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(54) **Lock accessory**

(57) A lock accessory, whereby a key-operated lock is convertible into an electrically operated lock. The lock comprises a rotatable opening spindle (4) and a turn spindle (3) rotatable with a handle element (3a). The accessory comprises a housing mountable on a door surface, into which said spindles (3,4) extend and which contains a mechanism (40,41) interconnecting the spindles (3,4) and being capable of coupling, by way of an electrical control (10,11,12), the spindles (3, 4) with each other for

a relative mechanical drive link engagement, such that a rotation of the opening spindle (4) translates into a rotational motion of the turn spindle (3) as well. The mechanism (40,41) for the drive link engagement is adapted to decouple either automatically after a delay time or as the lock is opened. The opening spindle (4) is in its rotation-effecting engagement with an opening ring (5), which is rotatable manually from outside the door (1) and which encircles a key cylinder (2) or a key cylinder extension (2).

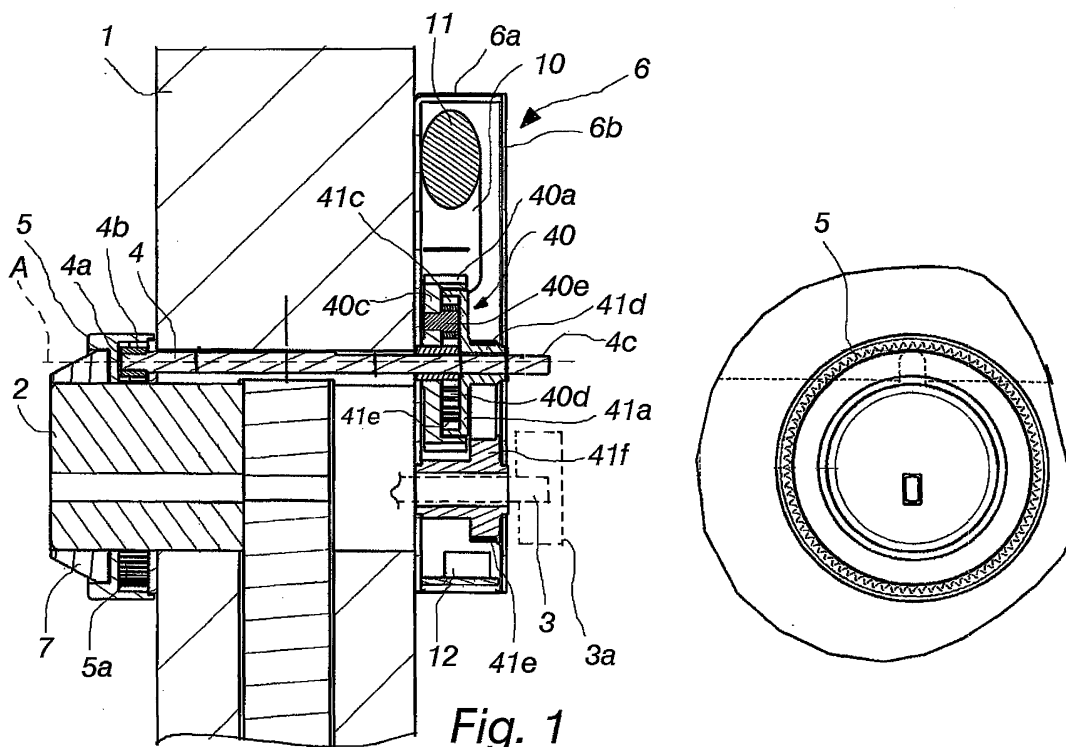


Fig. 1

Description

[0001] The invention relates to a lock accessory, whereby a key-operated lock is convertible into an electrically operated lock, the lock comprising a rotatable opening spindle and a turn spindle rotatable with a handle element, the accessory comprising a housing mountable on the surface of a door, into which said spindles extend and which contains a mechanism interconnecting the spindles, and said opening spindle being settable by an electric control through the mechanism in a drive link engagement with the turn spindle rotatable by means of the handle element, such that a rotation of the opening spindle translates into a rotational motion of the turn spindle as well.

[0002] One problem relevant to home care of the elderly involves the distribution and management of a sufficiently large number of keys. In the case of electrically controlled locks, this problem has been overcome by recent systems, enabling the opening of locks with a mobile communicator which transmits to a server of the control center a request to open a specific door and, after checking the user record for the rights of a requesting party, the server supplies the mobile communicator with necessary data to open the requested door. However, such a system cannot be used in connection with exclusively key-operated locks.

[0003] A lock accessory of the above mentioned type is known from the patent publication SE 529017 C2. The lever mechanism of this SE publication is only apt for use in a type of locks which are provided with a lever or handle external of the door, thus requiring merely a drive link engagement between a spindle of the door lever or handle and a spindle of the door knob. Such a drive link engagement is implemented in the cited SE publication by means of a solenoid-controlled lever mechanism. These prior known electric locks include solenoid-driven levers, bringing the lock to an opening position as the solenoid receives a current. The solenoid's power consumption is of such a magnitude that the excessively frequent need of replacing the batteries makes this accessory impractical. Also, the complicated lever system and the necessity of using two solenoids make the accessory expensive. A mains-current operated version of the accessory is not practical in terms of installation engineering and for many other reasons. However, there would also be a demand for a type of electric locks with a consumption of power low enough for sustaining the same in a battery-operated version for several years without a battery replacement. In order to achieve this objective, the unlocking must not be based on a solenoid-operated active application of force. An insight in the invention is that, as the opening function is based on the use of a piezoelectric or corresponding low energy actuator for disabling a movement of the bolt, the consumption of energy is extremely slight.

[0004] An object of the invention is to solve the problem of how to conveniently convert a key-operated lock, into

an electrically operated lock.

[0005] An additional object of the invention is to provide a battery-operated lock accessory, whereby a key-operated lock is convertible readily and at low cost into an electrically operated lock, whose energy consumption is extremely slight.

[0006] This object is achieved by the invention on the basis of the characterizing features presented in the appended claim 1.

[0007] Preferred embodiments of the invention are presented in the dependent claims, which also disclose preferred embodiments of the additional object.

[0008] One exemplary embodiment of the invention will now be described more closely with reference to the accompanying drawings, in which:

Fig. 1 shows a door-mounted accessory of the invention in a cross-sectional side view, and

Fig. 2 shows an accessory of the invention in an axonometric exploded view, and

Fig. 3 shows schematically the use of an accessory of the invention and the control of an actuator 10.

[0009] The lock, in which the invention is applied, includes a turn spindle 3 rotatable with a handle element such as a door knob 3a, the door knob being set inside a door 1. Outside the door 1 is a key cylinder 2, which is normally used for opening the door 1 with a key. The key cylinder is circular in cross-section.

[0010] In the embodiment of figs. 1 and 2, the accessory of the invention comprises an opening ring, represented by reference numeral 5. The opening ring 5 is preferably an annular element, comprising a circular wall which can be placed around the key cylinder 2. The opening ring 5 is adapted to be rotatable around the key cylinder 2. The circular wall has its inner surface provided with an internal serration 5a. The opening ring 5 is preferably locked immovably in the direction of its rotation axis by means of a ring lock 7. The ring lock 7 prevents movement of the opening ring 5 and its disengagement from around the key cylinder 2.

[0011] Between an outer surface of the key cylinder 2 and the internal serration 5a is left an annular void space. Into the space, especially into a section above the key cylinder, has been passed a first end 4a of an elongated opening spindle 4. It should be noted here that a second end 4c of the opening spindle 4 is adapted to extend into the interior of a housing 6 mounted inside the door. The opening spindle 4 is adapted to spin around its longitudinal axis A as described hereinafter.

[0012] The opening spindle 4 has its first end 4a provided with a gear 4b, spinning jointly with the spindle 4 around the axis A of the spindle 4. Thus, the gear 4b is meshed with the serration 5a of the opening ring 5, such that, as the opening ring is turned, the opening spindle

4 rotates around its axis A.

[0013] The opening spindle 4 has its second end 4c in engagement with a mechanism 40, 41, disposed inside the housing 6 and interlinking the spindles 3 and 4. Next described is one preferred configuration of the mechanism 40, 41.

[0014] Thus, the mechanism 40, 41 is accommodated in the housing 6 which consists of a bottom plate 6a and a cover element 6b, which latter can be fixed to the bottom plate 6a preferably in a removable fashion. The housing 6 has its walls defining a space, into which the second end 4c of the opening spindle 4 extends at a distance above the turn spindle 3, which can be rotated by the door knob 3a or a lever shaped doorhandle.

[0015] Around the second end 4c of the opening spindle 4 is disposed a first segment 40 of the mechanism, which constitutes a coupling element. In this embodiment, the coupling element is a planetary gearset. In this case, the planetary gearset 40 is made up of gears 40a, 40d and 40e. Of these, the gear 40d is adapted to spin with the second end 4c of the opening spindle 4 around the axis A, and constitutes a so-called sun gear. Adapted to be rotatable around the axis A is a second gear 40a, which is larger in diameter than the gear 40d and constitutes a so-called ring gear. In the direction of the axis A, the ring gear 40a lies on the same plane as the sun gear 40d. Consequently, the sun gear 40d is left within a space defined by an inner wall 40b of the ring constituting the second gear, i.e. the ring gear 40a.

[0016] The ring gear 40a comprises a planet flange 40c, providing a wall for the gear 40a. The wall 40c is located adjacent to the bottom plate 6a of the housing 6, in its immediate proximity. Between the inner surface 40b of the ring gear 40a and the plane extending by the outer serration crests of the sun gear 40d is left an annular space, in which is disposed a planetary gearset. In this case, the planetary gearset consists of three gears 40e, whose rotating axles are set in connection with the planet flange 40c codirectionally with the rotation axis A of the sun gear 40d. In addition, these rotating axles are spinning (as the planet flange 40c is rotating) around the axis A along a circular orbit and are disposed around the axis A at equidistant circumferential intervals (the radial distance is 120 degrees). The planet gears 40e have their serrations meshed with those of the sun gear 40d.

[0017] Furthermore, between the plane extending by the outer serration crests of the planet gears 40e and the inner surface 40b of the ring gear 40a is left an annular space, which is used for passing a transmission element 41 of the mechanism 40, 41 to the engagement with the planetary gearset 40. For this purpose, the transmission element 41 is provided with a gear 41a, which is provided with an internal serration 41c and which can be passed to the engagement with the planetary gearset 40 in the direction indicated by an arrow B. This gear 41a rotates around the same rotation axis A as the sun gear 40d and is bearing-mounted around the second end 4c of the opening spindle 4 for free rotation. Hence, the transmis-

sion element 41 has its internal serration 41c meshed with those of the planet gears 40e.

[0018] The transmission element 41 comprises pulleys 41d and 41f adapted to be rotatable therewith. Of these, the first pulley 41d co-rotates with the gear 41a, and the second pulley 41f rotates through the intermediary of a belt 41e as the first pulley 41d rotates. The first pulley 41d is coupled to rotate by turning the opening ring 5 as discussed hereinbelow.

[0019] It can be seen from fig. 2 that the second pulley 41f is disposed in the engagement with the turn spindle 3 (shown with dashed lines) of the door knob 3a, more specifically in such a way that the turn spindle 3 coincides with the rotation axis of the pulley 41f. The engagement is such that, when the second pulley 41f rotates, the turn spindle 3 of the door knob 3a is also rotating, and so is thereby also the door knob 3a. For this purpose, the turn spindle 3 has been passed through the pulley 41f, such that the turn spindle 3 and the pulley 41f have a common rotation axis. It should be noted here that the pulleys may be of equal or unequal in terms of their diameters, whereby the gear ratio of the pulleys 41d and 41f changes in compliance with the ratio of diameters according to per se known principles.

[0020] Further in connection with the ring gear 40a is disposed an actuator 10 operating on electric control. The components essential for the operation of the actuator 10 are illustrated schematically in fig. 3. After receiving an electrical control, the actuator 10 disables rotation of the ring gear 40a around the axis A. At the same time, the planetary gearset 40e is prevented from rotating around the axis A. The actuator 10 receives a control command from the electronic circuit of a control unit 12, and the electric control from the control unit 12 to the actuator 10 is transmitted over a cable 13.

[0021] The actuator 10 includes a piezoelectric element 14 which, after receiving an electrical control, provides for the locking of a bolt or plunger 10a in the engagement with the serration of the ring gear 40e, thus disabling a rotational motion of the ring gear 40a. At the same time, the motion of the planet flange 40c, and that of the axles of the planetary gearset 40e connected therewith, around the rotation axis A is disabled. Thus, the bolt or plunger 10a can be locked by means of the piezoelectric element 14 for opening the door. Hence, a stopper means 15 of the piezoelectric element 14, for example a small tab 15, is passed by a small displacement into a detent 16 present in the bolt or plunger 10a in coincidence with the tab 15. In connection with the bolt or plunger 10a is disposed a spring 17 or some other power unit, which allows, without electrical control, a displacement of the bolt or plunger 10a against the spring force while the bolt or plunger 10a is pressed back and forth against the spring force by the rotating ring gear 40a with its guide surfaces made up by serrations. The planet gears 40e roll along the ring gear 41c, thus failing to transmit a torque for rotating the gear 41a. In other words, without an electrical control of the piezoelectric actuator 10, said

bolt or plunger 10a, as it yields to a weak return force of the spring 17 or some other power unit, is adapted to disable or not to activate a coupling of the drive link engagement as the opening spindle 4 is rotated.

[0022] Next described is the operation of an accessory of the above configuration with the actuator 10 in various control modes (without and with electrical control).

[0023] When the actuator 10 has not been supplied with electrical control, the sun gear 40d is rotated by a spinning motion of the opening spindle 4 around the axis A. At the same time, the planet gears 40e orbit around the axis A while rotating around their own rotation axes along the serration of the sun gear 40d. At the same time, the ring gear 40a is rotating around the axis A. Thus, the transmission element 41a remains stationary, because the planet gears 40e have their pinions, which rotate freely on their axles, rolling freely along the internal serration 41c of the transmission element 41a, and the rotating force is not translated to the transmission element 41 but, by way of the planet flange 40c, to the ring gear 40a. Consequently, the door does not open as the opening ring 5 is turned from outside the door.

[0024] When the actuator 10 has been supplied with electrical control, the ring gear 40a is locked in place (i.e. the ring gear 40a does not rotate around the axis A while the sun gear 40d is rotating). Because the planet gears 40e are provided on the planet flange 40c, the rotating axes of the planet gears 40a remain stationary, i.e. they do not orbit around the axis A, and the planet gears 40e rotate around their own axes. As a consequence, the force rotating the planetary gearset transmits to the first pulley 41d of the transmission element 41 through the intermediary of the internal serration 41c. Thereby, the transmission pulley 41d is rotating and so is also the second pulley 41f through the intermediary of the belt 41e. As a result, the turn spindle 3 of the door knob 3a turns and the door opens as the turn spindle 3 has turned to a sufficient extent.

[0025] First and foremost, the planetary gearset 40 transmits a force from the opening spindle 4 to the turn spindle 3, but the gearset functions also as a transmission ratio variator between the spindles 3 and 4 as the planet gears 40e change the angular speed between the internal serrations of the sun gear 40d and the transmission element 41a and, thus, the first pulley 41d as well. Because the first pulley 41d and the second pulley 41f of the transmission element 41 can be implemented, if desired, to have such diameters that the transmission ratio changes in a per se known manner, the door-opening turning motion of the opening ring 5 can be made optimal in terms of its turning angle and/or turning force. For example, the ratio between the respective turning angles of the spindles 3 and 4 can be set at 1:1, whereby the opening spindle 4 is rotated, for opening the door, practically with the same force and over the same radial distance as those used for turning the door knob 3a from inside. Or, for example, the respective ratio between turning angles can be 1:2, whereby the opening spindle 4 is

turned, for opening the door, over a double radial distance but with a lesser force. Hence, these are merely examples of ratios for the turning angles of the spindles 3 and 4.

[0026] The piezoelectric actuator 10 has a working time which only enables opening of the lock with the opening ring 5 for just a specific time span, which has been set in the electric control unit 12. This control unit 12 receives its operating power from a battery 11 and functions only when a server 18 of the service provider has delivered an access right message to a specified mobile communicator 19, which can carry a list of addresses for doors whose opening authorization can be requested therefrom.

[0027] The accessory's electric control unit 12, or the mobile communicator 19 controlling the same, can be adapted to emit an audio signal as soon as the electric control has coupled a drive link between the spindles 3 and 4. At this point, the user knows that the lock is openable by turning the opening ring 5 associated with the opening spindle 4.

[0028] The accessory according to the invention is thus located inside a door, while the opening ring 5 associated with the opening spindle lies outside the door. This means that, in a locked condition of the lock, the opening ring 5, the opening spindle 4 and the ring gear 40a in engagement therewith conduct a dead travel (no transmission to the coupling element 41) unless the accessory's mechanical drive link engagement has been coupled by means of electrical control.

[0029] The accessory may also include a micro switch 8 capable of switching the accessory's electric control unit 12 to a standby mode as the bolt or plunger 10a travels back and forth in response to a rotational motion of the opening ring 5. The arrangement provides a considerable saving for the battery 11 because the accessory can now be in a totally power non-consuming state except for when opening of the lock is desired. In this case, it is first necessary to perform an activation twirl with the opening ring 5 and only then to communicate a control message from the mobile communicator 19 to the control unit 12. This communication may function by using any short range communication link.

[0030] The accessory of the invention can be used, for instance, to change an ordinary Abloy lock into an electrically controlled lock. It is economical and quick to install and can be removed without leaving marks on the door.

[0031] The invention is not limited to the above exemplary embodiment, but a mechanical drive engagement can be implemented by a skilled artisan by using various combinations of pinions and transmission gears.

Claims

1. A lock accessory, whereby a key-operated lock is convertible into an electrically operated lock, the lock comprising a rotatable opening spindle (4) and a turn spindle (3) rotatable with a handle element (3a), the

accessory comprising a housing (6) mountable on the surface of a door (1), into which said spindles (3, 4) extend and which contains a mechanism (40, 41) interconnecting the spindles (3, 4), and said opening spindle (4) being settable by an electric control (10, 11, 12) through the mechanism (40, 41) in a drive link engagement with the turn spindle (3) rotatable by means of the handle element (3a), such that a rotation of the opening spindle (4) translates into a rotational motion of the turn spindle (3) as well, **characterized in that** the opening spindle (4) is in its rotation-effecting engagement with an opening ring (5), which is rotatable manually from outside the door (1) and which encircles a key cylinder (2) or a key cylinder extension (2).

2. A lock accessory according to claim 1, **characterized in that** the accessory comprises a piezoelectric actuator (10) which is adapted, in a mode activated by the electric control (10, 11, 12, 19), to lock in place a bolt or plunger (10a) which in its immovably locked condition couples said drive link engagement upon turning the opening spindle (4), and that, without an electrical control of the piezoelectric actuator (10), said bolt or plunger (10a) is adapted, as it yields to the weak resetting force of a spring (17) or some other force device, to disable or not to activate a coupling of the drive link engagement upon turning the opening spindle (4).
3. A lock accessory according to claim 1 or 2, **characterized in that** the interconnecting mechanism (40, 41) comprises a coupling element (40) and a transmission element (41).
4. An accessory according to claim 1 or 2, **characterized in that** the mechanism (40, 41) is formed with a guide surface (40a), under whose guidance said bolt or plunger (10a) moves back and forth against the force of the spring (17) in response to a turning motion of the opening spindle (4) as the piezoelectric actuator is disengaged from the electrical control.
5. An accessory according to any of claims 1-4, **characterized in that** a control unit (12) for the accessory, or a mobile communicator (19) controlling the same, is adapted to emit an audio signal as soon as the electrical control has coupled the drive link engagement between the spindles (3, 4).
6. An accessory according to any of claims 1-5, **characterized in that** the accessory is located inside a door and the opening ring (5) associated with the opening spindle (4) lies outside the door, whereby the opening ring (5) and the opening spindle (4) are rotating idly or freely unless said mechanical drive link engagement (40, 41) has been coupled by the electrical control (10, 11, 12, 19).

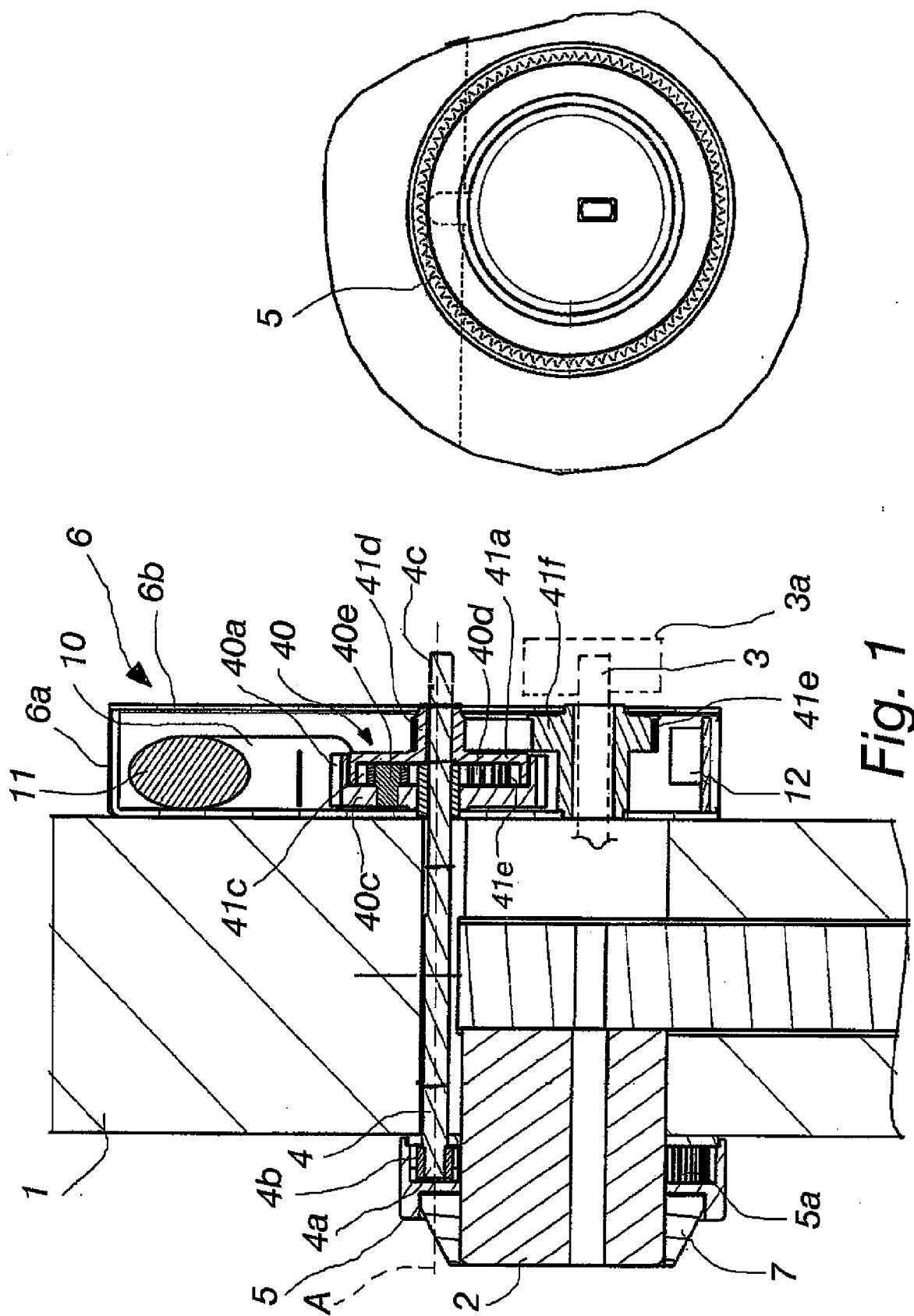
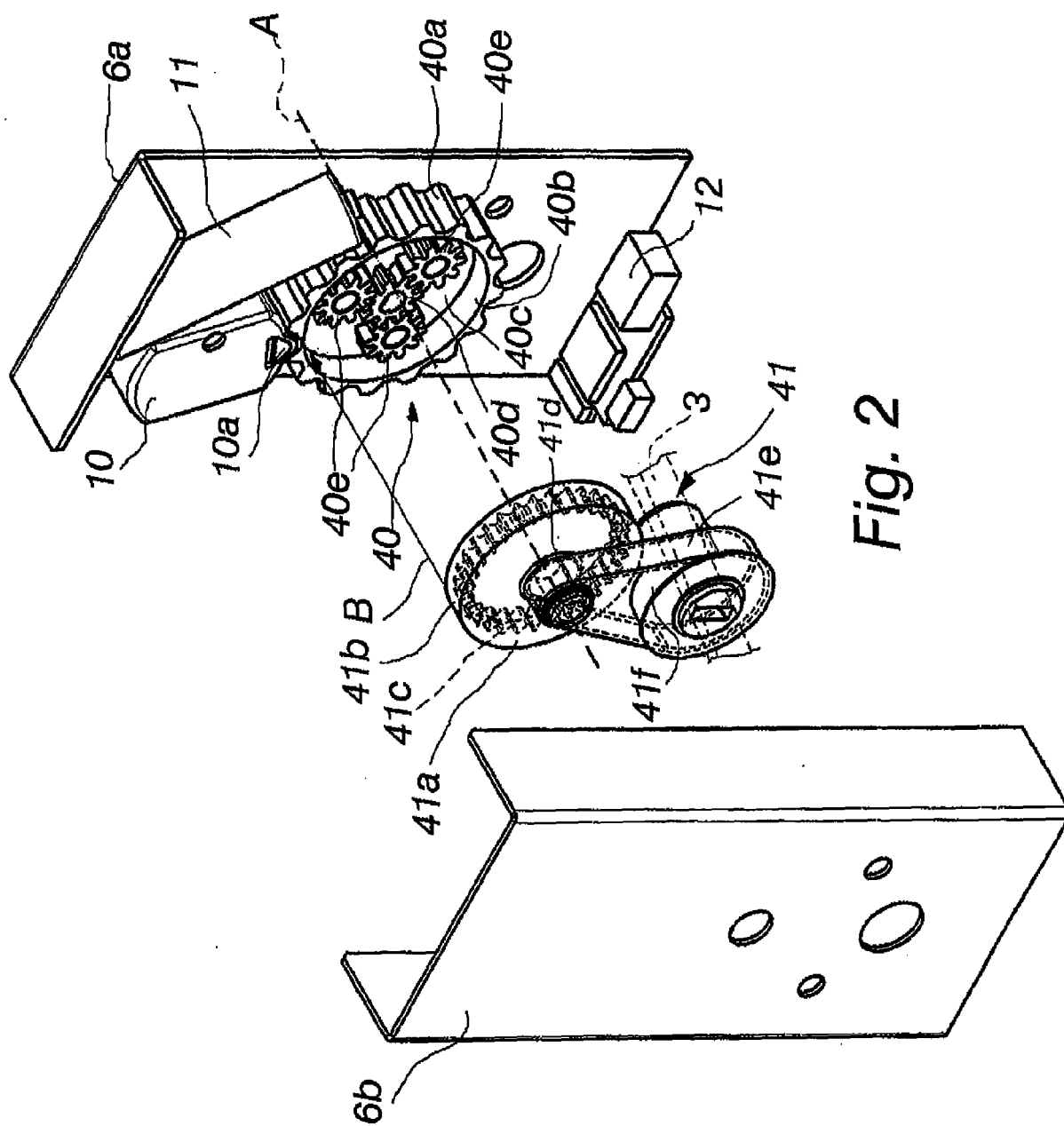


Fig. 1



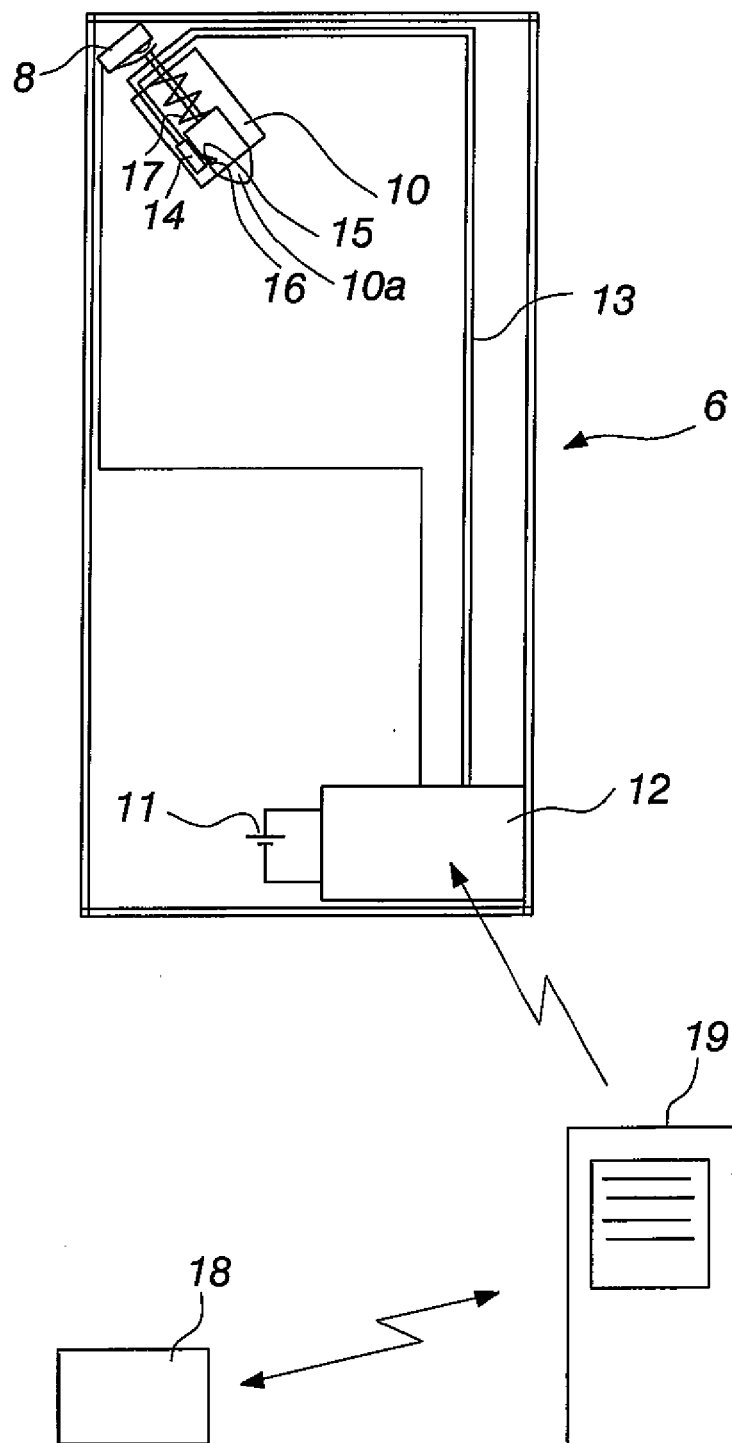


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 09 18 0834

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Place of search The Hague		Date of completion of the search 19 April 2010	Examiner Perez Mendez, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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