematic circuit diagram of the key 1 according to the invention. The components of key 1 are shown in the rectangle with a dashed outline labeled 1. These components comprise the generator 9, the key electronics 7 and an energy storage 81 connected between the generator 9 and the key electronics 7. The components of the locking cylinder are shown in the dashed rectangle labeled 11. These components comprise locking cylinder electronics 12 and an electrically switchable blocking element 13 for releasing or blocking actuation of the locking cylinder 11.

[0107] The energy storage 81 comprises a storage element, which is designated here as a capacitor 811. This storage element can be designed as a single capacitor 811 or as several capacitors connected in parallel. The electrical energy generated by the generator 9 is stored in the capacitor 811.

[0108] The key electronics 7 is connected via the electrical contact 32 to the locking cylinder 11 or to the locking cylinder electronics 12 arranged in the locking cylinder 11 and the blocking element 13. The locking cylinder electronics and the switchable blocking element 13 can also be supplied with electrical energy from the energy storage 81 or from the generator 9 via the electrical contact 32. This means that the locking cylinder 11 does not need its own power supply.

[0109] Furthermore, it is provided that the electrical contact 32 is designed to transmit electrical energy and electrical information. Advantageously, the electrical contact 32 is designed as a digital interface, in particular as a bidirectional serial interface.

[0110] This enables the key 1 to be plugged into a programming adapter, a desktop station or a wall station, for example, and programmed or parameterized by this via the electrical contact 32.

[0111] This makes it possible to ensure a high level of security with the key 1 according to the invention without requiring batteries or having to replace them, or without the need for complex wiring on a door on which a corresponding locking cylinder 11 is used. On the one hand, this reduces the power consumption of the system, as there is no need for a power supply unit, and on the other hand, no batteries are required, so that no hazardous waste in the form of batteries is produced when operating a corresponding key-locking cylinder system.

List of reference signs

[0112]

1	Key
11	Locking cylinder
12	Locking cylinder electronics
13	Blocking element
2	Key head
21	First housing half
22	Second housing half
23	Cover
3	Key shank
31	Detent pin
32	Electrical contact
33	Slider guide
331	First flank
332	Second flank
333	First groove
334	Second groove
335	Stop
34	Insertion area
35	Key tip
4	Movable component
41	Plunger
42	Slider

421 Slider shoe
431 First surface
432 Second surface
43 Slider arm
45 Clutch
46 Pin
47 Receiving device

5 Gear element
51 Spindle drive
511 Spindle nut
512 Spindle
513 Bevel gear

52 Belt drive
521 Drive belt
522 Belt guide
523 First deflection roller
524 Second deflection roller

53 Connecting rod drive
531 Connecting rod
54 Rack and pinion drive
55 Toothed rack

6 Gear device
61 First pinion
61a Second pinion
62 Return spring

63 Freewheel clutch

7 Key electronics
71 First spring pin
72 Second spring pin
731 First contact surface
732 Second contact surface
741 First connection
742 Second connection

81 Energy storage
811 First capacitor
812 Second capacitor
813 Third capacitor
814 Fourth capacitor
84 Circuit board

9 Generator

Patentkrav

1. Nøgle med et nøglehoved (2) og et nøgleskaft (3) til aktivering af en låsecylinder (11), især til et mekatronisk låsesystem, der omfatter nøgleelektronik (7), der overfører et kodet åbningssignal til en låsecylinder (11), og en generator (9), der er anbragt i nøglehovedet (2) til forsyning af nøgleelektronikken (7) og/eller låsecylinderelektronikken (12) med elektrisk energi, idet generatoren (9) drives af en bevægelig komponent (4),
kendetegnet ved, at
den bevægelige komponent (4) kommer i kontakt med låsecylinderen (11), når nøgleskaftet (3) indsættes i en låsecylinder (11), og driver generatoren (9), når nøgleskaftet (3) indsættes yderligere i låsecylinderen (11).

2. Nøgle ifølge krav 1,
kendetegnet ved, at
den bevægelige komponent (4) kommer i kontakt med låsecylinderen (11), når nøgleskaftet (3) indsættes i en låsecylinder (11) og driver generatoren (9) ved rotation, når nøgleskaftet (3) indsættes yderligere i låsecylinderen (11), fortrinsvis **ved, at** den bevægelige komponent (4) går i indgreb med et tandhjulselement (5) for at konvertere en lineær bevægelse af den bevægelige komponent (4) til en rotationsbevægelse for at drive generatoren (9) ved rotation.

3. Nøgle ifølge krav 1 eller 2,
kendetegnet ved, at
den bevægelige komponent (4) er konstrueret som en komponent, der er monteret på nøglehovedet (2) og/eller på nøgleskaftet (3), så den kan bevæges lineært, især som en skyder (42) eller som et stempel (41) eller som en slæde (42) eller som en magnet og/eller med en magnet.

4. Nøgle ifølge krav 3,
kendetegnet ved, at
magneten eller skyderen (42) eller stemplet (41) rager ud fra nøglehovedet (2) parallelt med nøgleskaftet (3), eller

slæden (42) eller skyderen (42) er monteret på nøglehovedet (2) og/eller på nøgleskaftet (3), således at den kan forskydes lineært og parallelt med nøgleskaftet (3).

5. Nøgle ifølge ét af kravene 3 til 4,
kendetegnet ved, at
skyderen (42) eller stemplet (41) eller slæden (42) er forbundet med tandhjulselementet (5) for at overføre trækkræfter og/eller kompressionskræfter mellem tandhjulselementet (5) og skyderen (42) eller stemplet (41) eller slæden (42).

6. Nøgle ifølge ét af kravene 3 til 5,
kendetegnet ved, at
tandhjulselementet (5) er konstrueret som en spindeldrev (51) eller som et forbindelsesstangsdrev (53) eller som en drivrem (52).

7. Nøgle ifølge ét af kravene 3 til 6,
kendetegnet ved, at
tandhjulselementet (5) er en del af en tandhjulsanordning (6), især en tandhjulsanordning (6), der omfatter tandhjulselementet (5) og et kraftoverførselselement (61), for at overføre en rotationsbevægelse af tandhjulselementet (5) til generatoren (9) ved en ændret rotationshastighed, hvor det fortrinsvis er tilvejebragt,
at tandhjulselementet (5) er anbragt inden i nøglehovedet (2), fortrinsvis at tandhjulsanordningen (6) er anbragt inden i nøglehovedet (2).

8. Nøgle ifølge et hvilket som helst af foregående krav,
kendetegnet ved, at
nøgleelektronikken (7) er anbragt inden i nøglehovedet (2), og/eller tandhjulselementet (5) har en tandstang (55), der samvirker med den bevægelige komponent (4).

9. Nøgle ifølge et hvilket som helst af foregående krav,
kendetegnet ved, at
der er tilvejebragt et friløbsgreb (63), således at den bevægelige komponent (4) kun er i indgreb med generatoren (9), når nøglen indsættes i en låsekanal på en låsecylinder (11), mens friløbsgrebet (63) frakobler den bevægelige komponent (4), når den trækkes ud, således at generatoren (9) kun kan drives i én rotationsretning, hvor det fortrinsvis er tilvejebragt,
at tandhjulsanordningen (6) har friløbsgrebet (63), og/eller
at den bevægelige komponent (4) er fjederbelastet med henblik på nulstilling, især fjederbelastet i retning mod spidsen af nøglen.

10. Nøgle ifølge ét af kravene 3 til 9,
kendetegnet ved, at
generatoren (9) og tandhjulselementet (5) og tandhjulsanordningen (6) er konstrueret sammen som en strukturel enhed, der kan indsættes i nøglehovedet (3), især **ved, at** tandhjulsanordningen (6), generatoren (9) og tandstangen (55) er konstrueret sammen som en strukturel enhed, der kan indsættes i nøglehovedet (2).

11. Nøgle ifølge et hvilket som helst af de foregående krav,
kendetegnet ved, at
nøgleelektronikken (7) har en kondensator som en energilagringsanordning til den elektriske energi, der genereres af generatoren (9), og især muliggør mellemenergilagring, fortrinsvis

at nøgleelektronikken (7) ikke kræver eller har nogen anden strømkilde end generatoren (9).

12. Nøgle ifølge et hvilket som helst af de foregående krav,
kendetegnet ved, at
der er anbragt en elektrisk kontakt (32) på nøgleskaftet (3) for at forbinde nøgleelektronikken (7) med en låsecylinderelektronik (12), og at generatoren (9) er konstrueret til at forsyne en låsecylinderelektronik (12) med elektrisk energi via denne kontakt (32), fortrinsvis at den elektriske kontakt (32) er konstrueret til at etablere en kablet dataforbindelse mellem nøgleelektronikken (7) og en låsecylinderelektronik (12).

13. System, der omfatter en nøgle (1) ifølge ét af de foregående krav og en mekatronisk låsecylinder (11), der omfatter låsecylinderelektronik (12), hvor det fortrinsvis er tilvejebragt,
at låsecylinderelektronikken (12) forsynes med elektrisk energi fra generatoren (9) for at kontrollere et åbningssignal, der udveksles mellem nøgleelektronikken (7) og låsecylinderelektronikken (12), og hvis en åbningstilladelse er til stede, at udløse et blokeringselement (13) for at muliggøre mekanisk aktivering af låsecylinderen (11).

14. Fremgangsmåde til aktivering af en mekatronisk låsecylinder (11) ved hjælp af en nøgle (1), idet låsecylinderen (11) roteres af nøglen (1) i åbningsretningen eller i lukningsretningen under aktivering, og
hvor nøglen (1) omfatter et nøgleskaft (3) til indsætning i en nøglekanal på låsecylinderen (11), et nøglehoved (2) og nøgleelektronik (7), og

hvor låsecylinderen (11) omfatter et blokeringselement (13), der kan omskiftes elektrisk, til udløsning eller blokering af rotation af låsecylinderen samt låsecylinderelektronik (12) til omskiftning af blokeringselementet (13),
kendetegnet ved, at
nøglen (1) har en generator (9), der drives ved rotation, når nøgleskaftet (3) indsættes i nøglekanalen, for at generere elektrisk energi til forsyning af nøgleelektronikken (7) og/eller låsecylinderelektronikken (12).

15. Fremgangsmåde ifølge krav 14,
kendetegnet ved, at
generatoren (9) forsyner nøgleelektronikken (7) samt låsecylinderelektronikken (12) og blokeringselementet (13) med elektrisk energi, og/eller
at når nøgleskaftet (3) indsættes i nøglekanalen, kommer en bevægelig komponent (4), der er anbragt på nøglen (1), i kontakt med låsecylinderen (11) og forskydes i forhold til nøgleskaftet (3), når nøgleskaftet (3) indsættes yderligere, for at drive generatoren (9) ved rotation.

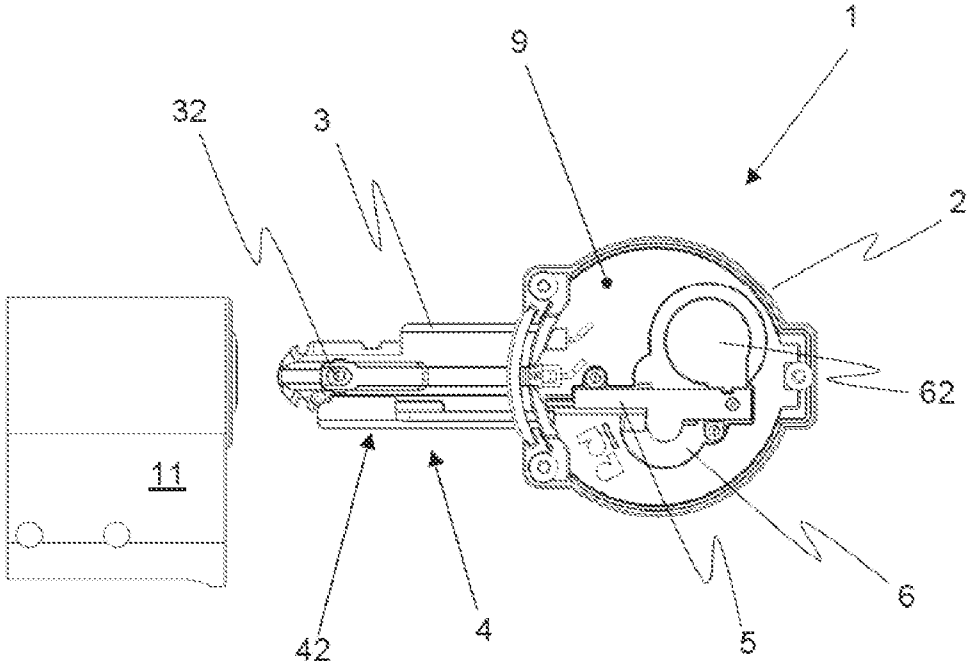


Figure 1a

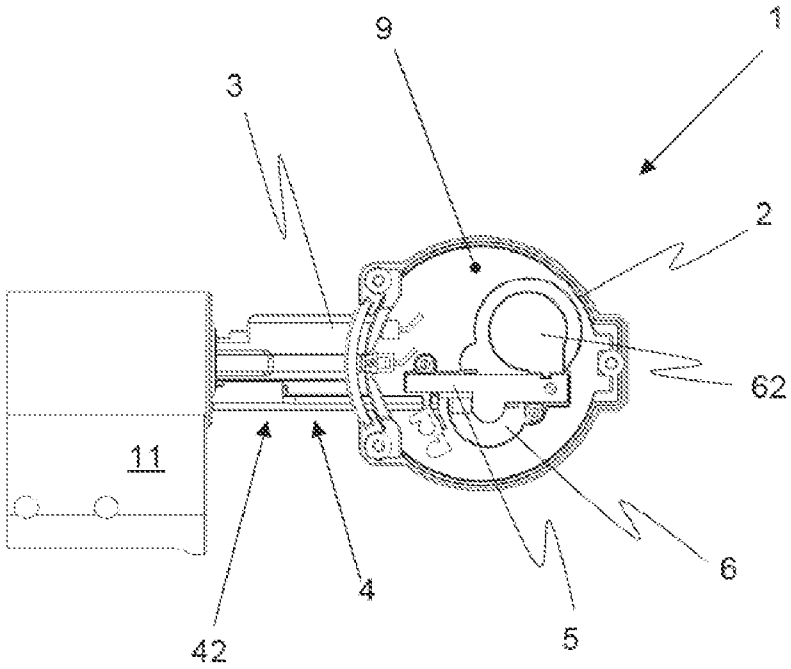


Figure 1b

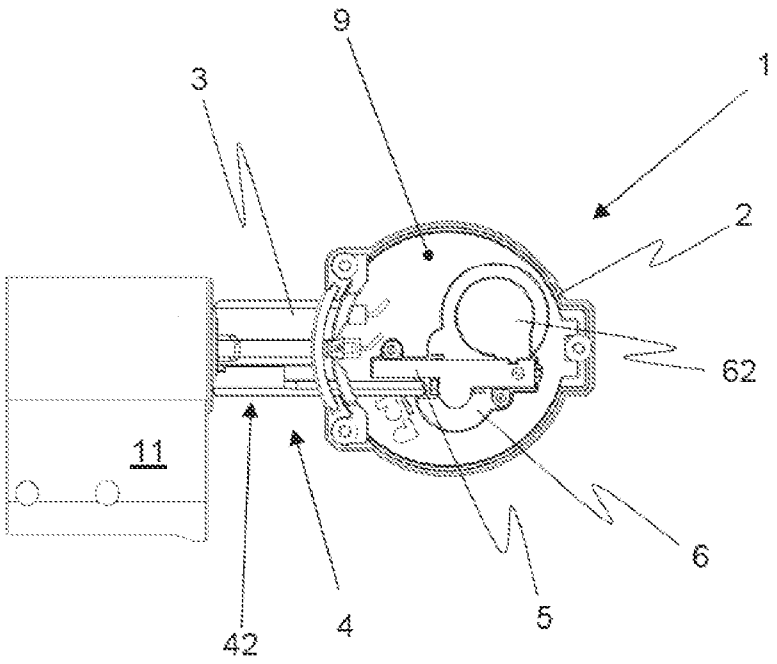


Figure 1c

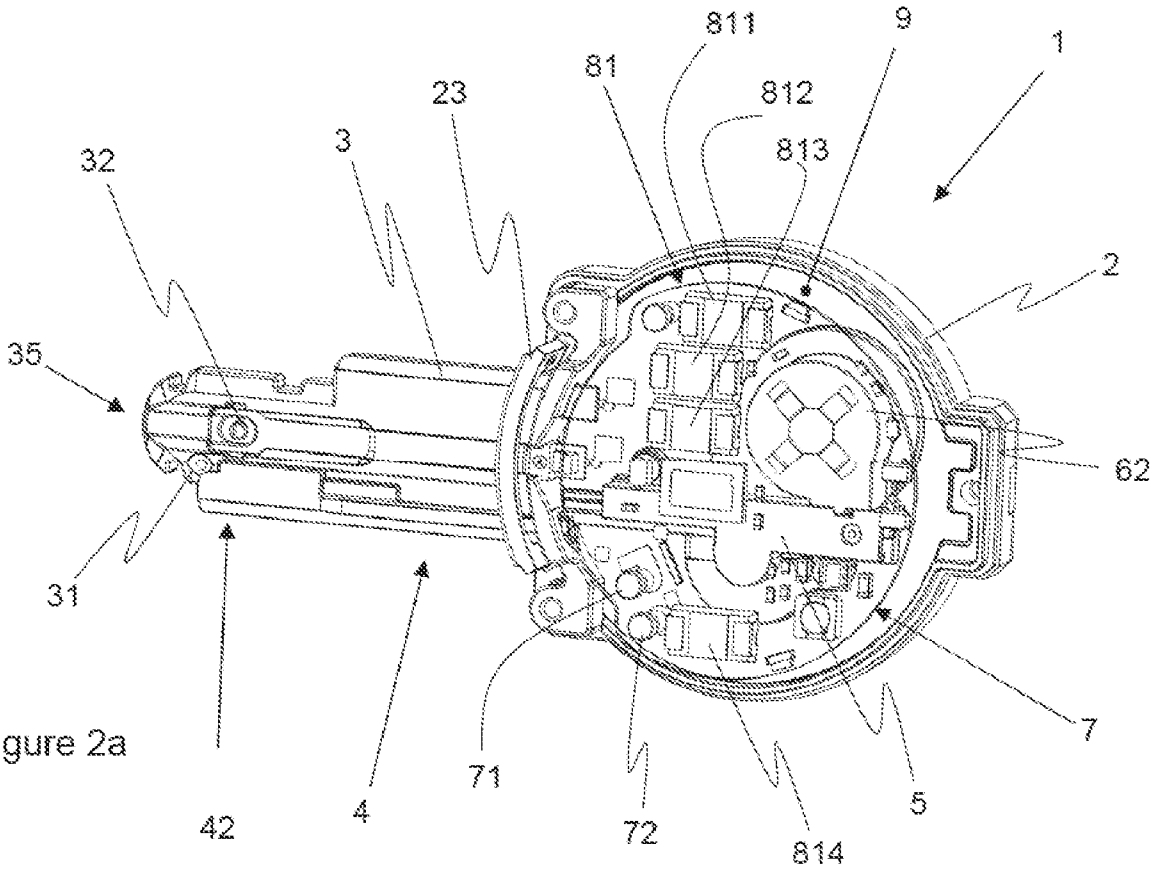


Figure 2a

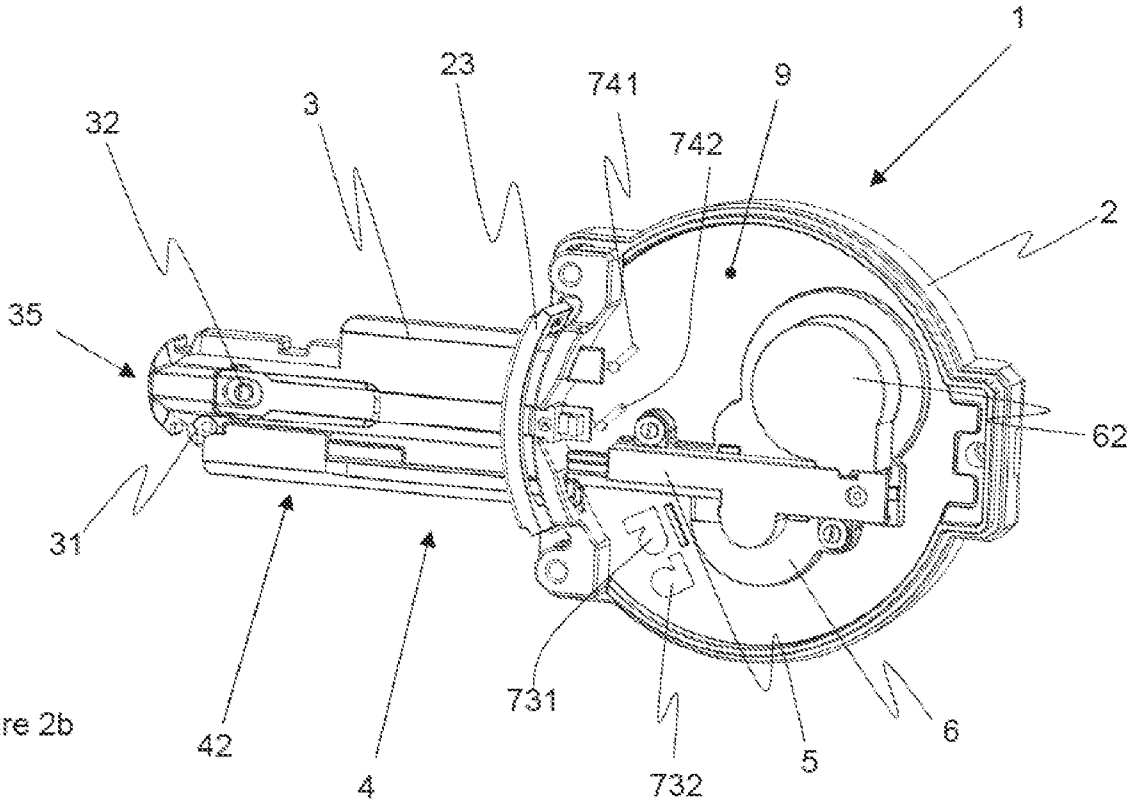


Figure 2b

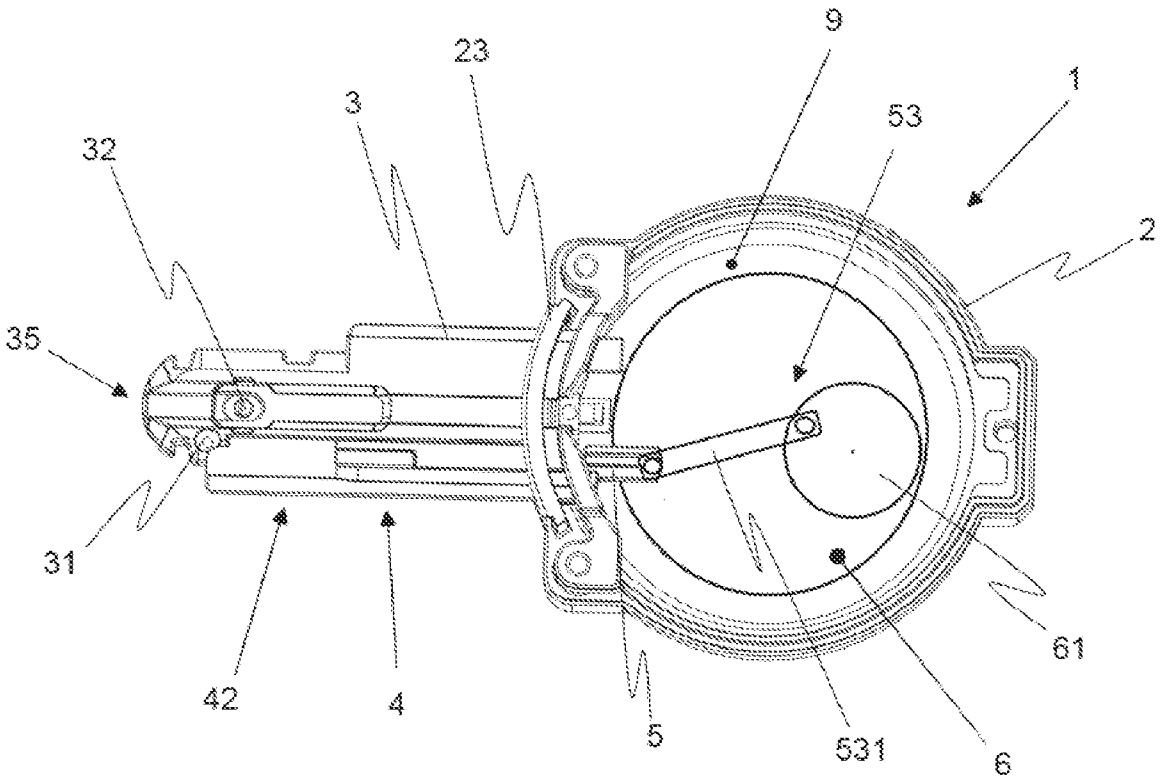


Figure 3a

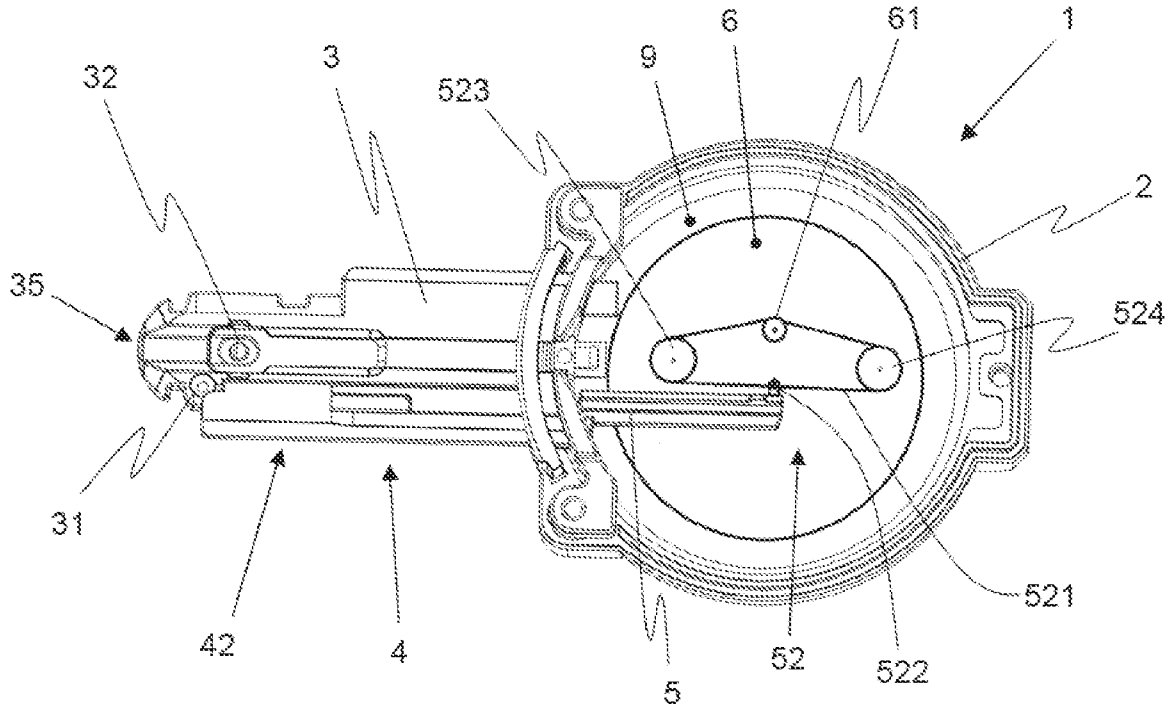


Figure 3b

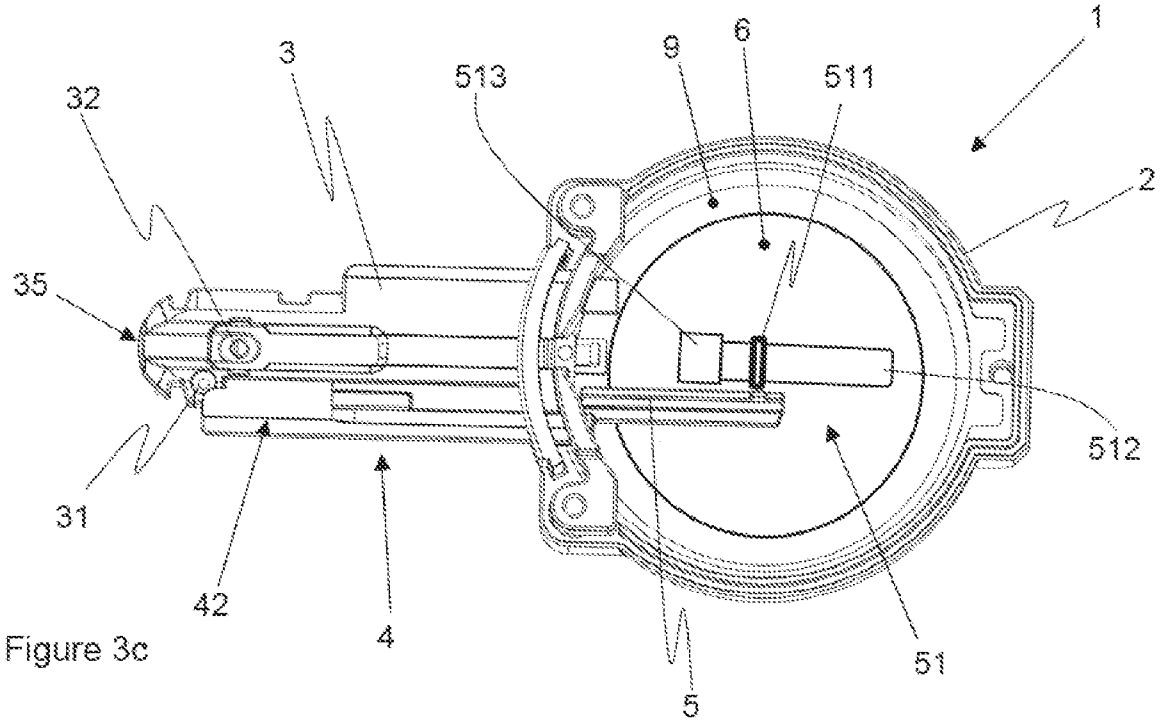


Figure 3c

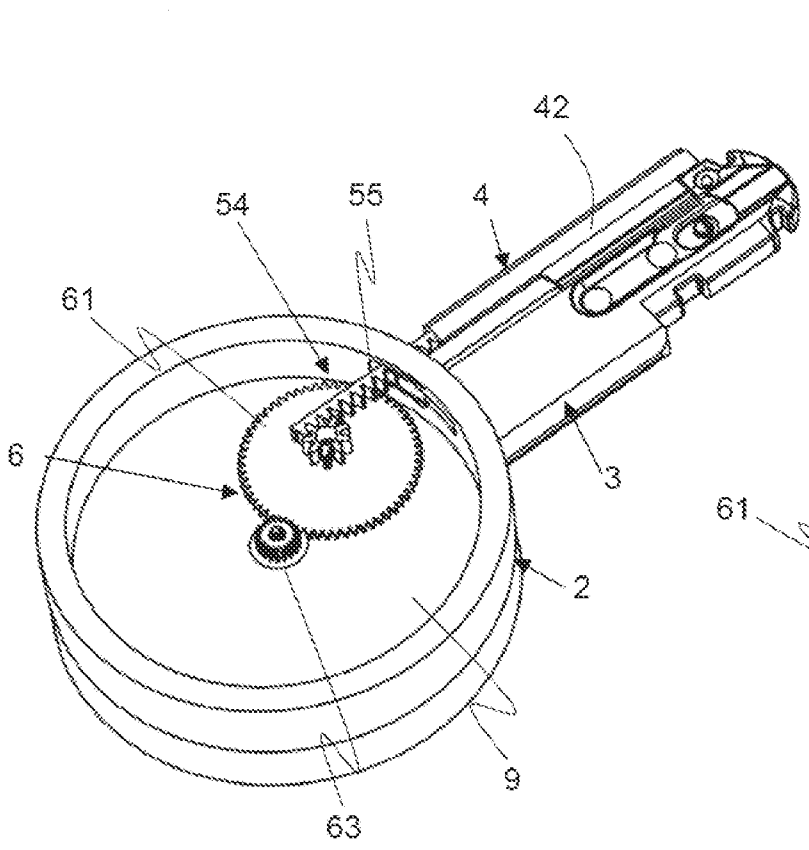


Figure 4a

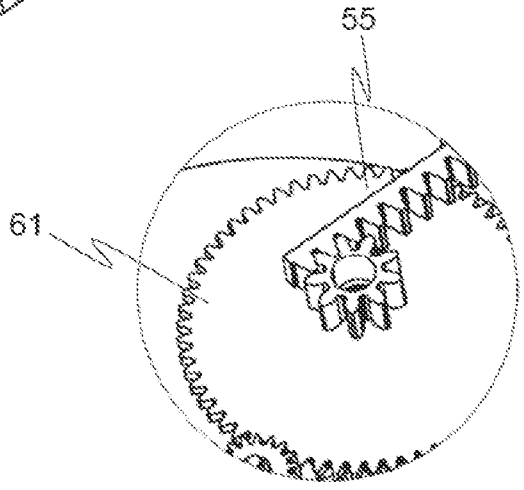


Figure 4b

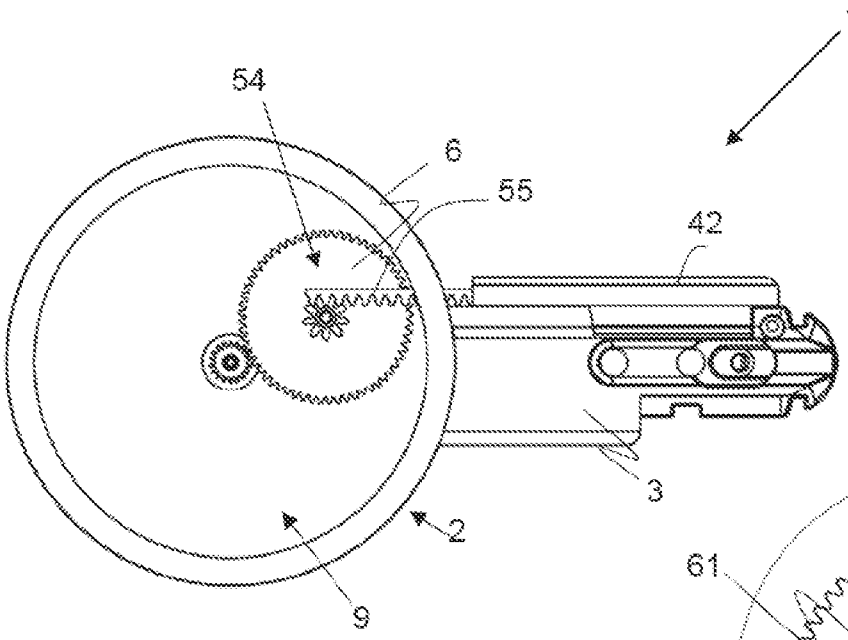


Figure 5a

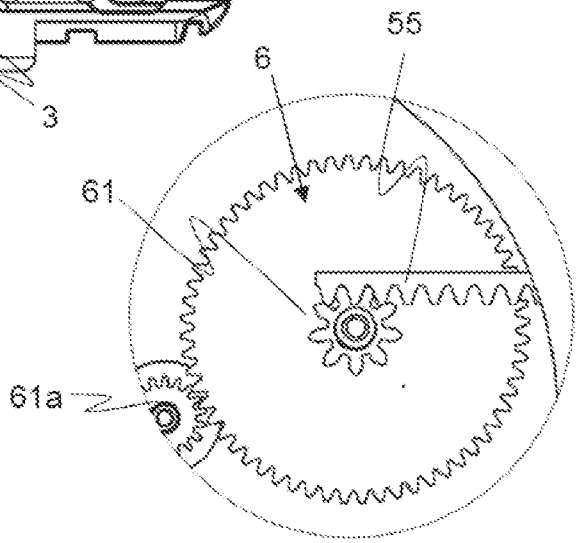
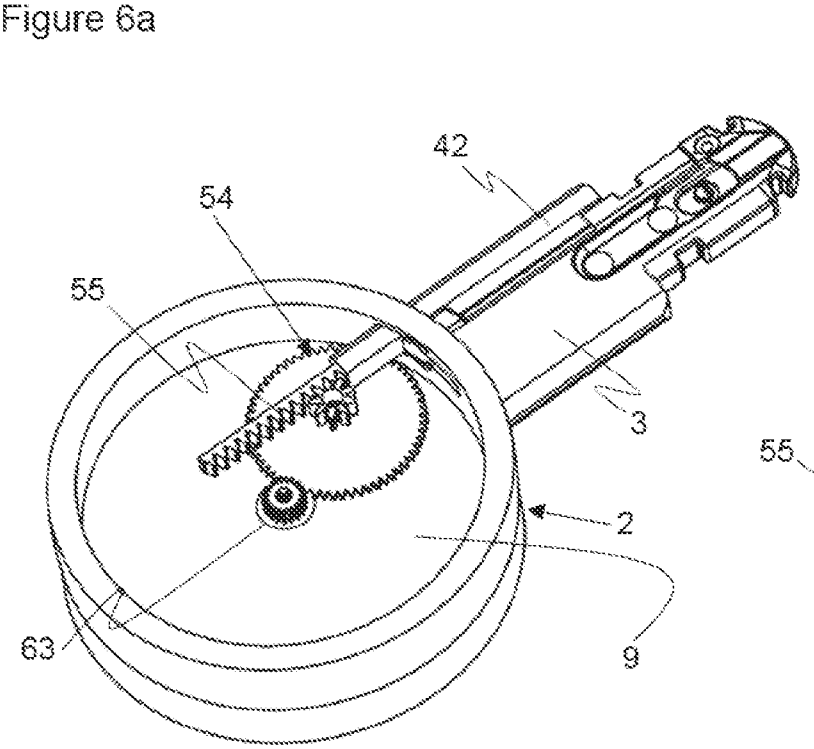


Figure 5b

Figure 6a



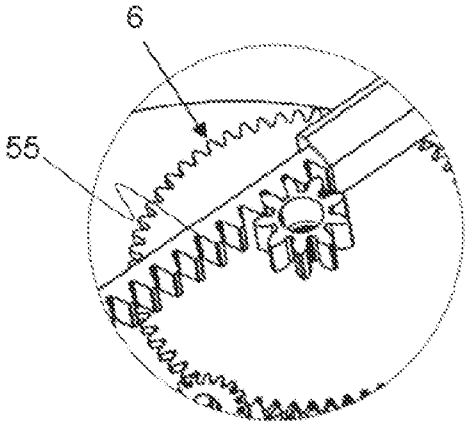
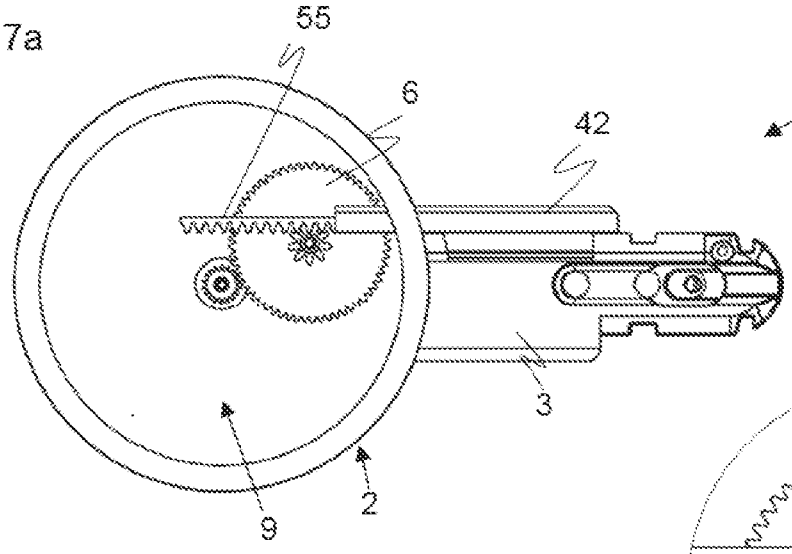


Figure 6b

Figure 7a



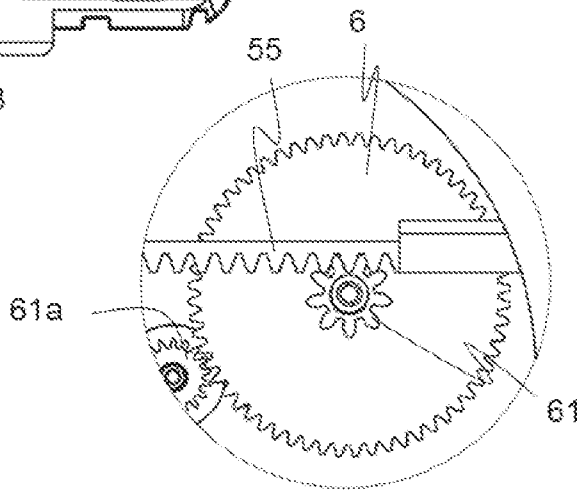


Figure 7b

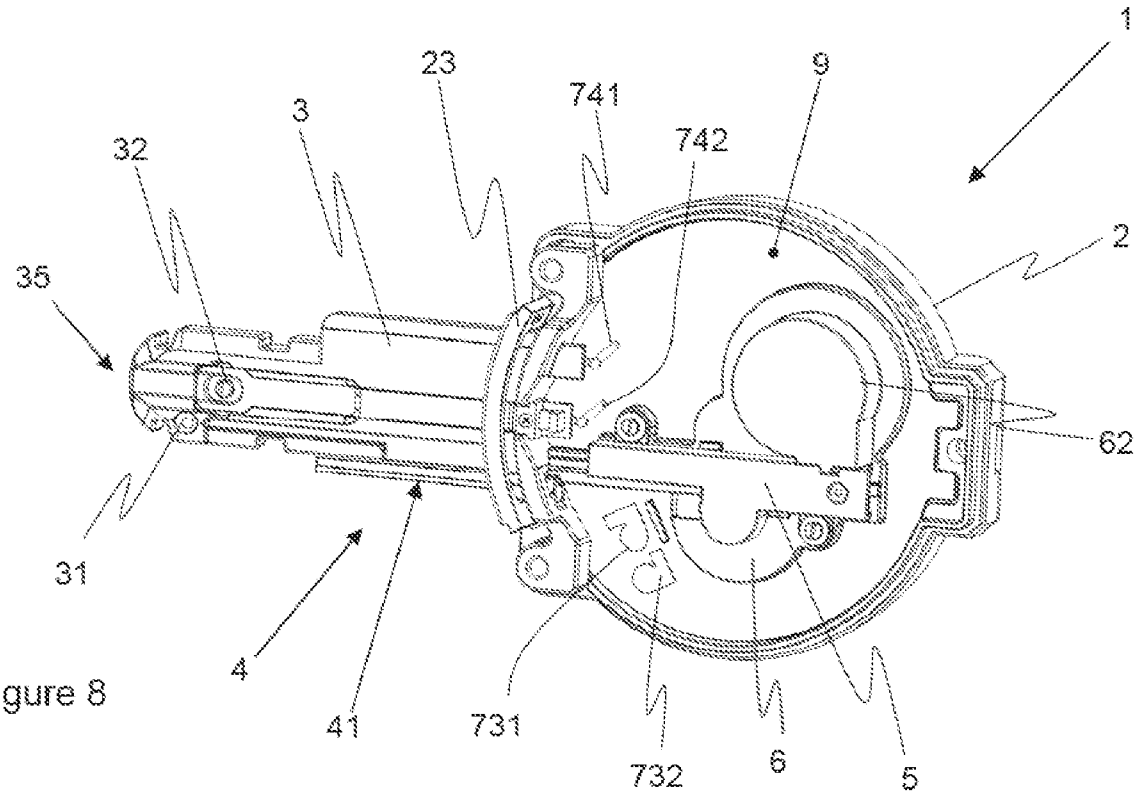


Figure 8

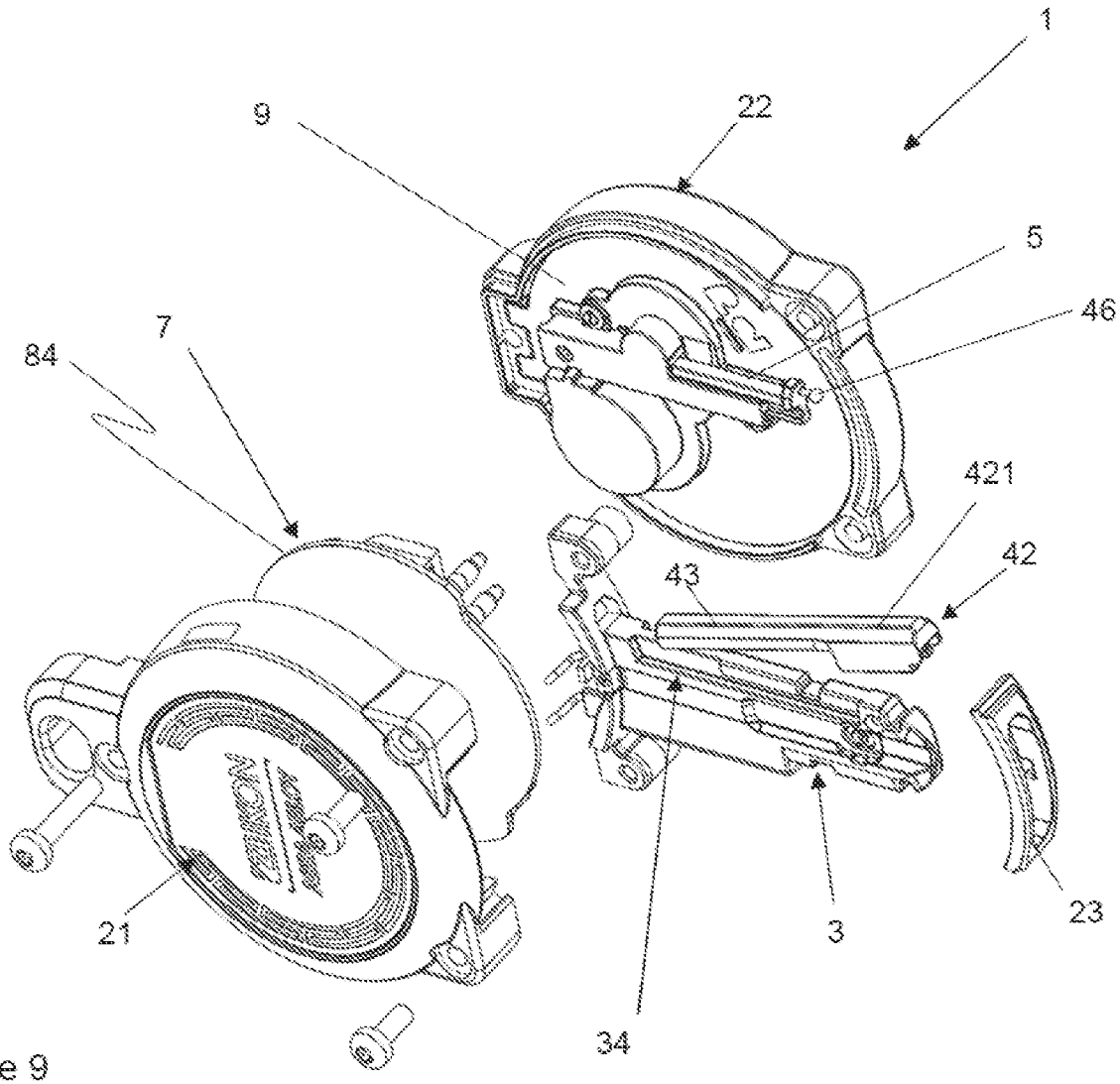


Figure 9

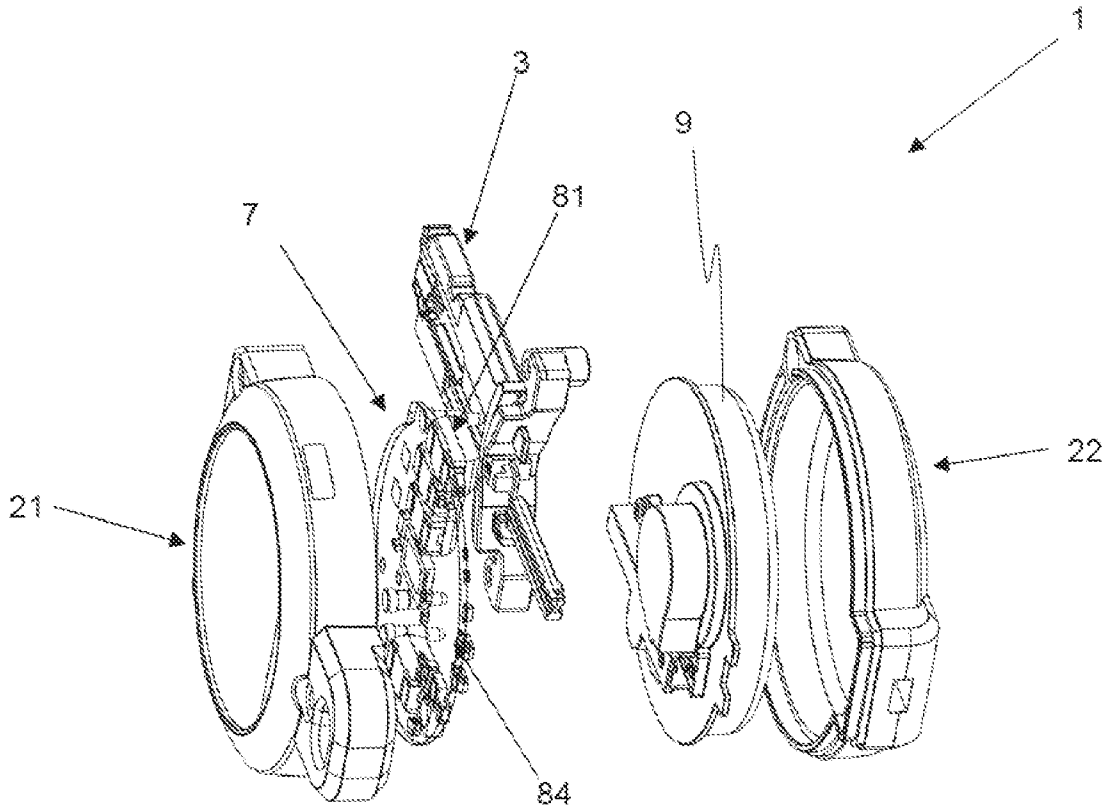
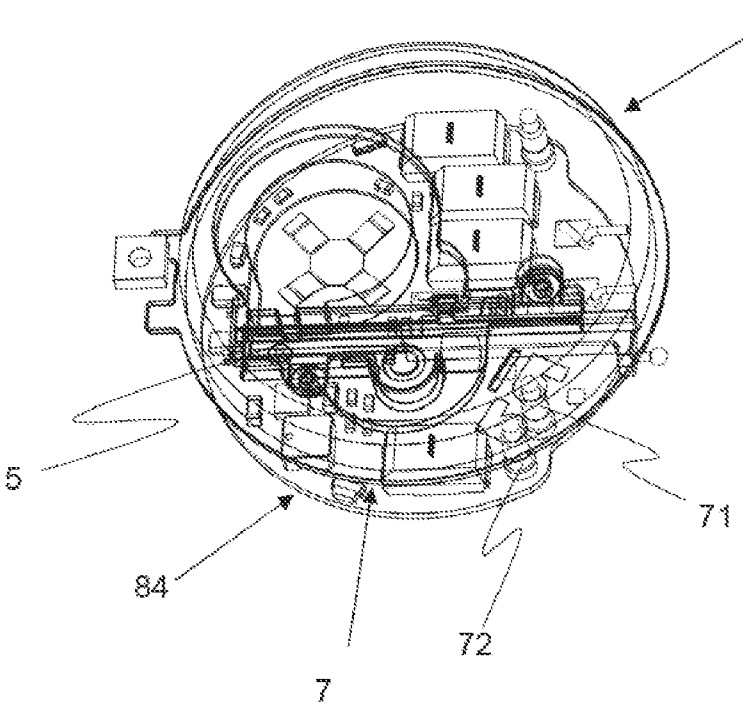


Figure 10

Figure 11a



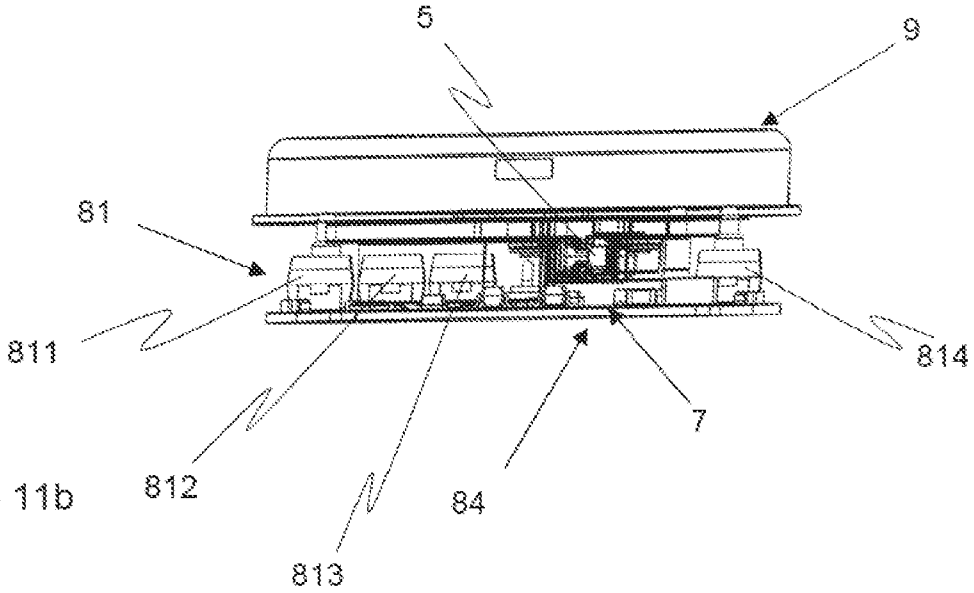


Figure 11b

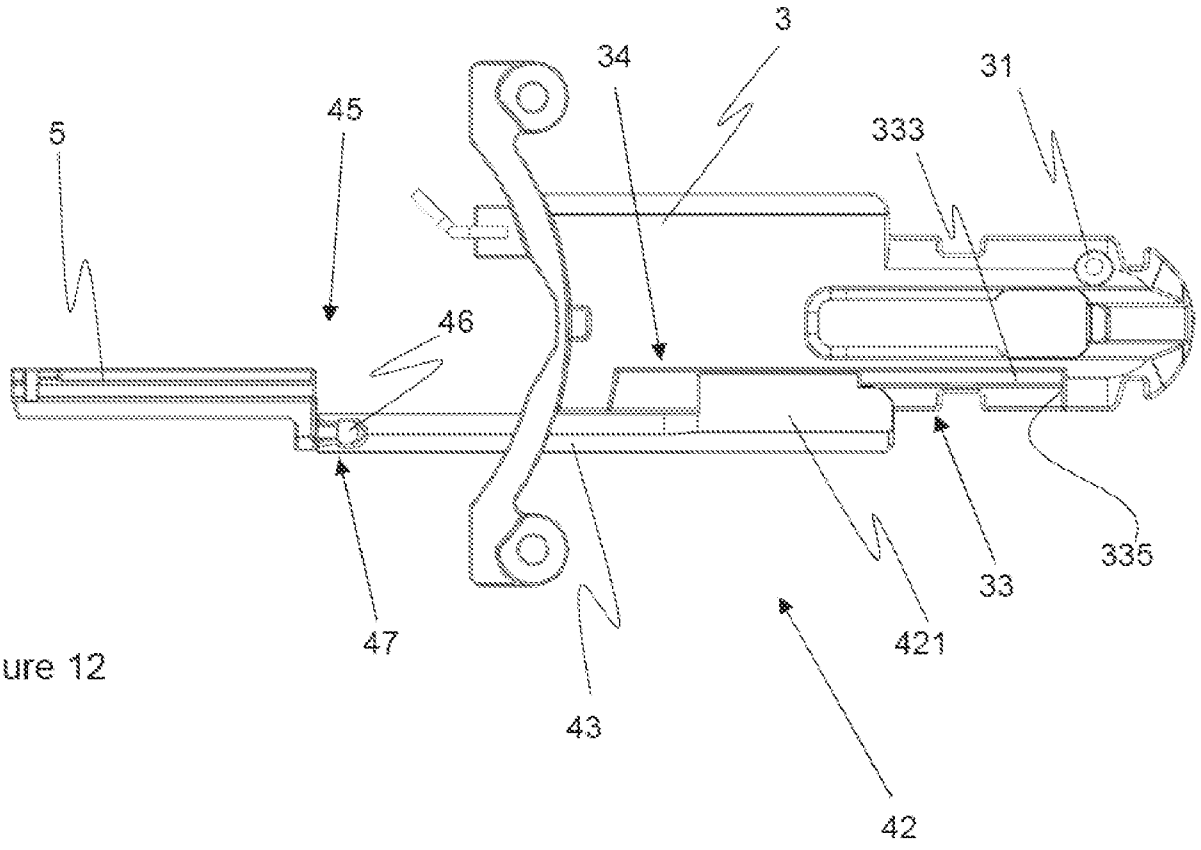


Figure 12

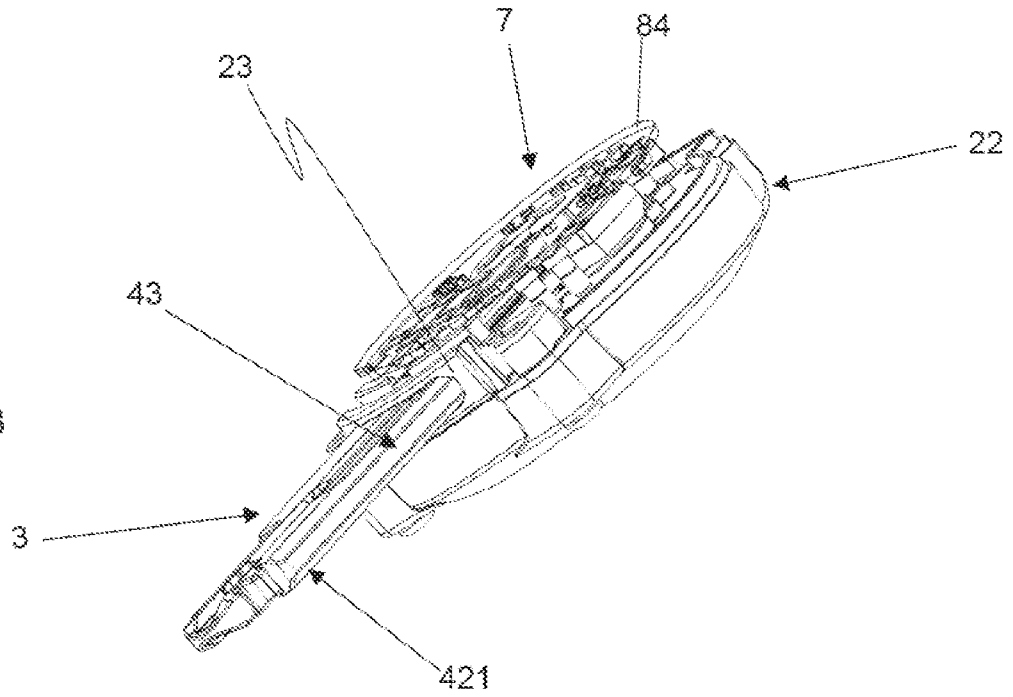


Figure 13

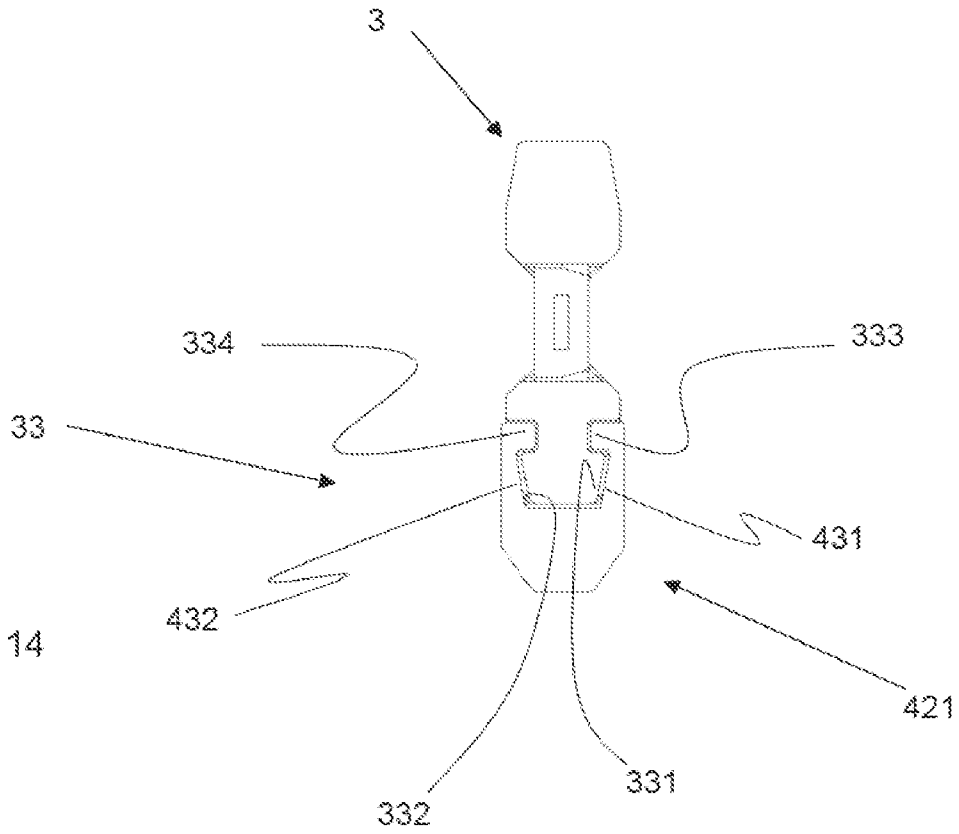


Figure 14

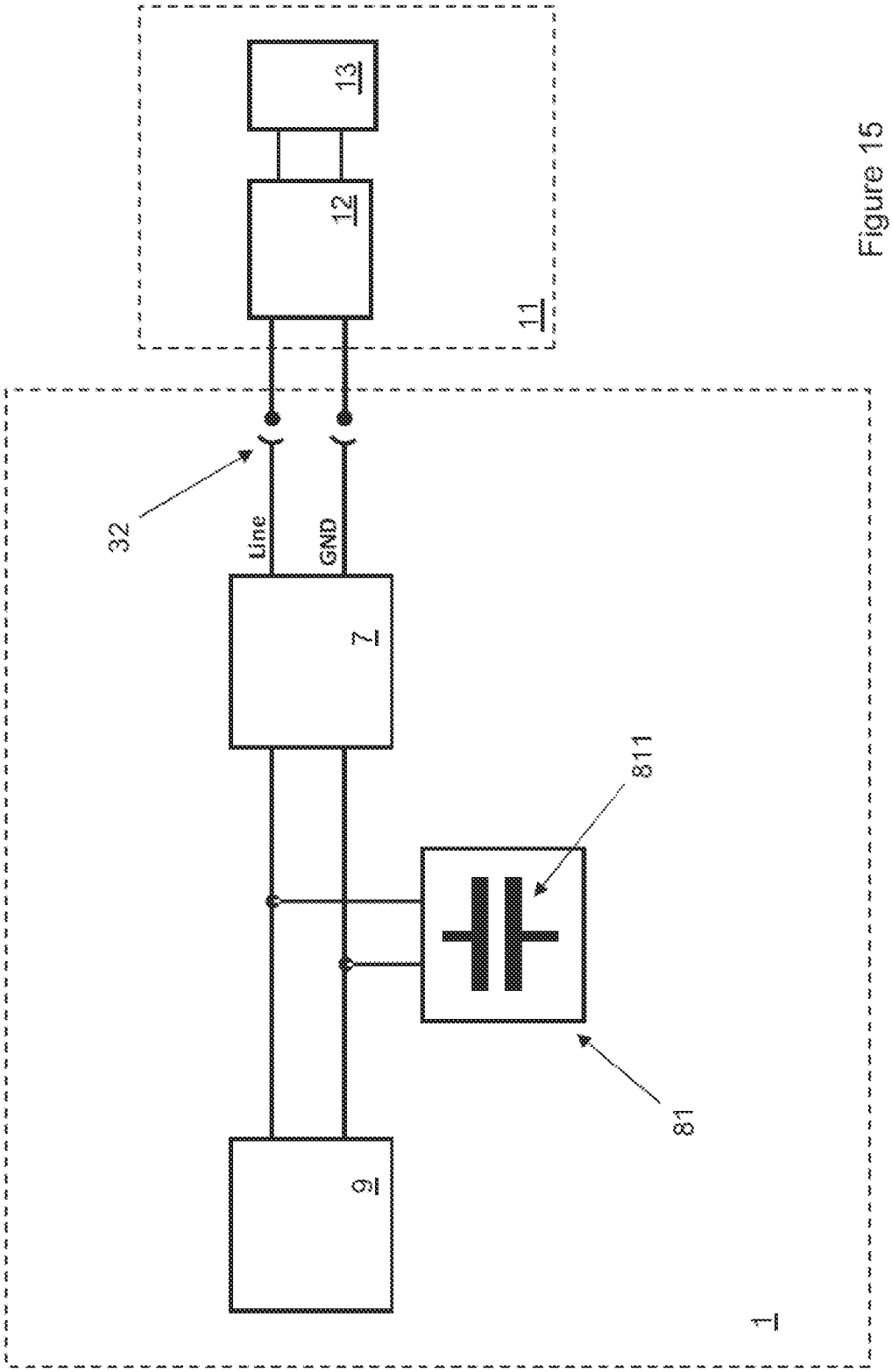


Figure 15