



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**15.12.2021 Bulletin 2021/50**

(51) Int Cl.:  
**E05B 13/00 (2006.01) E05B 47/06 (2006.01)**

(21) Application number: **20179284.3**

(22) Date of filing: **10.06.2020**

(84) Designated Contracting States:  
**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**  
 Designated Extension States:  
**BA ME**  
 Designated Validation States:  
**KH MA MD TN**

(71) Applicant: **ASSA ABLOY Opening Solutions Sweden AB**  
**631 05 Eskilstuna (SE)**  
 (72) Inventor: **WENNBERG, Rikard**  
**413 26 Göteborg (SE)**  
 (74) Representative: **Kransell & Wennborg KB**  
**P.O. Box 27834**  
**115 93 Stockholm (SE)**

(54) **ELECTROMECHANICAL LOCK ARRANGEMENT WITH AN ELECTRIC ACTUATOR**

(57) Electromechanical lock arrangement (10) with an electric actuator (20) which actuator comprises; an electric motor (30) with a bidirectionally rotatable output shaft (32), a drive shaft (40) which is connected to or formed integral with the output shaft (32) and which comprises an external helical thread portion (43), and a linearly displaceable sled (50) comprising an engagement portion which is arranged to engage the external thread portion (43) for driving the sled (50) longitudinally along

the rotational axis upon rotation of the drive shaft (40). The sled (50) comprises a resilient latch (56) which is arranged to block longitudinal displacement of the sled (50) in a first longitudinal direction, at a first axial position when the drive shaft (40) is not rotating and to allow longitudinal displacement of the sled (50) in the first longitudinal direction, past the first axial position, when the drive shaft (40) is rotating.

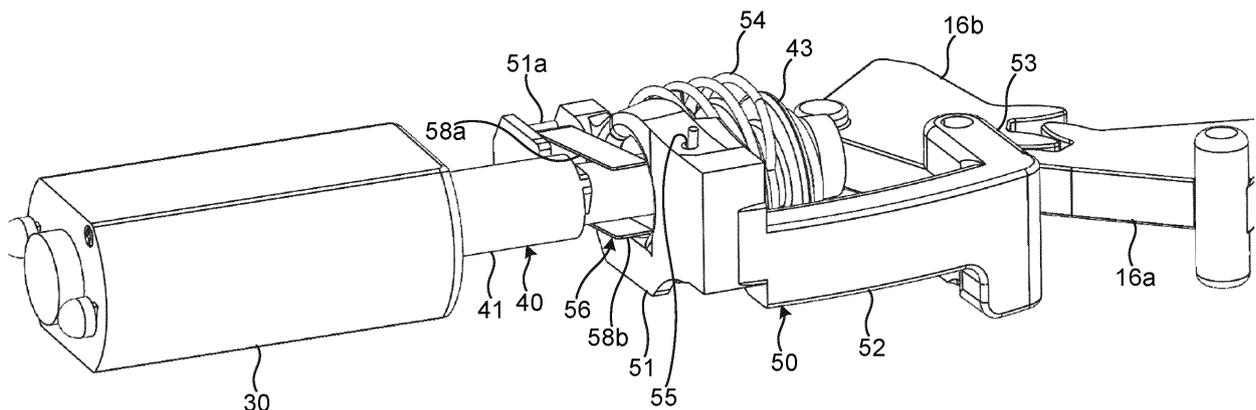


Fig. 4

## Description

### TECHNICAL FIELD

**[0001]** The present disclosure relates to the field of electromechanical lock arrangements and, in particular, to an electromechanical lock arrangement provided with an electric actuator arranged to accomplish certain actuation operations within the lock arrangement.

### BACKGROUND

**[0002]** There exist many different types of electromechanical lock arrangements. One type comprises a lock housing and a lock mechanism received in the housing for driving at least one lock bolt between a locking position, in which the bolt protrudes out from the housing and an opening position, in which the bolt is retracted into the housing. At some variants, the locks comprise manually operable means such as handles, thumb turns and/or key operated lock cylinders for driving the bolt between the locked and the opening positions. In cases where key operated lock cylinders are present, these lock cylinders provide one means of verifying the authority of the person operating the cylinder by means of the coded key.

**[0003]** Another type of electromechanical lock arrangement comprises a handle device for manual operation of the lock bolt(s) of a mortise lock or the like. The handle device may comprise a coupling for selectively connecting and disconnecting a rotatable handle to another part which may be movable or stationary. When the other part is movable, it may constitute a connection to the lock bolt such that connecting the handle to the movable part allows manual operation of the bolts, whereas disconnecting the handle from the movable part disables manual operation of the lock bolt. Thus, connecting the handle to the movable part unlocks the handle device whereas disconnecting the handle from the moving part locks the handle device. In cases where the other part is instead stationary, the handle is normally permanently connected to the lock bolts. At such instances, connection of the rotatable handle to the stationary part blocks rotation of the handle to thereby prevent operation of the bolt whereby the handle device is locked. On the other hand, disconnecting the handle from the stationary part allows rotation of the handle such that the bolt may be operated and the handle device is unlocked.

**[0004]** Both types of electromechanical lock arrangements may be provided with electronic means for verifying the authority of person operating the lock arrangement. Such electronic authorisation verification means may comprise e.g. a keypad for entering an authorisation code, an RFID-tag reader, or readers for Bluetooth, Bluetooth Low Energy (BLE), Ultra Wideband Radio (UWB) or IEEE 802.15.x communication with a handheld device or the like. A further alternative for verifying the authority is so called galvanic readers which may be arranged in the keyway of a lock cylinder and which is arranged to

communicate galvanically with a code carrying memory arranged e.g. on a key which is insertable in the keyway of the cylinder.

**[0005]** In addition to or as an alternative to means for manually driving the bolt(s) from the locking position to the opening position, electromechanical locks may also be provided with motors or other electrical means for driving the lock bolt(s).

**[0006]** Such electromechanical lock arrangements comprising electronic means for reading a verification code presented by the person intending to operate the lock arrangement often comprise an electric actuator which is controlled electrically in response to whether or not a correct authorisation code has been presented. Typically, the actuator is arranged to block the operation of the lock mechanism such that at least one lock bolt may not be retracted to the opening position unless a correct verification code has been received by the code reading means. Correspondingly, if a correct verification code has been presented, the actuator unblocks the lock mechanism such that the lock bolt(s) may be retracted to the opening position.

**[0007]** The actuator may be arranged in the lock housing for interacting with the lock mechanism. Alternatively, the actuator may be arranged in a lock cylinder of the electromechanical lock for selectively allowing and preventing the core of the lock cylinder to rotate relative to the cylinder housing. At electromechanical handle device lock arrangements, the actuator may be arranged for driving a coupling member between an engagement position for connecting the handle to the other part and a release position for disconnecting the handle from the other part. The actuator may be arranged to drive a blocking or coupling member rectilinearly between a blocking/coupling position and a releasing position. In some cases, a rectilinear output movement from the actuator may be translated into a rotational or pivotal movement by means of a follower or other linear-to-rotational movement conversion devices. The movement generating means of the actuator may comprise e.g. a solenoid, such as a linear solenoid or an electric motor.

**[0008]** EP1845224B1 discloses an electromechanical lock comprising a lock case housing a lock mechanism and an electric actuator.

**[0009]** EP3299553A1 discloses a handle device comprising a coupling device with an engaging member and an electric actuator for moving the engagement member between an engagement position and a release position.

**[0010]** EP2314809B1 discloses an electromechanical lock cylinder comprising an electrical motor, the output shaft of which is connected to a rotational threaded spindle. A carriage comprises a U-shaped spring element having an elastic longer arm and an elastic shorter arm which arms are mutually connected by means of an intermediate arm. The longer arm engages the valleys of the spindle such that the carriage is driven rectilinearly back and forth upon rotation of the spindle in a corresponding rotational direction.

## SUMMARY

**[0011]** An object of the present invention is to provide an electromechanical lock arrangement comprising an enhanced actuator.

**[0012]** Another object is to provide such an electromechanical lock arrangement with increased security.

**[0013]** A further object is to provide such an electromechanical lock arrangement which reduces the risk of manipulation caused by applying impacts.

**[0014]** Yet another object is to provide such an electromechanical lock arrangement wherein the actuator requires only a limited space.

**[0015]** Still another object is to provide such an electromechanical lock at which the actuator may be driven at low power consumption.

**[0016]** These and other objects are achieved by an electromechanical lock arrangement as set out in appended claim 1. The electromechanical lock arrangement has an electric actuator which actuator comprises; an electric motor, a bidirectionally rotatable shaft which is connected to the electric motor and which comprises an external helical thread portion, and a linearly displaceable sled comprising an engagement portion which is arranged to engage the external thread portion for driving the sled longitudinally along the rotational axis upon rotation of the shaft. The sled comprises a resilient latch which is arranged to block longitudinal displacement of the sled in a first longitudinal direction, at a first axial position when the shaft is not rotating and to allow longitudinal displacement of the sled in the first longitudinal direction, past the first axial position, when the shaft is rotating.

**[0017]** By this means the sled is efficiently prevented from being forcibly moved in the first direction at attempts to manipulate the lock arrangement e.g. by applying impacts to the lock arrangement without authorized rotation of the shaft for driving the sled in the first direction. The actuator should thus preferably be arranged such that longitudinal displacement of the sled in the first direction causes a lock mechanism to unlock the lock arrangement.

**[0018]** The shaft may exhibit a shaft shoulder forming a stop arranged at said first axial position, between a first shaft portion having a first diameter and a second shaft portion having a second diameter, which is larger than the first diameter.

**[0019]** The shaft shoulder may define a stop surface which is essentially perpendicular to the longitudinal direction of the shaft.

**[0020]** The shaft may comprise at least one ramp portion which is inclined in the circumferential direction of the shaft and arranged at the shaft shoulder.

**[0021]** The shaft may then comprise at least one pair of ramp portions each pair comprising two ramp portions having opposite inclinations in the circumferential direction of the shaft.

**[0022]** The resilient latch may comprise at least one

resilient leg which is flexible in a direction normal/radial of the shaft.

**[0023]** The resilient latch may be generally U-shaped and comprise two resilient legs.

5 **[0024]** The engagement portion may comprise a helical spring which is arranged to engage the external thread.

**[0025]** An end portion of the helical spring may be fixed to the sled.

10 **[0026]** The sled may comprise or be connected to a driver arranged to move a blocking device between a blocking and a non-blocking position.

**[0027]** The blocking device may comprise two movable and cooperating blocking members.

15 **[0028]** The sled may exhibit a through opening which receives the shaft.

**[0029]** The electromechanical lock arrangement may further comprise a guide means for rectilinear guiding of the sled.

20 **[0030]** The actuator may be arranged in a handle device.

**[0031]** Alternatively, the actuator may be arranged in a mortise lock case.

25 **[0032]** Further objects and advantages of the invention will appear from the following description and from the appended claims.

**[0033]** Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the element, apparatus, component, means, step, etc." are to be interpreted openly as referring to at least one instance of the element, apparatus, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

## BRIEF DESCRIPTION OF THE DRAWINGS

40 **[0034]** Aspects and embodiments are now described, by way of example, with reference to the accompanying drawings, in which:

Fig 1. is an exploded perspective view of an exemplifying electromechanical lock arrangement in the form of a handle device.

45 Figs. 2a-b are plan views, partly in section of the handle device shown in fig. 1 in a locked and an unlocked state respectively.

50 Figs 3a and 3b are plan views in enlarged scale illustrating some components of the handle device of figs 2a-b and illustrating the locked and unlocked state respectively.

55 Fig. 4 is an perspective view in enlarged scale and seen from another angle of the components shown

in fig. 3a.

Figs. 5a-d are perspective views in further enlarged scale of some of the components shown in fig. 4 and illustrating these components at different positions when changing the state of the handle device from locked to unlocked.

## DETAILED DESCRIPTION

**[0035]** The aspects of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which certain embodiments of the invention are shown.

**[0036]** These aspects may, however, be embodied in many different forms and should not be construed as limiting; rather, these embodiments are provided by way of example so that this disclosure will be thorough and complete, and to fully convey the scope of all aspects of invention to those skilled in the art. Like numbers refer to like elements throughout the description.

**[0037]** Fig. 1 is a simplified exploded perspective view of a electromechanical lock arrangement in form of a handle device (10) intended to be mounted to a window or a door (not shown) provided with a lock mechanism for driving one or several lock bolt in and out of engagement with a striker plate in a window or door frame (not shown).

**[0038]** The handle device 10 comprises a mounting plate or rosette 12 which is arranged to be fixed to a window or door (not shown) and a handle 14 which is pivotally fixed to the mounting plate 12. The handle 14 is arranged to receive a plain spindle (not shown) or the like for transferring the pivotal movement of the handle to the lock mechanism (not shown), as well known in the art. The handle device 10 further comprises a coupling arrangement comprising a blocking device with two engagement members 16a, 16b and an electric actuator 20 for operating the engagement members 16a, 16b. Each engagement member 16a, 16b is pivotal about a respective pivotal axis which is perpendicular to the pivotal axis of the handle. By pivotal movement of the engagement members 16a, 16b, they may be brought in and out of engagement of a respective radial slot 13a, 13b arranged in a cylindrical bore 13 in the mounting plate 12. The engagement members 16a, 16b each exhibit cooperating teeth, such that pivotal movement of one engaging member 13a, is transferred to the other engaging member 13b and vice versa.

**[0039]** Figs. 2a and 2b illustrate the handle device in a locked and an unlocked state respectively. At the locked state shown in fig. 2a, the engagement members 16a, 16b have been pivoted outwardly such that they engage a respective radial slot 13a, 13b of the mounting plate. The handle 14 is thereby prevented from rotating relative to the mounting plate 12, such that no motion of the handle 14 may be transferred to the lock mechanism (not shown) thereby to keep the handle device 10 locked. At the unlocked state shown in fig. 2b, the engagement

members 16a, 16b have been pivoted inwards to thereby be disengaged from the respective radial slot 13a, 13b. By this means the handle 14 has been released such that it is free to be rotated relative to the mounting plate 12 and pivotal movement of the handle 14 may thus be transferred to the lock mechanism (not shown) for operating the bolt or bolts in and out of engagement with the striker plate.

**[0040]** The electric actuator 20 for driving the engagement members 16a, 16b is illustrated more in detail in figs. 3a and 3b. The actuator 20 comprises an electric motor 30, a drive shaft 40 and an axially displaceable sled 50. The motor 30 has an output shaft 32 (see fig. 1) which is bidirectionally rotatable about a rotational axis. In the shown example, a fixation portion 41 of the drive shaft 40 is fixed to the output shaft 32, such that the drive shaft 40 is axially aligned with and may rotate together with the output shaft 32. At a non-shown alternative embodiment, the drive shaft may be formed integral with the motors' output shaft. At a further alternative, the drive shaft may be connected to the output shaft by means of a transmission device (not shown) such that the rotational axis of the drive shaft is arranged at an angle to the rotational axis of the output shaft.

**[0041]** The drive shaft 40 further comprises a drive portion 42 which is arranged at or in the proximity of the free end of the drive shaft 40, which free end is arranged distal to the motor 30. The drive portion 42 is provided with an external helical thread portion 43.

**[0042]** The actuator 20 also comprises an axially displaceable sled 50. The sled 50 comprises a base 51 which exhibits a through opening for receiving the drive shaft 40 with a clearance. A driver in the form of a drive arm 52 extends from the base 51 generally in parallel with the longitudinal direction of the drive shaft 40 and away from the motor 30. At its free end, the drive arm 52 comprises an angled connection portion 53 which is pivotally connected to one 16b of the engagement members. The sled 50 further comprises an engagement portion 54 which engages the external thread portion 43 for axial displacement of the sled 50, in either axial direction upon rotation of the drive shaft 40 in a corresponding rotational direction. In the shown example, the engagement portion comprises a helical spring 54. The helical spring 54 is formed of a helically wounded resilient spring wire. One end of the helical spring 54 is fixed to the base 51 of the sled 50 by that end being press fitted into a hole 55 through the base 51. The diameter and axial spacing of the coils of the helical spring 52 is arranged such that the spring coils may be received between the crest of the external thread portion 43 of the drive shaft 40. Rotation of the drive shaft 40 in either rotational direction is thus translated into a corresponding axial displacement of the helical spring 54 and thereby of the sled 50. The sled 50 is further guided to rectilinear displacement by means of guide means (not shown) which are arranged in the handle 14.

**[0043]** In fig. 3a the actuator 20 and the engagement

members 16a, 16b of the coupling arrangement are shown in the locking position, where the engagement members 16a, 16b have been pivoted outwardly to engage the radial slots 13a, 13b of the mounting plate 12 (see also fig. 1). Upon rotation of the motors' output shaft 32 and the drive shaft 40 in the clockwise direction, the helical spring is driven in a first axial direction, towards the motor 30. By this means also the sled 50 with the drive arm 52 is axially displaced towards the motor, whereby the connection portions' 53 pivotal connection with the engagement member 16b causes this engagement member 16b to pivot clockwise. The cooperating teeth translate the clockwise rotation of engagement member 16b into anti-clockwise rotation of engagement member 16a, such that both engagement members 16a, 16b are pivoted inwardly to thereby be retracted out of engagement with the respective radial slot 13a, 13b in the mounting plate 12. Fig. 3b illustrates the actuator 20 and the engagement members 16a, 16b, when the sled 50 has been fully displaced towards the motor 30 and the engagement members 16a, 16b fully retracted out of engagement with the mounting plates' 12 radial slots 13a, 13. The handle device has then reached its un-locked state and the handle 14 may be manually rotated for operating the lock mechanism to retract the bolts (not shown).

**[0044]** For locking the handle device 10, the handle 14 is first pivoted to a position corresponding to a protruding blocking position of the bolts (not shown), where the engagement members 16a, 16b are aligned with the radial slots 13a, 13b. Thereafter the motor 30 is controlled to rotate the output shaft 32 and the drive shaft 40 in the anti-clockwise direction, whereby the helical spring 54, in engagement with the external thread 43 drives the sled 50 to axial displacement away from the motor 30. Thereby the engagement members 16a, 16b are driven to pivot outwardly such that they again engage the respective radial slot 13a, 13b and the handle 14 becomes blocked from rotation.

**[0045]** The resiliency of the engagement portion achieved by forming the engagement portion of a helical spring 54 affords for the advantage that displacement energy may be stored in the spring 54. If for example at locking, either or both engagement members 16a, 16b is/are blocked from entering into engagement with the radial slots 13a, 13b upon rotation of the drive shaft 40, the motor 30 may still fulfil the rotation in the locking direction. Since the engagement members 16a, 16b, the drive arm 52 and the base 51 are prevented from axial displacement, the helical spring 54 is then axially extended, to thereby store energy. As soon as the blocking of the engagement members 16a, 16b is cleared, the energy stored in the helical spring 54 will, under relaxation of the helical spring 54, drive the base 51 and the drive arm axially away from the motor 30, such that the engagement members 16a, 16b enter into engagement with the radial slots 13a, 13. Correspondingly, if the engagement members 16a, 16b or the sled 50 is blocked during

unlocking, rotation of the output shaft 32 and the drive shaft causes the helical spring 54 to be axially compressed to thereby store energy. When the blocking is cleared, the helical spring 54 returns to its relaxed, non-compressed state and the so released energy drives the base 51 and the arm 52 axially to retract the engagement members 16a, 16b out of engagement with the radial slots 13a, 13b.

**[0046]** The handle device 10 also comprises a battery or the like for powering the motor, a control circuit for control of the motor's operation and means for verifying the authority of the person operating the handle device. Such authority verification means may e.g. comprise a keypad, an RFID reader or a reader for Bluetooth, Bluetooth Low Energy (BLE), Ultra Wideband Radio (UWB) or IEEE 802.15.x communication with a handheld device or the like. Such means for powering and control of the motor as well as for authorization verification are well known in the art and are not further described here.

**[0047]** The actuator 20 further comprises a safety means for preventing manipulation for unlocking the handle device 10 by application of impacts or strokes to the handle device. Since the sled 50 is connected to the drive shaft 42 by means of the resilient helical spring 54, impacts or strokes applied to the handle device in the displacement direction of the sled 50, may cause the sled to be resiliently displaced axially without rotating the motor. If such impacts or strokes are applied for displacing the sled in the unlocking direction, towards the motor 30, there is a risk that the engagement members 16a, 16b are brought out of engagement with the radial slots 13a, 13b such that the handle device becomes unauthorized unlocked. However, the electromechanical lock arrangement of the present disclosure comprises a resilient latch which forms an efficient means for preventing such unauthorized manipulation.

**[0048]** Figs. 4 and 5a-d show the manipulation preventing safety means more in detail. Fig. 4 is a perspective view in enlarged scale and seen from another angle of the actuator shown in figs. 3q-b. Figs. 5a-d illustrates some components of the actuator 20 shown in figs. 1 - 3 in greater detail. Figs. 5a-d show the motor 30 and the drive shaft 40 being fixed to the output shaft 32 (fig. 1). As described above, the drive shaft 40 comprises a fixation portion 41 arranged proximal to the motor 30 and a drive portion 42 arranged at or in proximity to the free end of the drive shaft 40. The fixation portion 41 forms a first shaft portion having a first outer diameter. A waist portion 44 forming a second shaft portion having a second outer diameter is arranged axially between the fixation portion 41 and the drive portion 42. The first diameter is greater than the second diameter, such that a shaft shoulder 45 is formed between the first 41 and second 44 shaft portions. The shaft shoulder 45 forms a stop surface which is arranged at a first axial position of the drive shaft 40. In the shown example, the stop surface is arranged perpendicular to the longitudinal direction of the drive shaft 40.

**[0049]** The drive shaft 40 further comprises a number of ramp portions 46a, 46b, 47a, 47b arranged at the shaft shoulder 45. Each ramp portion 46a, 46b, 47a, 47b exhibits a glide surface which is inclined in the circumferential direction of the drive shaft and which connects the smaller diameter of the waist portion 44 with the greater diameter of the fixation portion 41. The ramp portions 46a, 46b, 47a, 47b are arranged in two pairs separated by 180° on the envelope surface of the waist portion 44. Each pair comprises two ramp portions 46a, 46b and 47a, 47b respectively, wherein the ramp portion in each pair have mutually opposite circumferential inclination.

**[0050]** The actuator 20 further comprises a resilient latch 56 which is fixed to the base 51 of the sled 50. In the shown example, the resilient latch 56 is generally U-shaped and comprises an intermediate portion 57 and two resilient legs 58a, 58b which extend mutually in parallel when the resilient latch is relaxed. The resilient latch 56 is formed of a flat spring band which has been bent into the general U-shape. The resilient latch 56 is fixed to the base 51 of the sled 50 by the intermediate portion 57 being received in an elongate through opening 51a (figs. 3a, 3b and 4) arranged in the base. As best seen in figs. 5a-d, the resilient legs 58a, 58b, when in the relaxed state, straddles the second portion 44 of the drive shaft 40.

**[0051]** As apparent from figs. 4 and 5a, the resilient latch 56 may slide axially along the second portion 44 of the drive shaft 40 when the resilient legs 58a, 58b are relaxed. However, as long as the drive shaft is not rotating, the resilient latch 56 is prevented from passing along the drive shaft from the second, intermediate shaft portion 44 to the first, fixation portion 41. At such axial relative displacement in a first direction towards the motor, the side edges of the relaxed legs 58a, 58b will make contact with the stop surface 45 or either of the ramp portions' side surfaces facing the intermediate shaft portion 44. By this means, the resilient latch 56 and thereby the sled 50 is, at axial displacement in the first direction towards the motor 30, prevented from passing the first axial position defined by the stop surface 45 as long as the drive shaft is not rotating. Thus, at manipulation attempts, such that by striking the handle device for bringing the engagement members 16a, 16b out of engagement with the radial slots 13a, 13b, without rotating the drive shaft 40, the sled 50 will not be able to pass the first axial position and thereby the engagement members 16a, 16b will not be brought out of engagement with the radial slots 13a, 13b. The resilient latch 56, in combination with the shaft shoulder 45 thus efficiently prevents any such manipulation attempts by striking or impacting the handle device.

**[0052]** On the other hand, when the motor 30 and the driving shaft 40 are rotated in the clockwise, unlocking direction and the sled 50 is driven towards the motor 30 by the helical spring 54 being in engagement with the rotating thread portion 43, the resilient legs 58a, 58b will make contact with a respective inclined ramp portion 46a, 47a (see fig. 5a-b). As shown in figs. 5b-c, during con-

tinued rotation, the inclined ramp portions 46a, 47a will gradually force the respective leg 58a, 58b to flex radially outwards, under tensioning of the resilient legs 58a, 58b. During this widening, resilient bending of the legs 58a, 58b, the resilient latch 56 and the sled 50 are prevented from further displacement in the first direction and the helical spring 54 is thereby compressed. When the resilient legs 58a, 58b have been resiliently bent outwardly such that they are brought in level with the envelope surface of the first fixation portion 41 of the drive shaft, the energy stored in the compressed helical spring 56 pushes the sled 50 and the resilient latch 56 further in the first direction towards the motor 30 (see fig. 5d). Thereafter, continued rotation of the drive shaft 40 in the clockwise unlocking direction causes the sled 50 to complete its axial displacement to the final unlocking position such that the engagement members 16a, 16b are retracted from the radial slots 13a, 13b and the handle device is unlocked.

**[0053]** When the motor 30 and the drive shaft 40 are driven for rotation in the anti-clockwise locking direction, the helical spring 56 engages the external thread portion 43 and drives the sled 50 in the second axial direction away from the motor 30 and the engagement members 16a, 16b are brought into engagement with the radial slots to thereby lock the handle device 10 as described above. When the resilient latch 56 reaches the shaft shoulder 45, the tensioning of the previously outwardly bent legs 58a, 58b causes the legs to resume the relaxed state and thereby to make contact with the envelope surface of the second intermediate portion 44 of the drive shaft 40.

**[0054]** The actuator 20 thus provides a simple means for authorized electric locking and unlocking of the handle device at the same time as it efficiently prevents manipulation such as by applying impacts or strikes for bringing the engagement members out of locking engagement with the radial slots 13a, 13b.

**[0055]** In the above described example, the electromechanical lock arrangement constitutes an electromechanical handle device. It is however realized that the electromechanical lock arrangement of the present disclosure also may be constituted by many other lock arrangements wherein certain components are movable by means of an electric actuator. Examples of such other electromechanical lock arrangements are mortise lock cases housing a lock mechanism and lock cylinders.

**[0056]** The aspects of the present disclosure have mainly been described above with reference to a few embodiments and examples thereof. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims. For example, the engagement portion of the sled may, instead of being formed as a separate helical spring, be formed integral with the sled. In such case the sled with engagement portion may be formed in one piece of a resilient material such as a pol-

ymmer material and the engagement portion may be formed as one or several protruding legs arranged to engage the external tread. The resilient latch need not be provided with two resilient legs. The resilient latch may instead comprise a single resilient leg or more than two resilient legs. Alternatively the resilient latch may comprise other means which is able to pass a stop arranged on the drive shaft or elsewhere only during rotation of the drive shaft.

**[0057]** As readily understood, the electric actuator may find several other applications in an electromechanical lock than the ones described above. E.g. the actuator may be arranged to linearly displace or rotate other components of a lock mechanism such as internal latching means, deadlocking means or the like, especially where it is desirable to prevent forced motion of such components by impacts or strokes applied to the electromechanical lock arrangement.

### Claims

1. Electromechanical lock arrangement (10) with an electric actuator (20) which actuator comprises;

- an electric motor (30) with a bidirectionally rotatable output shaft (32),
- a drive shaft (40) which is connected to or formed integral with the output shaft (32) and which comprises an external helical thread portion (43), and
- a linearly displaceable sled (50) comprising an engagement portion which is arranged to engage the external thread portion (43) for driving the sled (50) longitudinally along the rotational axis upon rotation of the drive shaft (40),

#### characterized in that

the sled (50) comprises a resilient latch (56) which is arranged to block longitudinal displacement of the sled (50) in a first longitudinal direction, at a first axial position when the drive shaft (40) is not rotating and to allow longitudinal displacement of the sled (50) in the first longitudinal direction, past the first axial position, when the drive shaft (40) is rotating.

2. Electromechanical lock arrangement according to claim 1, wherein the drive shaft (50) exhibits a shaft shoulder (45) forming a stop arranged at said first axial position, between a first shaft portion (41) having a first diameter and a second shaft portion (44) having a second diameter, which is smaller than the first diameter.

3. Electromechanical lock arrangement according to claim 2 or 3, wherein the shaft shoulder (45) defines a stop surface which is essentially perpendicular to the longitudinal direction of the drive shaft 40.

4. Electromechanical lock arrangement according to claim 2 or 3, wherein the drive shaft (40) comprises at least one ramp portion (46a, 46b, 47a, 47b) which is inclined in the circumferential direction of the drive shaft (40) and arranged at the shaft shoulder (45).

5. Electromechanical lock arrangement according to claim 4, wherein the drive shaft (40) comprises at least one pair of ramp portions each pair comprising two ramp portions (46a, 46b, 47a, 47b) having opposite inclinations in the circumferential direction of the drive shaft (40).

6. Electromechanical lock arrangement according to any of claim 1 - 5, wherein the resilient latch (56) comprises at least one resilient leg (58a, 58b) which is flexible in the radial direction of the drive shaft (40).

7. Electromechanical lock arrangement according to claim 6, wherein the resilient latch (56) is generally U-shaped and comprises two resilient legs (58a, 58b).

8. Mechanical lock arrangement according to any of claim 1 - 7, wherein the engagement portion comprises a helical spring (54) which is arranged to engage the external thread portion (43).

9. Electromechanical lock arrangement according to claim 8, wherein an end portion of the helical spring (54) is fixed to the sled (50).

10. Electrical lock arrangement according to any of claims 1 - 9, wherein the sled (50) comprises or is connected to a driver (52, 53) arranged to move a blocking device (16a, 16b) between a blocking and a non-blocking position.

11. Electromechanical lock arrangement according to claim 10, wherein blocking device comprises two movable and cooperating engagement members (16a, 16b).

12. Electromechanical lock arrangement according to any of claims 1 - 11, wherein the sled (50) exhibits a through opening which receives the drive shaft (40).

13. Electromechanical lock arrangement according to any of claims 1 - 12 further comprising guide means for rectilinear guiding of the sled.

14. Electromechanical lock arrangement according to any of claims 1 - 13, wherein the actuator is arranged in a handle device (10).

15. Electromechanical lock arrangement according to any of claims 1 - 13, wherein the actuator is arranged

in a mortise lock case.

5

10

15

20

25

30

35

40

45

50

55

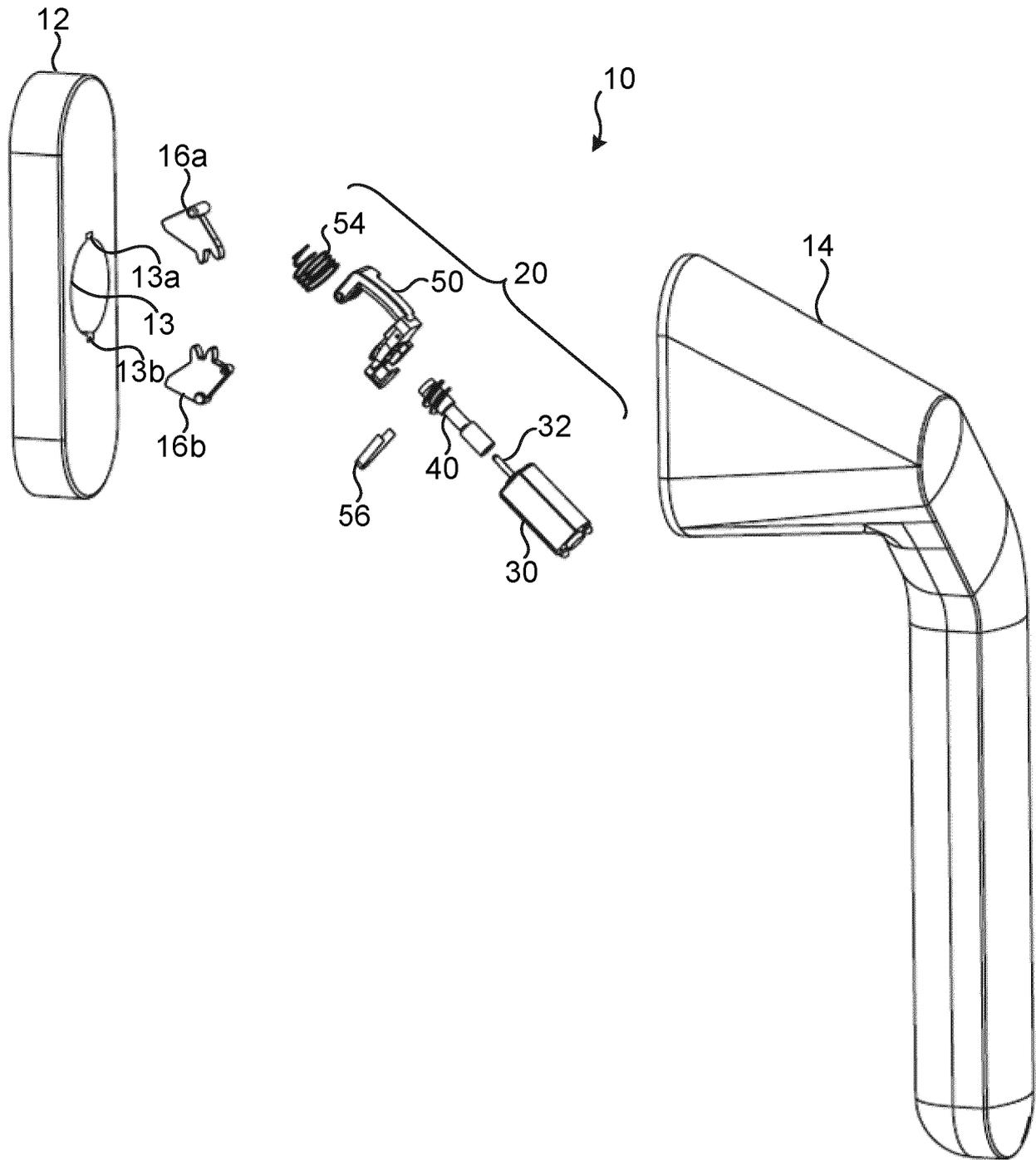


Fig. 1

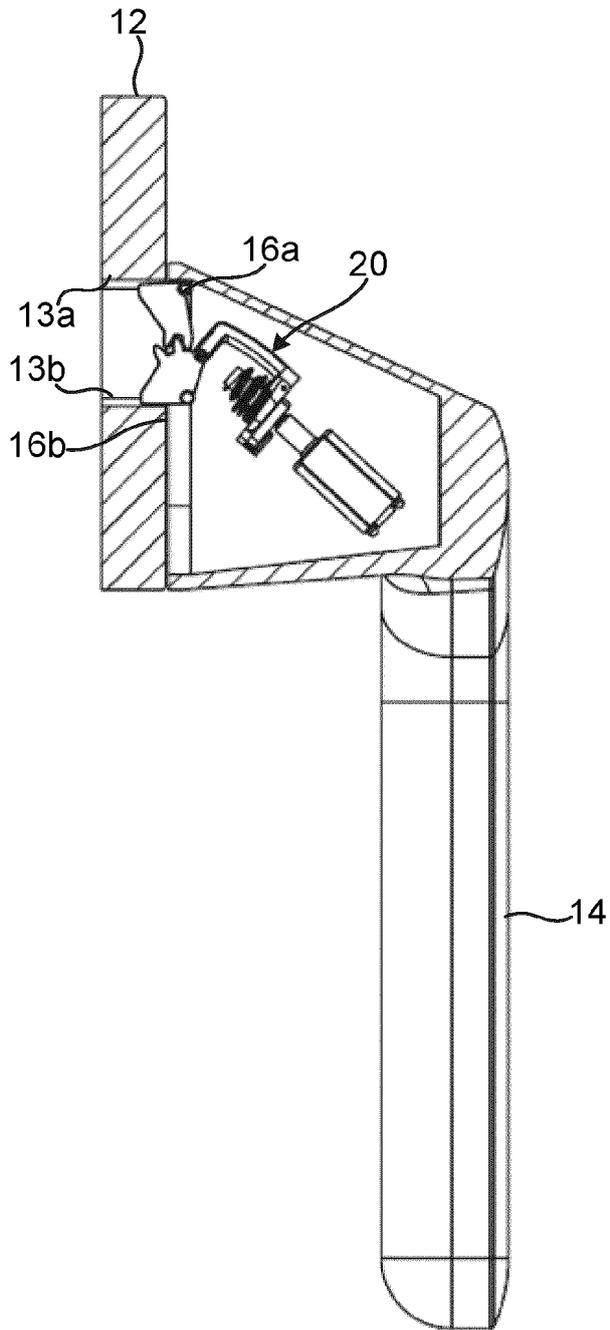


Fig. 2a

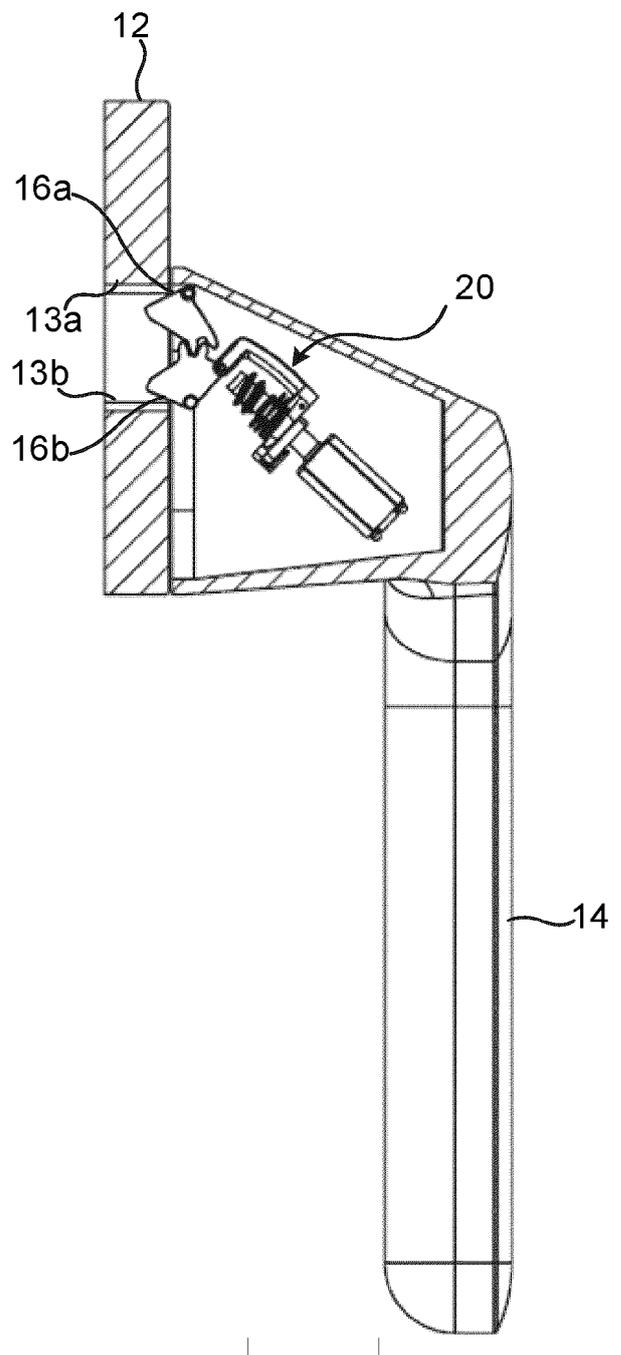


Fig. 2b

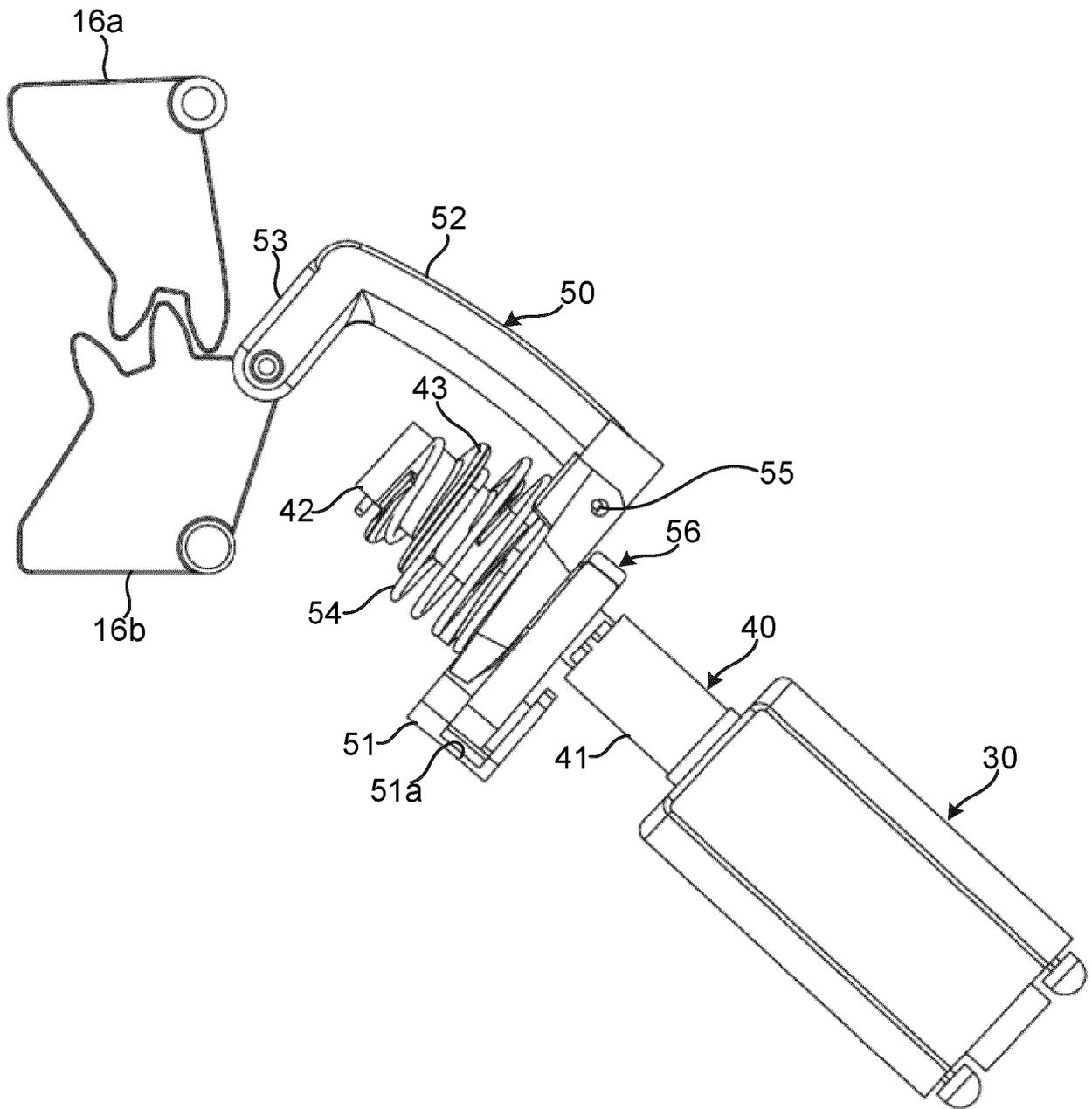


Fig. 3a

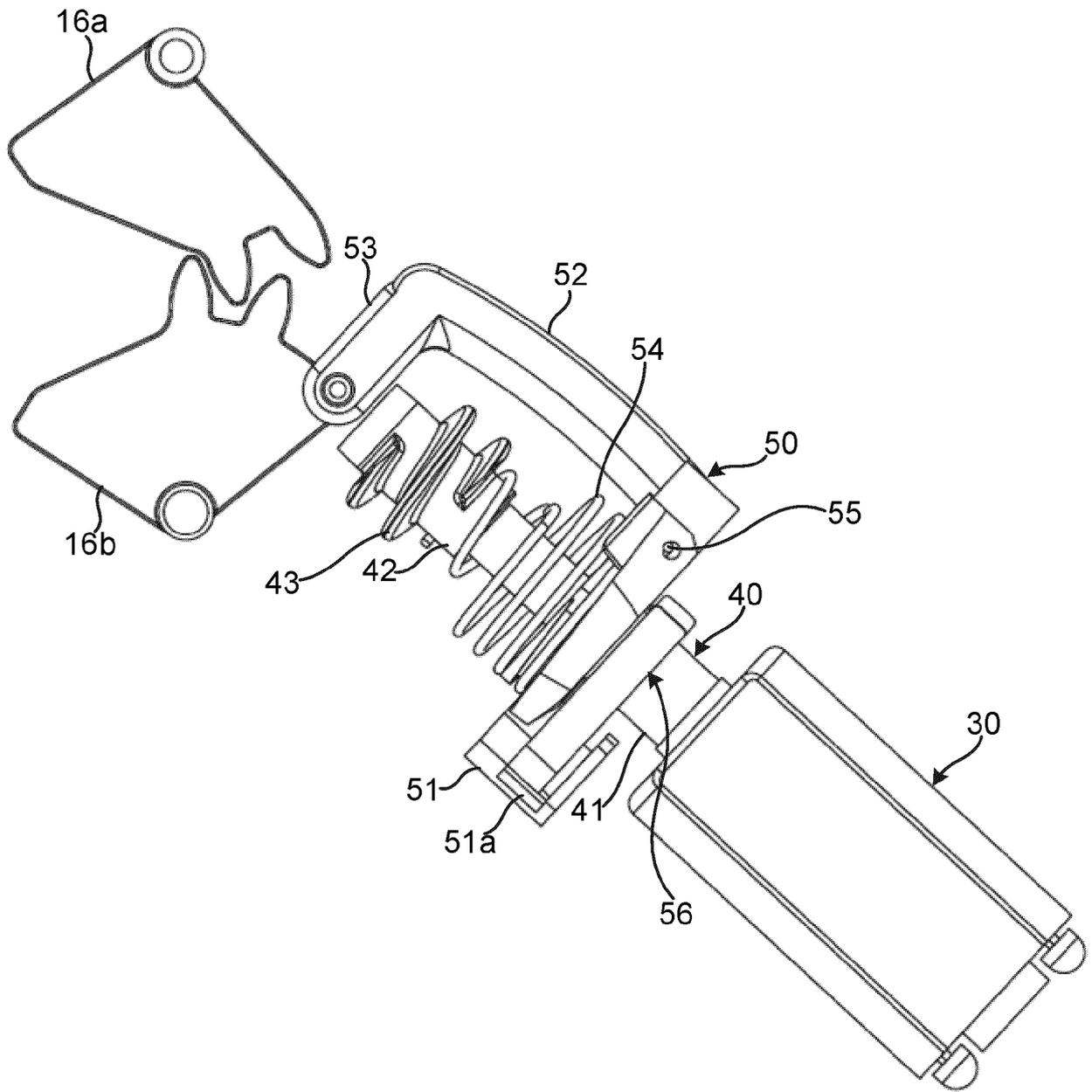


Fig. 3b

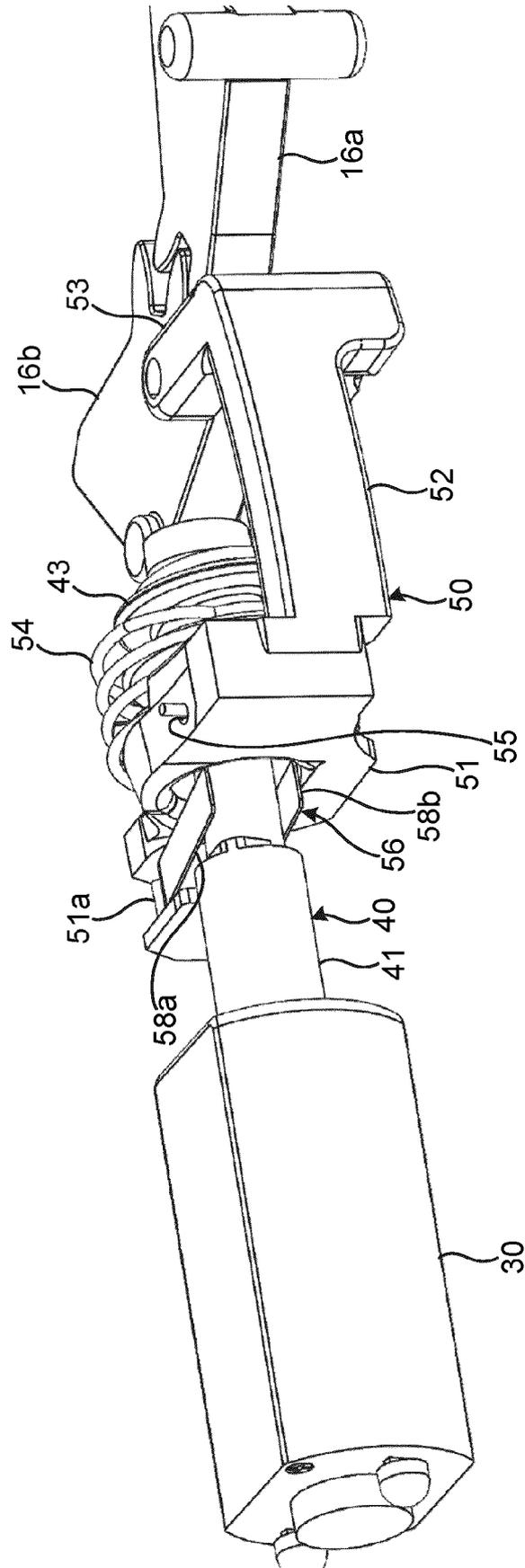


Fig. 4

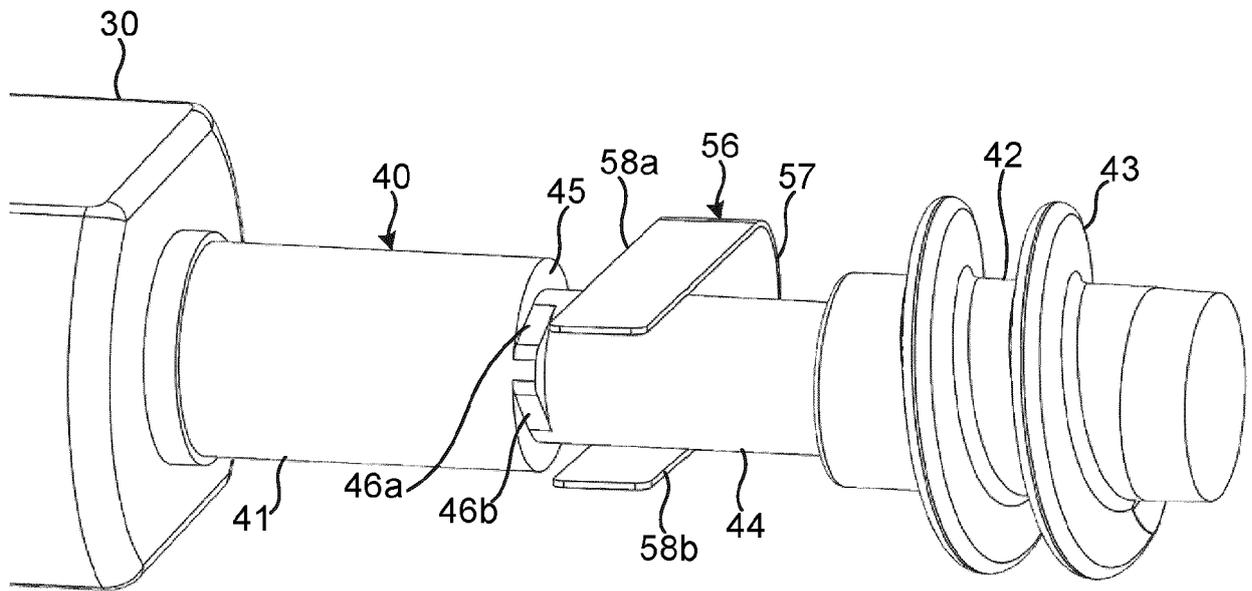


Fig. 5a

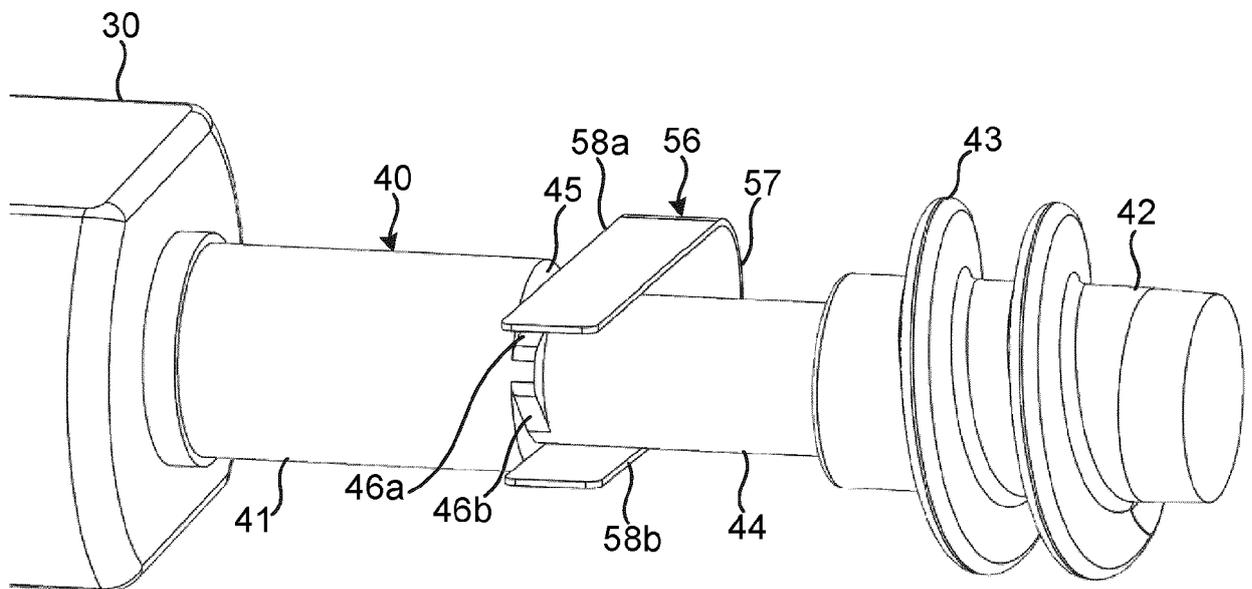


Fig. 5b

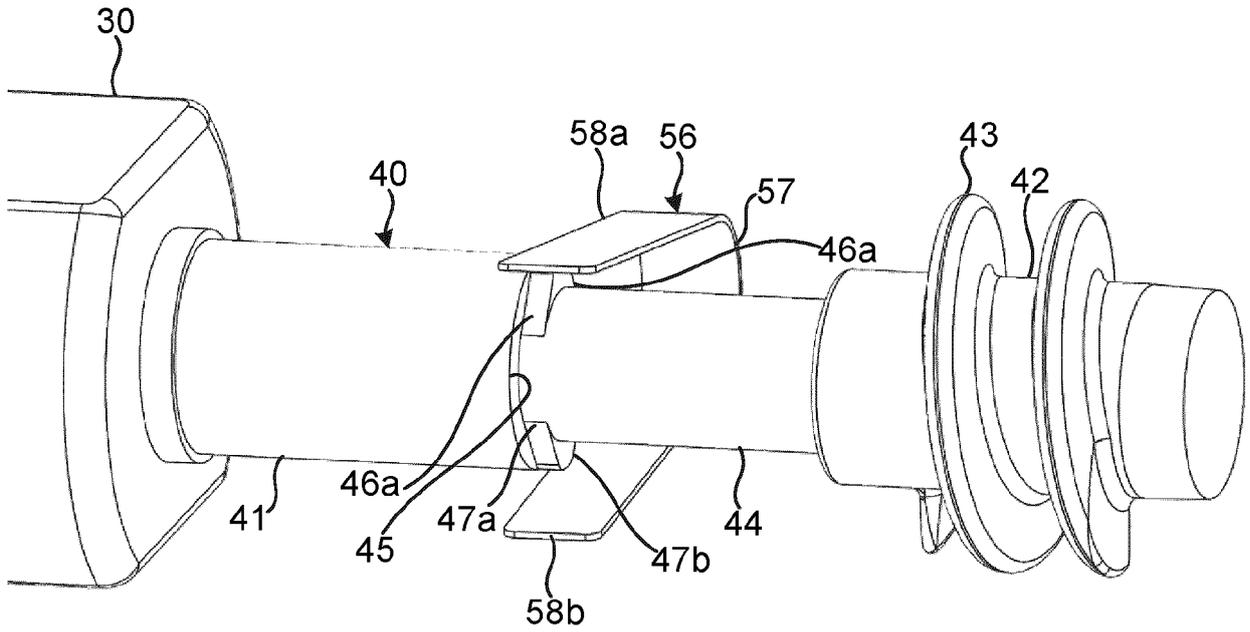


Fig. 5c

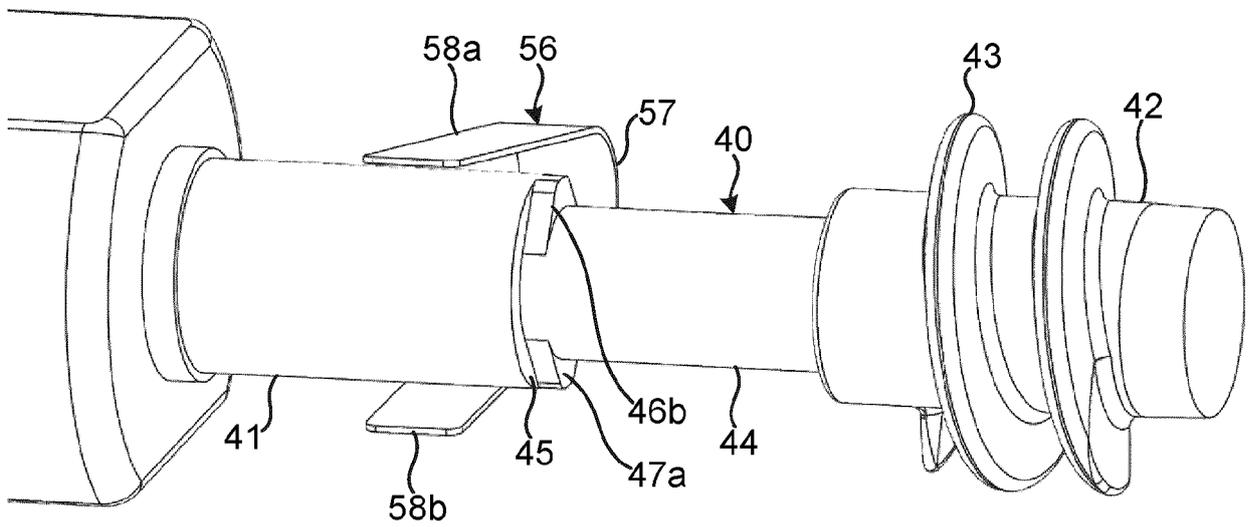


Fig. 5d



EUROPEAN SEARCH REPORT

Application Number  
EP 20 17 9284

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 3 299 553 A1 (ASSA OEM AB) 28 March 2018 (2018-03-28) * paragraphs [0046] - [0049]; figure 1b * -----	1-15	INV. E05B47/0012 E05B47/06 E05B13/005
A	WO 2018/055035 A1 (ASSA OEM AB) 29 March 2018 (2018-03-29) * page 12; figures * -----	1-15	
A	US 2012/198897 A1 (LUI) 9 August 2012 (2012-08-09) * figures * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E05B
Place of search		Date of completion of the search	Examiner
The Hague		16 November 2020	Van Beurden, Jason
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	

EPO FORM 1503 03.02 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 20 17 9284

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-11-2020

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3299553 A1	28-03-2018	AU 2017331936 A1	11-04-2019
		CA 3035930 A1	29-03-2018
		CN 109790725 A	21-05-2019
		DK 3299553 T3	27-04-2020
		EA 201990692 A1	30-08-2019
		EP 3299553 A1	28-03-2018
		JP 2019529750 A	17-10-2019
		KR 20190054133 A	21-05-2019
		US 2019360236 A1	28-11-2019
		WO 2018055035 A1	29-03-2018
-----			
WO 2018055035 A1	29-03-2018	AU 2017331936 A1	11-04-2019
		CA 3035930 A1	29-03-2018
		CN 109790725 A	21-05-2019
		DK 3299553 T3	27-04-2020
		EA 201990692 A1	30-08-2019
		EP 3299553 A1	28-03-2018
		JP 2019529750 A	17-10-2019
		KR 20190054133 A	21-05-2019
		US 2019360236 A1	28-11-2019
		WO 2018055035 A1	29-03-2018
-----			
US 2012198897 A1	09-08-2012	NONE	
-----			

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- EP 1845224 B1 [0008]
- EP 3299553 A1 [0009]
- EP 2314809 B1 [0010]