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(72) Inventor: **Lauer, Andreas**
97230 Estenfeld (DE)

(74) Representative: **Lohr, Jöstingmeier & Partner**
Junkersstraße 3
82178 Puchheim/München (DE)

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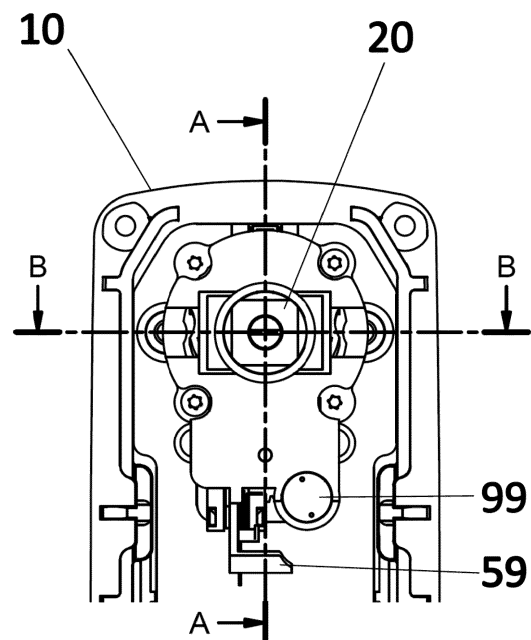
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(71) Applicant: **Uhlmann & Zacher GmbH**
97297 Waldbüttelbrunn (DE)

(54) **CABINET LOCK**

(57) A cabinet lock 1 comprising a housing 10, a shaft 20, at least one blocking member 30, and at least one rotary bearing 12, wherein the rotary bearing 12 rotatably supports the shaft 10 relative the housing 10 and defines a rotational axis 2 of the shaft allows to safely block a rotation of the shaft if the shaft 10 has an axially extending channel 22 being delimited by a channel surface 24, wherein a through hole 26 extends between a peripheral surface 28 of the shaft 20 and the channel surface 24 and if a pair azimuthal abutments 14, 16 is attached to the housing 10 and defines a recess 15 in between of the azimuthal abutments 14, 16, while the blocking member 30 is movably supported in the through hole 26, and movable between an extended position and a retracted position. In the extended position, a radially outward portion of the blocking member 30 extends radially outward out of the through hole 26 and into the recess 15 while another portion of the blocking member 30 is supported by the boundary of the through hole 26. In the retracted position, the blocking member 30 does not interfere with the pair of azimuthal abutments 14,16, while a radially inward portion of the blocking member 30 extends into the channel 22. A movement of the blocking members can be controlled by a movable slider 40, being accommodated in the housing, wherein the slider 40 has a blocking position and an unblocking position. In the blocking position, the slider 40 blocks a movement of the blocking member 30 out of the extended position into to the retracted position and in the unblocking position, the slider 40 clears a void 23 dimensioned to receive at least a radially inward facing portion of the blocking member 30 in the retracted position.

Fig. 2



Description**Field of the invention**

5 **[0001]** The invention relates to a lock for cabinets, mail boxes, lockers, drawers or the like. The lock comprises a housing, at least one blocking member, a shaft and at least one rotary bearing, wherein the rotary bearing rotatably supports the shaft relative the housing and defines a rotational axis of the shaft.

Description of the related art

10 **[0002]** Drawers, cabinets, mail boxes, lockers or the like usually can be considered to come under the subordinate term of a case with a door or a cover plate that prevents access to a volume being enclosed by the case unless the door or cover plate, respectively is opened. To control access to these types of cases so called "cabinet locks" are available. These cabinet locks block or unblock rotation of a handle to retract a latch and/or a bolt (jointly herein 'locking member').
 15 Thus, if the lock is 'open', a user can rotate or otherwise operate (e.g. push) the handle and thereby retract or advance the bolt or latch (i.e. the locking member). If the cabinet lock is 'closed' the movement of the handle is blocked, the bolt cannot be retracted and in some case as well not be advanced. The orientation of the handle in space is an indicator if the cabinet latch or the bolt is advanced or not.

20 **[0003]** These cabinet locks are different from modern electronic door locks in that locking or unlocking a door by advancing or retracting a locking member is controlled by operating a clutch being in between of the handle and the deadlock. If the clutch is closed, the dead bolt is coupled to the handle and hence it can be advanced or retracted. If the clutch is open, the handle is decoupled from the dead bolt, i.e. the door lock cannot be operated by moving the handle.

25 **[0004]** In the past decade electronic access control gained relevance and so-called electronic cabinet locks have been suggested. These electronic cabinet locks can be switched from "locked" to "unlocked" and vice versa by electronic authentication instead of using mechanical keys. Examples for electronic authentication means are key pads that allow to enter a password or identification numbers ("PINs"), transceivers for communication with RFID-cards or scanners for biometric identifiers. In all these cases an identifier (e.g., the password, a cryptokey stored on the RFID-card or a fingerprint) is examined by a lock control. If the identifier is valid, the lock control powers an actuator to thereby switch
 30 the lock from "locked" to "unlocked" or vice versa. In the "locked" state, movement of the handle is blocked and in the unlocked state, the handle can be moved to thereby advance or retract a dead bolt or the like.

35 **[0005]** US 9,273,492 B2 discloses a cam lock for cases like cabinets, drawers and the like. The cam lock has a housing supporting a rotatable shaft. The shaft has a cam at a first end and a knob at the opposite second end. The cam essentially serves as a dead bolt that may be pivoted to engage into a recess of the cabinet to thereby prevent the cover plate from being opened. A notch extends from the peripheral surface of the shaft inwardly. A movable pin may be advanced from
 40 the housing into the notch to block a rotation of the shaft and subsequently retracted to release said blockage and thereby shift the lock from the locked into the unlocked state. The pin is driven by a solenoid or miniature motor.

45 **[0006]** Generally, one may consider using technology that has been proven reliable in the field of door locks for building as well in the fields of cabinet locks, but these locks usually have a clutch mechanism that maintains the handle disconnected from the locking member (latch and/or bolt). Only in case a valid identifier has been presented to the lock control, the clutch is closed and thereby a movement of the handle can drive the latch or bolt. This type of mechanism renders these type of locks particularly safe, however it cannot be used for cabinet locks, because the handle of a cabinet lock serves as a visible indicator and/or haptic indicator for the information if the locking member is retracted or not. Therefore, electronic door locks cannot be simply used as cabinet locks. Beyond, at least in many applications, the costs for an electronic door lock is far above the acceptable price range for a simple cabinet lock.

Summary of the invention

50 **[0007]** The problem to be solved by the invention is to provide a robust and versatile locking mechanism for a cabinet lock being more difficult to manipulate.

[0008] Solutions of the problem are described in the independent claims. The dependent claims relate to further improvements of the invention.

[0009] The invention provides a lock for cabinets, mail boxes, lockers, drawers or the like that allows to block rotation of a shaft relative to a housing of the lock.

55 **[0010]** For example, a first portion of the shaft may be connected and/or coupled to a handle in a torque proof manner. The other portion may be connected and/or coupled to a cam, a bolt, a latch or the like in case the shaft is rotated. Blocking a rotation of the shaft relative to the housing thus allows to ensure that the cam (bolt, latch, etc., herein "locking member" is used as a pars pro toto) remains in its present state, which may be "extended" (the cabinet door cannot be opened) or as well "retracted" (the cabinet door can be opened or closed).

[0011] The lock comprises a housing. In a preferred example, the housing encloses at least most of the other parts of the lock, but this is not required, as the housing may as well be mounted at the inner side of the case to be locked. The housing may thus be or comprise a mounting base or a support, which may be attached to a case, e.g. to a cabinet door or a front plate of the case or to a wall of the case. The lock further comprises at least a shaft being rotatably supported relative to the housing by a rotary bearing. In other words, the shaft is rotatable relative to the housing and hence has a rotational axis. Only for the purpose of conceptual simplicity, we assume herein that the rotational axis coincides with the longitudinal axis of the shaft, however, this is not required. In a preferred example, the angle α_s between the two axes is smaller or equal to at least one of 45° , 30° , 15° , 10° , 5° , 1° , 0° , i.e. $\alpha_s \leq \alpha_{max}$, wherein $\alpha_{max} \in \{45^\circ, 30^\circ, 15^\circ, 10^\circ, 5^\circ, 1^\circ, 0^\circ\}$ and wherein smaller angles α_{max} are preferred. As well, there may be a distance between the two axes, however, it is preferred if the distance is smaller or equal than maximum of the diameter of the shaft.

[0012] The lock further preferably comprises at least one blocking member. As will be explained below, the blocking member can be moved between two positions, namely an extended and retracted position. In the extended position of the blocking member, a rotation of the shaft relative to the housing is blocked and in the retracted position the shaft can be rotated relative to the housing.

[0013] The shaft may further have an at least essentially axially extending channel. In a preferred example, the channel is aligned with the rotational and/or the longitudinal shaft axis. At least essentially axially extending shall be understood to express that a channel axis coincides with the shaft axis within an error margin of $\pm \alpha_e$ and that $|\alpha_e| \leq \alpha_{max}$, wherein $\alpha_{max} \in \{45^\circ, 30^\circ, 20^\circ, 10^\circ, 5^\circ, 2.5^\circ, 1^\circ, 0^\circ\}$, smaller α_{max} are preferred. The channel is delimited by a channel surface. For example, the channel surface is an inner surface of the shaft. As apparent, the shaft may be a hollow shaft or at least have a hollow section.

[0014] Preferably, at least one through hole extends between a peripheral surface of the shaft and the channel surface. The surface delimiting the through hole thus connects the peripheral surface and the channel surface. The through hole may accommodate the blocking member as will be explained below in more detail. In case the lock has multiple blocking members each blocking member may be accommodated in a separate through hole.

[0015] Further, the lock preferably comprises at least one pair of azimuthal abutments with a recess in between. These azimuthal abutments may be attached directly or indirectly to the housing and may even be integrally formed by the housing. In Other words, the at least one pair of azimuthal abutments provides at least one recess in between of each of the two azimuthal abutments forming the respective pair of azimuthal abutments.

[0016] As already mentioned, the blocking member may be movably supported in the through hole and may be movable between an extended position and a retracted position. In the extended position, a radially outward portion of the blocking member may extend radially outward out of the through hole and into the recess between the two azimuthal abutments of the pair of azimuthal abutments, while another portion of the blocking member is supported by the surface delimiting the through hole azimuthally. Thus, if the blocking member is in its extended position, the blocking member interlocks with the shaft and the pair of azimuthal abutments and hence blocks a rotation of the shaft relative to the housing. Of course, the lock may comprise not only one pair of azimuthal abutments, but a higher number (e.g. 2, 3, 4, 5, 6, ...) of pairs of abutments, enabling to lock the shaft in multiple orientations. But it is noted that, a single recess formed by a single pair of azimuthal abutments is sufficient.

[0017] In its retracted position, the blocking member does not interfere with at least one of the azimuthal abutments of the pair, while a radially inward portion of the blocking member extends into the channel. Thus, when moving the blocking member from the extended position to the retracted position it is shifted away from the azimuthal abutments, e.g. towards the longitudinal axis. The interlocking is hence released and the shaft can be rotated relative to the housing.

[0018] The lock may further comprise a movable slider. The movable slider can be movably accommodated in the channel, for example, the slider may be axially movable in the channel. The slider can be movable between a blocking position and an unblocking position. In the blocking position, the slider blocks a movement of the blocking member from the extended position into the retracted position. In the blocking position, a portion of the slider may simply occupy and hence block the space of the channel being required to shift the blocking member into the retracted position. However, when shifting the slider into the unblocking position, the slider clears and hence provides a space and/or a void dimensioned to receive at least the radially inward facing portion of the blocking member in the retracted position. The blocking member can hence be moved into the retracted position if the slider is in the unblocking position and a rotation of the shaft is made possible. In this sense, the position of the blocking member can be controlled by the movable slider. If the lock is blocked, the slider is in its blocking position and a torque being provided to the shaft cannot push the blocking member into the retracted position, not even if the azimuthal abutment blocking the rotation of the blocking member and hence of the shaft has an oblique surface configured to push the blocking member towards the retracted position, because the blocking member simply abuts the slider and is thus prevented, i.e. blocked, from moving into the retracted position. If the slider is, however, moved into the unblocking position, the blocking member's path into the retracted position is cleared. The shaft can thus be rotated, because the blocking member no longer interferes with the azimuthal abutment. Above, it has been assumed that said shifting of the slider is an axial translation of the slider in the channel. This is indeed a preferred example, but the "shift" may as well be a rotation of the slider in the channel or a superposition

of a rotation and a translation. In case the shift is a pure rotation, the terms unblocking position and blocking position should be replaced by "*unblocking orientation*" and a "*blocking orientation*", respectively. The term "*blocking position*" may hence herein be replaced by "*blocking position and/or orientation*" and similarly "*unblocking position*" may hence be replaced by "*unblocking position and/or orientation*", herein. Only for linguistic simplicity, herein, "*blocking position*" and "*unblocking position*" shall be understood as "*blocking position and/or orientation*" and "*unblocking position and/or orientation*", respectively.

[0019] In an example, the azimuthal abutments and/or the slider may have an oblique surface configured to push the blocking member into the retracted and/or extended position, respectively, if the shaft is rotated and/or if the slider is shifted in the blocking position. In addition or alternatively the blocking member may be preloaded towards the extended position or towards the retracted position. Such preload may be provided by an elastic member, like e.g. a spring. In addition or alternatively, the preloading force may be provided by a magnet.

[0020] The movement of the slider may be driven by a motor and hence a lock controller may control shifting the slider from the blocking position to the unblocking position and back in the blocking position by powering or otherwise controlling the motor. In preferred example the slider is coupled to a motor by a transmission. In a particularly preferred example the transmission comprises a safety coupling (a safety clutch) and/or an elastic coupling. The safety coupling and the elastic coupling both allow to operate the motor without monitoring if a movement of the slider is blocked or jammed. In this case, the elastic coupling stores energy and releases it once the jamming is released. In case of a safety coupling the load to the transmission and/or the motor is limited and defects are avoided as the transmission may slip if the force and/or torque to be transmitted by the transmission exceeds a threshold.

[0021] In a preferred example, the lock comprises at least a first lever element (as well "lever element" or "lever", for short). The first lever element is preferably pivotably supported relative to the housing, e.g. by a hinge. The first lever element may be a part of the transmission, i.e. the slider and the motor may be coupled (i.a.) via the lever element.

[0022] The pivot axis of the lever element is preferably least essentially perpendicular (i.e. within the same error margins being introduced above) to the longitudinal axis and/or the rotational axis. The lever may as well be referred to as pivotably supported element and the two terms may be replaced by the respective other.

[0023] The lever is preferably coupled to the slider, i.e. a movement of the lever causes a corresponding movement of the slider. Preferably, the lever has a first end orientation and a second end orientation. If the lever is in its first end orientation, the slider is in its unblocking position. If the lever is in its second end orientation, the slider is in its blocking position. In this sense, the orientations of the lever are associated to positions of the slider and vice versa. Pivoting the lever from a one of the two end positions into the respective other end position hence causes a movement of the slider toward its respective other position.

[0024] The lever may have an opening and the shaft may extend through the opening. Further, the shaft may have an at least essentially axially extending slot and a pin extending through the slot over the peripheral surface of the shaft. The pin preferably extends through the longitudinal shaft axis. If the pin is coupled to the slider, shifting the pin at least essentially axially with respect to the shaft axis and/or the rotational axis in the axially extending slot results in a movement of the slider in the channel. In other words, a movement of the pin parallel to the rotational axis may shift the slider in the respective direction.

[0025] The pin is preferably connected by at least one thrust bearing to the lever, hence a pivotal movement of the lever translates in an axial shift of the pin, wherein "axial shift" references to the shaft axis and/or the rotational axis.

[0026] The optional thrust bearing(s) allows for a rotation of the pin relative to the lever and a pivotal movement of the lever translates into movement of the pin relative to the rotational axis.

[0027] The lever may for example engage into a motor driven worm gear, i.e. it may engage into a thread of a screw (the worm gear) or another kind of gear wheel. In this case, driving the worm gear with a motor pivots the lever and thus shifts the slider in the corresponding direction.

[0028] Preferably, the lever is connected via a spring with a motor. Such spring allows to decouple operation of the motor from pivoting the lever on the time scale. For example, if the blocking member is jammed, because the shaft is torque loaded and/or because the blocking member does not (yet) align with the recess, the motor may load the spring and as soon as the jamming is released the blocking member can be retracted or extended, respectively, by the energy previously stored in the spring. It is not relevant where the spring element is located in the transmission chain: The spring element may be and/or provide an elastic coupling. The spring element may be a part of the transmission and may connect the motor and the (optional) worm gear and/or it may be integrated in the optional lever and/or it may be between the lever and the optional pin and/or between the pin and the optional slider to name only some possibilities. As already apparent, the spring element has the function of a mechanical energy storage means and the terms may be used interchangeably in this context. In another example, the spring may simply allow to load a follower against the worm gear. In case the lever is blocked, the follower may simply be pushed radially with respect to the worm gear until it is no longer in engagement with the thread and 'fall' back into a neighbored thread.

[0029] Preferably, the lever is biased towards its first end orientation, if the lever is in the second end orientation and/or the lever is biased towards its second end orientation, if the lever is in the first end orientation. This biasing ensures that

the transmission connecting the lever to a motor may freewheel if the lever reaches one of the end orientations but reengages reliably if the direction of the motor is inverted. Biasing can be obtained by elastic elements being located at the corresponding end orientations. Alternatively or in addition, a hinge supporting the lever may have end stops and pivoting the lever further than these end stops allow, may elastically deform the lever until it reaches the corresponding end orientation. Other solutions like magnetic preloading may be used as well.

[0030] Preferably, the azimuthal abutments are connected to and/or by at least one ring segment. The ring segment may surround a segment of the peripheral surface. The ring segment further contributes to operational safety as it prevents the blocking member to enter the extended position if it is not aligned with the recess. Rotation of the shaft can thus be blocked only in predefined orientations of the shaft.

[0031] In a particularly preferred example, the ring surface is a plain bearing surface radially supporting the shaft. This allows a very compact and at the same time sturdy lock. For example, the ring surface faced radially inwards. Preferably, the azimuthal extension of the ring segment is greater than the azimuthal extension of the through hole. This measure ensures that in any orientation of the ring segment the shaft cannot be pivoted or pushed radially out of its intended position because the ring segment cannot extend into the through hole.

[0032] Advantageously, the lock comprises at least two pairs of azimuthal abutments and hence a corresponding number of recesses, this allows to lock the shaft in multiple orientations: For example, the shaft may be locked in a first orientation in which the corresponding cabinet (or more generally case) is closed and as well in a second orientation, in which the case is open.

[0033] Advantageously, the lock comprises at least two blocking members and/or at least two pairs of azimuthal abutments. In this case, the lock can withstand an increased torque in its locked state. Further, by selecting a mirror symmetric arrangement (with respect to the rotational axis and/or the shaft axis) of the two blocking members and the recesses being in between the of the azimuthal abutments, the shaft can be locked in at least two orientations. For example, if the lock has four pairs of abutments and thus four recesses a shaft having two blocking members can be locked in at least four different orientations, if the recesses and the blocking members are evenly distributed azimuthally.

[0034] Preferably, the number of recesses may be greater than the number of blocking members. This allows to increase the number of orientations in which the shaft can be locked while keeping costs for blocking members, through holes etc. low.

[0035] The at least one blocking member or at least one of the blocking members, as the case may be, is preferably elastically biased towards its extended position. This biasing provides a tactile feedback to a user of the lock as the user turns the shaft, each time a/the biased blocking member(s) engages into a recess as a continuing the rotation provides an increase of torque to thereby push the blocking member(s) back into the retracted position. Such biasing may be provided by a spring, magnetically or pneumatically. In a preferred example, a biasing spring biases the at least one blocking member towards the extended position. The biasing spring may comprise at least two free legs that are connected by a middle leg and in this sense may be a U-shaped spring. If the blocking member is in the extended position, the void that can be occupied by the slider may be in between of the at least two free legs. In a preferred example, each free leg of the U-shaped spring biases a blocking member towards its extended position.

[0036] The housing may have an indicator window and an arm may be coupled, e.g., attached or otherwise connected to the first lever. Hence the arm pivots together with the first lever. The arm may have at least a first indicator section and this first indicator section is preferably in front of the window if the first lever is in a position in which the slider is in the blocking position or in the unblocking position and not of the slider is the unblocking position or in the blocking position, respectively. The arm may further have a second indicator section and this second indicator section may be in front of the window if the if the first lever is in a position in which the slider is in the unblocking position or in the blocking position and not of the slider is the blocking position or in the unblocking position, respectively. The arm hence provides as reliable and inexpensive indicator showing a user of the lock if rotation the shaft is blocked against a rotation or not.

Description of Drawings

[0037] In the following, the invention will be described by way of example, without limitation of the general inventive concept, on examples of embodiment with reference to the drawings.

Figure 1 shows a side view of a cabinet lock.

Figure 2 shows a detail of a front view of a partially assembled cabinet lock

Figure 3 shows a sectional view of the cabinet lock in the unblocked open state along section plane A-A as indicated in FIG. 2.

Figure 4 shows a sectional view of the cabinet lock in the blocked state along the section plane A-A as indicated in

FIG. 2.

Figure 5 shows an exploded view of a portion of the cabinet lock.

[0038] In FIG. 1 a lock for a cabinet or another kind of case is shown. As can be seen, the lock has a housing 10 and a handle 11, being attached to a shaft 20. In the open state, the handle 11 can be rotated relative to the housing 10 while in closed state the rotation 11 is blocked. The shaft is not necessarily unitary, but it may be. In the depicted example, the shaft comprises a first shaft piece and a second shaft piece that are connected by a permanent rotary coupling, but this is only an example allowing to simplify assembly of the lock. The shaft may support a dead bolt, a cam (i.e. a locking member) or the like. In the present case the shaft is only configured to receive a locking member that rotates with the shaft and thereby allows to block or release a movement of the lock relative to an abutment of a cabinet's housing. Only to declutter the figures, the locking member itself is not depicted, as such locking members are well known and multiply depicted in many varieties in the prior art.

[0039] FIG. 2 shows the lock of FIG. 1, with the housing cover and the handle 11 removed. FIG. 3 is a sectional view long along the plane A-A as indicated in FIG. 2 and FIG. 4 is a sectional view of the same cabinet lock along the same section plane. FIG. 4 differs from FIG. 3 only in that it shows the cabinet lock in the blocked state.

[0040] In FIG. 2 to FIG. 4 the handle 11 has been removed from the shaft 20. The shaft 20 is rotatably supported relative to the housing 10 by rotary bearings 12. In the depicted example, the rotary bearings 12 are plain bearings being formed by corresponding plain bearing surfaces of the shaft 20 and the housing, but other types of rotary bearings 12 (e.g. ball bearings, roller bearings, ...) may be used as well. In the depicted example, the longitudinal axis 2 of the shaft is the rotational axis 2, but this is not required.

[0041] The shaft 20 may comprise an at least essentially axially extending channel 22. The channel 22 may be delimited by a channel surface 24. In the present example, the channel surface 24 provides a plain bearing surface radially supporting a slider 40 in the channel 22. In other words, the slider 40 may move axially in the channel. The slider 40 has an unblocking position (see FIG. 3) and a blocking position (see FIG. 4).

[0042] The shaft 20 further has at least one (shown are two, the number is only a preferred example) through hole 26 (see FIG. 3 to FIG. 5). The through hole 26 extends between the shaft's peripheral surface 28 and the channel surface 24. The through hole 26 preferably accommodates at least one blocking member 30 and supports it azimuthally, wherein azimuthally references to the shaft's axis 2 (see FIG. 3 to FIG. 5). This means that if the shaft 20 is rotated, the at least one blocking member 30 is rotated with the shaft 20. In FIG. 3 and FIG. 4 two blocking members 30 are depicted in their respective extended positions, but other numbers of blocking members 30 are possible as well.

[0043] As shown in FIG. 3 and FIG. 4, the at least one blocking member 30 may be biased by a spring 35 (see as well FIG. 5) towards its extended position. In the extended position, a radially outward portion of the blocking member 30 extends radially over the peripheral surface 28 (see FIG. 5) of the shaft 20 into a recess 15 of the housing 10. In the present example the housing has a couple of portions and as can be seen in FIG. 2 to FIG. 5, recess 15 is provided by a housing portion 10.1.

[0044] As can be seen in FIG. 5, the recess 15 may be delimited in the azimuthal direction by a pair of two azimuthal abutment surfaces 14, 16 in between of which the recess 15 is formed. These azimuthal abutment surfaces 14, 16 are as well referred to as azimuthal abutments 14, 16. Hence, between two recesses 15 is a ring segment, which is preferably delimited in the azimuthal direction by these azimuthal abutments 14, 16. In FIG. 5 the azimuthal abutments 14, 16 of two different recess 15 have been indicated by corresponding reference numerals, but as can be seen, the inner surface of the corresponding portion of the housing portion 10.1 has a number of essentially identical recesses 15, azimuthal abutments 14, 16 and ring segments 17. These are only rotated by an angle relative to the respective next recess 15, azimuthal abutment(s) 14, 16 and ring segment 17.

[0045] If a torque is applied to the shaft 20 while the slider 40 is in its unblocking position as shown in FIG. 3, the blocking members 30 may be pushed against the radial force provided by the spring 35 into their respective retracted positions by the oblique azimuthal abutments 14, 16 (see FIG. 5). In these retracted positions at least a portion of the blocking members 30 extends into a void 23 (see FIG. 3) in the shaft 20, while in turn the radially outward portion of the blocking members 30 no longer interferes with the azimuthal abutments 14, 16 and may pass the ring segments 17. Thus, the shaft 20 can be rotated relative to the housing 10. This rotation can be prevented by shifting the slider 40 into its blocking position being depicted in FIG. 4, because in this blocking position of the slider 40 a portion of the slider extends into the void(s) 23 and thereby prevents the at least one blocking member(s) 30 from being shifted into the (respective) retracted position.

[0046] Generally, the slider 40 may be driven by a motor 99 via an optional transmission. In the example shown in FIG. 3 to FIG. 5, the transmission comprises a lever element 50, briefly referred to as lever 50. The lever 50 is pivotably supported to pivot relative to the housing 10 around a pivot axis 52 and the pivot axis 52 is preferably at least essentially perpendicular to the rotational axis 2 of the shaft and/or the direction of movement of the slider 40 when being shifted from the blocking to the unblocking position.

[0047] The lever 50 may have an opening. The opening may extend around the shaft 20 and may be attached via an elastic element 57 (see FIG. 5) to a worm gear 98 (see FIG. 3 and 4) or another kind of gear wheel, wherein the worm gear 98 may be driven by the motor 99. Thus, if the motor 99 drives the gear 98 the lever 50 may be pivoted between the positions as shown in FIG. 3 and in FIG. 4. Thereby the slider 40 is shifted accordingly as will be explained below

and the lock may be shifted between the blocked and the unblocked state.

[0048] A pin 60 may be movably attached to the lever 50 and extend across the opening of the lever 50 through axially extending slots 29 of the shaft 20. Thus, if the shaft 20 is rotated, the pin rotates with the shaft 20. As shown in FIG. 3 and

[0049] FIG. 4, the pin 60 may be rotatably supported in a ring shaped groove 56 of the lever 50. The ring shaped groove 56 is preferably covered by a groove cover 58 (see FIG. 5) which may be attached to the lever 50 (see FIG. 3 and 4).

[0050] The lever 50 may hence allow for a rotation of the pin 60 relative to the longitudinal axis 2, but transmits forces in the axial direction between the pin 60 and the lever 50, with respect to the axial direction of the shaft 20. The lever 50 and the pin 60 may thus form an integrated thrust bearing (e.g. together with groove cover 58) and/or may be connected via a thrust bearing.

[0051] Further, the pin 60 is attached to the slider 40. Like in the present example, the pin may extend through a through hole of the slider 40. Thus, if the motor 99 drives the worm gear 98, the lever 50 is pivoted and with the lever 50 the pin 60 is pivoted. The pivotal movement of the pin 60 has an axial component and hence the slider 40 is moved axially towards the blocking position (see FIG. 3) or if rotation of the motor is inverted back to the extended position (see FIG. 2). In the example of FIG. 1 to FIG. 5, the connection between the slider 40 and the pin 60 is provided by the pin 60 protruding through a through hole in the slider 40, which though hole is herein referred to as an aperture 41, but only to verbally distinguish the aperture from the through holes 26 accommodating the blocking members 30. It is not required that the pin 60 extends through the slider, all that is required is that the pin 60 or another structure attaches the lever 50 and the slider 40 in a thrust transmissive manner (i.e. by a thrust bearing). In this sense the term pin 60 can be replaced by "structure 60 attaching or coupling the lever 50 to the slider 40".

[0052] As can be seen in FIG. 3 and 4 with FIG. 5, the lever 50 may be coupled to the worm gear 98 by at least one elastic element 57. A portion of the elastic element 57 may engage into the worm gear 98 (or any other kind of gear wheel) and another portion may be attached directly or indirectly to a free end of the lever 50. The elastic element 57 is preferably at least essentially not elastic parallel to the axis of the worm gear and/or the arc being defined by the lever 50 if pivoted, but may be elastic at least essentially perpendicular to the arc. In other words, the elastic element may be elastic at least essentially radially with respect to the pivot axis of the lever, thereby allowing, in case the lever is blocked but the worm gear is driven, the portion of the elastic element 57 to climb over the crest of the gear defining the thread into the next valley of the gear wheel or worm gear as the case may be, thereby preventing the drive mechanism from being damaged. The combination of the elastic element 57 and the worm gear hence provides a very cost effective safety coupling in the transmission connecting the motor 99 and the slider 40. In other words, the motor 99 and the slider 40 may be coupled by a transmission comprising a safety clutch.

[0053] The motor 99 hence drives the movement of the lever 50 from an unblocking orientation (FIG. 3) to a blocking orientation (FIG. 4) of the lever 50, wherein pivoting the lever 50 towards the unblocking orientation causes a movement of the slider 40 towards its unblocking position and pivoting the lever 50 towards the lever's blocking orientation causes the slider 40 to move towards its blocking position. Only to verbally distinguish the unblocking orientation and the blocking orientation of the lever 50 from the unblocking orientation and the blocking orientation of the slider 40, we reference to the unblocking orientation and the blocking orientation of the lever 50 as first end orientation and second end orientation, respectively.

[0054] In case the motor is not stopped -for whatever reason- when the lever 50 reaches one of the two end orientations, the elastic member 57 may reach the end of the thread of the worm gear 98 and may disengage with the thread of the worm gear 98. To prevent that the lever 50 remains stuck in one of the two end orientations, it is preferred that the lever or at least the elastic member 57 is spring loaded towards the respective other end orientation in case it reaches one end. In other words, preferably, the lever 50 (and/or at least the elastic member 57) is biased towards the second end orientation in case the lever 50 is in its first end orientation and/or the lever 50 (and/or at least the elastic member 57) is biased towards the first end orientation in case the lever 50 is in its second end orientation. Said biasing may be obtained by separate elastic elements, but as well by the elasticity of the lever 50 and/or the elastic member.

[0055] As can be seen in FIG. 2, the lock may comprise an indicator arm 59 ("arm 59" for short). The arm 59 may have an indicator (the portion to which the line connecting the arm with the reference numeral 50 ends). In the present example, the indicator defines the free end of the arm. As can be seen in FIG. 2, the indicator arm 59 is pivotably supported relative to the housing and may be coupled (e.g. by any kind of transmission) with the lever 50. Thus the arm 59 moves if the lever 50 moves and the location of the indicator portion of the arm is indicative for the present orientation of the lever 50. As can be seen in FIG. 3 (indicating lock unblocked) and FIG. 4 (indicating lock blocked), the indicator moves accordingly and providing a transparent portion in the housing, i.e. a housing window, allows to indicate the state of the lock without any additional power requirement. Battery life is thus not reduced by the permanent indication. Further, like in the present example, the arm may be biased towards its respective other position and by the coupling between

the arm 59 and thereby, as a result of coupling the lever 50 and the arm 59, the lever 50 may be biased in its end orientations as suggested above.

[0056] Herein "at least essentially" has been used to indicate that a given orientation or direction (parallel, perpendicular, radial, ...) of two parts is preferred. But of course deviations $\pm \alpha$ from the preferred orientation or direction can be accepted. These deviations are preferably smaller than a critical angle α_{max} , i.e. $|\alpha| \leq \alpha_{max}$, wherein $\alpha_{max} \in \{45^\circ, 30^\circ, 20^\circ, 10^\circ, 5^\circ, 2.5^\circ, 1^\circ, 0^\circ\}$ and smaller values of α_{max} are preferred.

[0057] As already apparent from the above, the lever is a pivotably supported element and the two terms may be interchanged herein.

[0058] Generally, the lock may not only used to control access to a cabinet, a drawer or the like but as well to control access to doors.

List of reference numerals

Numeral	Item	Indicated in:				
1	Lock	FIG. 1				
10	housing	FIG. 1	FIG. 2			
10.1	housing portion					FIG. 5
11	handle	FIG. 1				
12	rotary bearing			FIG. 3	FIG. 4	
14	azimuthal abutment					FIG. 5
15	recess			FIG. 3	FIG. 4	FIG. 5
16	azimuthal abutment					FIG. 5
17	ring segment					FIG. 5
20	shaft	FIG. 1	FIG. 2	FIG. 3	FIG. 4	FIG. 5
22	channel			FIG. 3	FIG. 4	
23	space/void/free volume			FIG. 3		
24	channel surface			FIG. 3	FIG. 4	
26	through hole			FIG. 3	FIG. 4	FIG. 5
28	peripheral surface			FIG. 3	FIG. 4	FIG. 5
29	slot			FIG. 3	FIG. 4	FIG. 5
30	locking member			FIG. 3	FIG. 4	
35	spring biasing the blocking members			FIG. 3	FIG. 4	
40	slider			FIG. 3	FIG. 4	
41	aperture (through hole in slider)					FIG. 5
50	lever			FIG. 3	FIG. 4	
52	pivot axis			FIG. 3	FIG. 4	
56	thrust bearing / ring shaped groove			FIG. 3	FIG. 4	
57	Spring /elastic member			FIG. 3		FIG. 5
58	groove cover			FIG. 3		FIG. 5
59	arm		FIG. 2	FIG. 3	FIG. 4	
60	pin			FIG. 3	FIG. 4	
98	worm gear /gear wheel			FIG. 3	FIG. 4	
99	motor			FIG. 3	FIG. 4	

Claims

1. A lock (1) comprising a housing (10), a shaft (20), at least one blocking member (30), and at least one rotary bearing (12), wherein the rotary bearing (12) rotatably supports the shaft (20) relative to the housing (10) and defines a rotational axis (2) of the shaft (20),
characterized in that

- the shaft (20) has an axially extending channel (22) being delimited by a channel surface (24),
- at least one through hole (26) extends between a peripheral surface (28) of the shaft (20) and the channel surface (24),
- at least one pair azimuthal abutments (14, 16) is attached to the housing (10) and defines a recess (15) in between of the azimuthal abutments (14, 16),
- the blocking member (30) is movably supported in the through hole (26), and movable between an extended position and a retracted position,
- in the extended position, a radially outward portion of the blocking member (30) extends radially outward out of the through hole (26) and into the recess (15) while another portion of the blocking member (30) is supported by the boundary of the through hole (26),
- in the retracted position, the blocking member (30) does not interfere with the pair of azimuthal abutment (14, 16), while a radially inward portion of the blocking member (30) extends into the channel (22),
- the channel (22) accommodates a movable slider (40), wherein the slider (40) has a blocking position and an unblocking position,
- in the blocking position, the slider (40) blocks a movement of the blocking member (30) out of the extended position into to the retracted position,
- in the unblocking position, the slider (40) clears a void (23) dimensioned to receive at least a radially inward facing portion of the blocking member (30) in the retracted position.

2. The lock of claim 1, **characterized in that** it further comprises a pivotably supported first lever (50), wherein

- the first lever (50) has a pivot axis (52),
- the pivot axis is perpendicular to the rotational axis,
- the first lever (50) has an opening,
- the shaft (20) extends through the opening,
- the shaft (20) has an axially extending slot (29),
- a pin (60) extends through the slot (29) and is coupled to the slider (40),
- the pin (60) is connected via a thrust bearing to the lever (50).

3. The lock (1) of one of the previous claims, **characterized in that** an actuator (90) is coupled to the first lever (50) and configured to pivot the first lever (50) relative to the pivot axis (52).

4. The lock (1) of one of the claims 2 or 3, **characterized in that** the housing has an indicator window and **in that** an arm (59) is connected to the first lever (50) and pivots with the first lever (50), wherein the arm (59) has at least a first indicator section and this indicator section is in front of the window if the first lever is in a position in which the slider is in the blocking position or in the unblocking position and not of the slider is the unblocking position or in the blocking position, respectively.

5. The lock (1) of one of the previous claims, **characterized in that** the abutments (14, 16) are connected to and/or by a ring segment (17), and **in that** the ring segment (17) surrounds a segment of the peripheral surface (28).

6. The lock (1) of the previous claim, **characterized in that** the ring segment (17) provides a plain bearing surface radially supporting the shaft (20).

7. The lock (1) of one of claims 5 and 6, **characterized in that** the azimuthal extension of the ring segment (17) is greater than the azimuthal extension of the through hole (26).

8. The lock (1) of one of the previous claims, **characterized in that** it comprises at least two blocking members (30) and at least two pairs of azimuthal abutments (14, 16).

9. The lock (1) of one of the previous claims, **characterized in that** the number of recesses (15) is greater than the

number of blocking members (30).

10. The lock (1) of one of the previous claims, **characterized in that** the at least one blocking member (30) if, in its retracted position, is elastically biased towards its extended position.

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Amended claims in accordance with Rule 137(2) EPC.

1. A lock (1) comprising a housing (10), a shaft (20), at least one blocking member (30), and at least one rotary bearing (12), wherein the rotary bearing (12) rotatably supports the shaft (20) relative to the housing (10) and defines a rotational axis (2) of the shaft (20), wherein

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- the shaft (20) has an axially extending channel (22) being delimited by a channel surface (24),
- at least one through hole (26) extends between a peripheral surface (28) of the shaft (20) and the channel surface (24),
- at least one pair azimuthal abutments (14, 16) is attached to the housing (10) and defines a recess (15) in between of the azimuthal abutments (14, 16),
- the blocking member (30) is movably supported in the through hole (26), and movable between an extended position and a retracted position,
- in the extended position, a radially outward portion of the blocking member (30) extends radially outward out of the through hole (26) and into the recess (15) while another portion of the blocking member (30) is supported by the boundary of the through hole (26),
- in the retracted position, the blocking member (30) does not interfere with the pair of azimuthal abutment (14, 16), while a radially inward portion of the blocking member (30) extends into the channel (22),
- the channel (22) accommodates a movable slider (40), wherein the slider (40) has a blocking position and an unblocking position,
- in the blocking position, the slider (40) blocks a movement of the blocking member (30) out of the extended position into to the retracted position,
- in the unblocking position, the slider (40) clears a void (23) dimensioned to receive at least a radially inward facing portion of the blocking member (30) in the retracted position,

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characterized in that

the at least one blocking member (30) if, in its retracted position, is elastically biased towards its extended position.

2. The lock of claim 1, **characterized in that** it further comprises a pivotably supported first lever (50), wherein

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- the first lever (50) has a pivot axis (52),
- the pivot axis is perpendicular to the rotational axis,
- the first lever (50) has an opening,
- the shaft (20) extends through the opening,
- the shaft (20) has an axially extending slot (29),
- a pin (60) extends through the slot (29) and is coupled to the slider (40),
- the pin (60) is connected via a thrust bearing to the lever (50).

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3. The lock (1) of claim 2, **characterized in that** an actuator (90) is coupled to the first lever (50) and configured to pivot the first lever (50) relative to the pivot axis (52).

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4. The lock (1) of one of the claims 2 or 3, **characterized in that** the housing has an indicator window and **in that** an arm (59) is connected to the first lever (50) and pivots with the first lever (50), wherein the arm (59) has at least a first indicator section and this indicator section is in front of the window if the first lever is in a position in which the slider is in the blocking position or in the unblocking position and not of the slider is the unblocking position or in the blocking position, respectively.

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5. The lock (1) of one of the previous claims, **characterized in that** the abutments (14, 16) are connected to and/or by a ring segment (17), and **in that** the ring segment (17) surrounds a segment of the peripheral surface (28).

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6. The lock (1) of the previous claim, **characterized in that** the ring segment (17) provides a plain bearing surface radially supporting the shaft (20).

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7. The lock (1) of one of claims 5 and 6, **characterized in that** the azimuthal extension of the ring segment (17) is greater than the azimuthal extension of the through hole (26).
8. The lock (1) of one of the previous claims, **characterized in that** it comprises at least two blocking members (30) and at least two pairs of azimuthal abutments (14, 16).
9. The lock (1) of one of the previous claims, **characterized in that** the number of recesses (15) is greater than the number of blocking members (30).

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Fig. 1

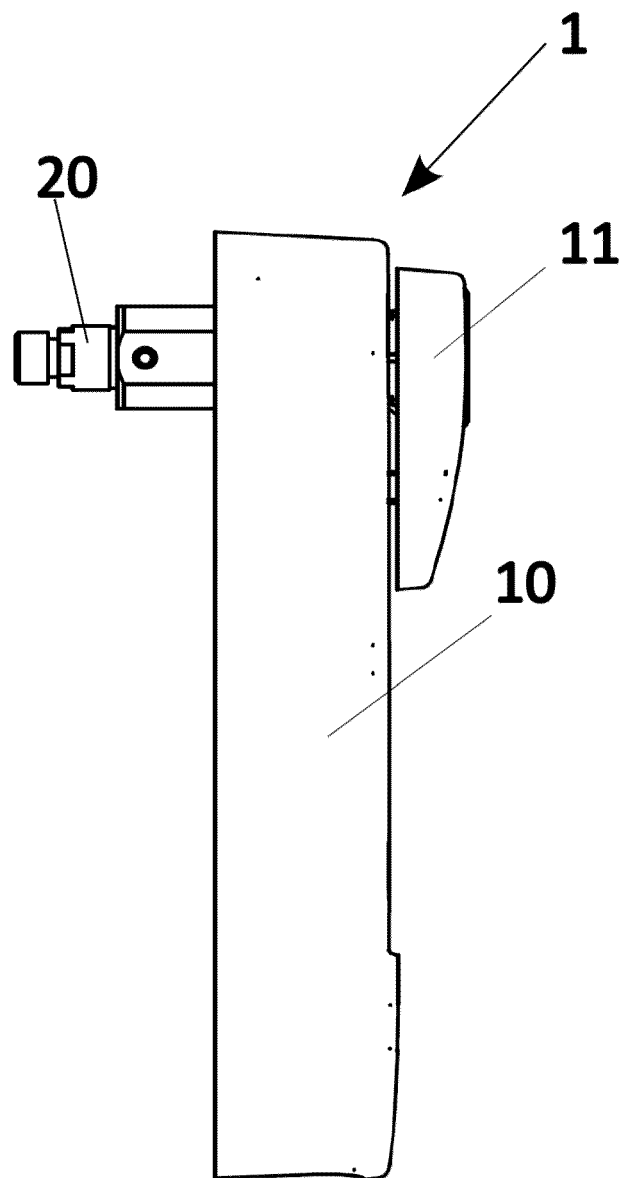


Fig. 2

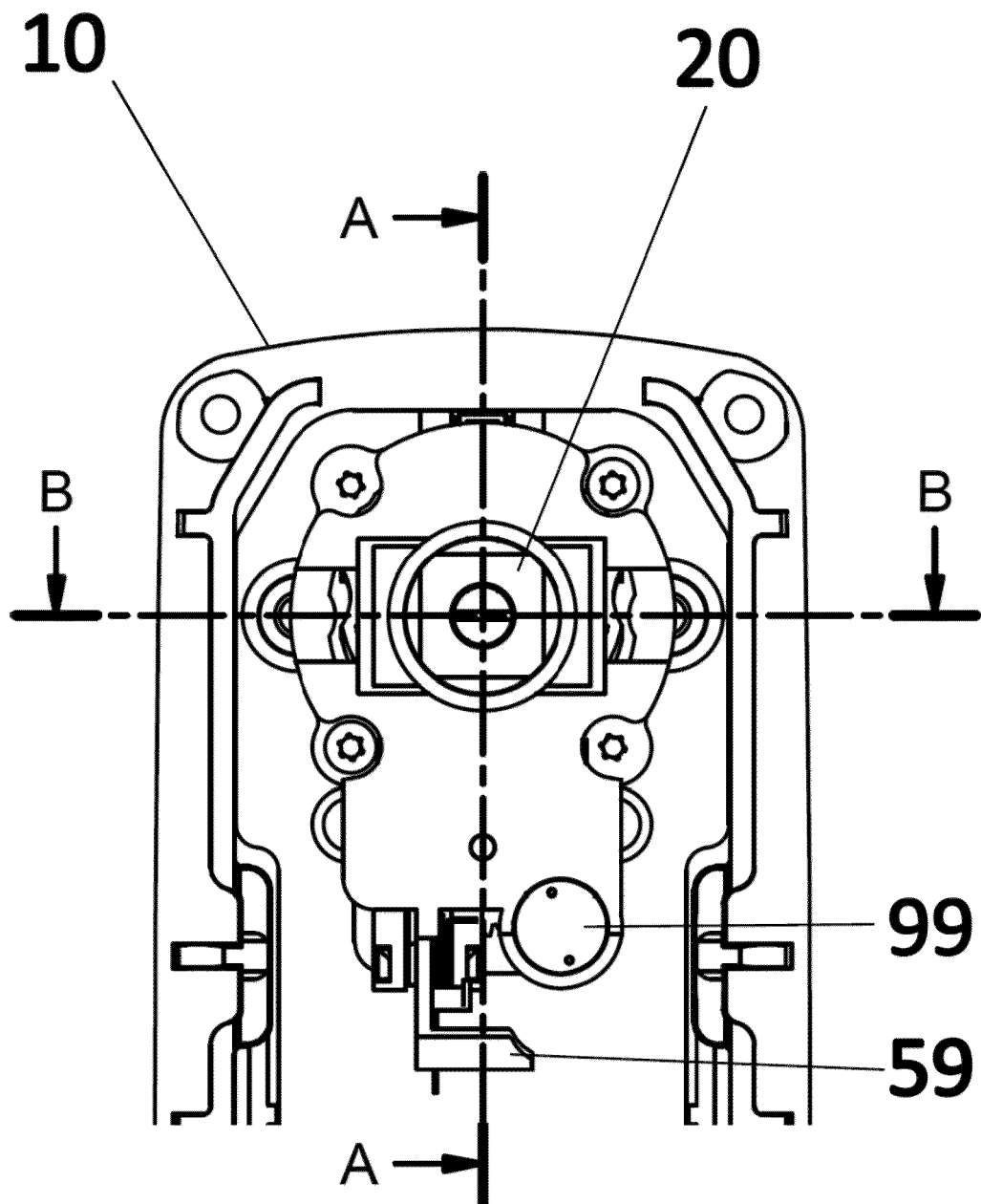


Fig. 3

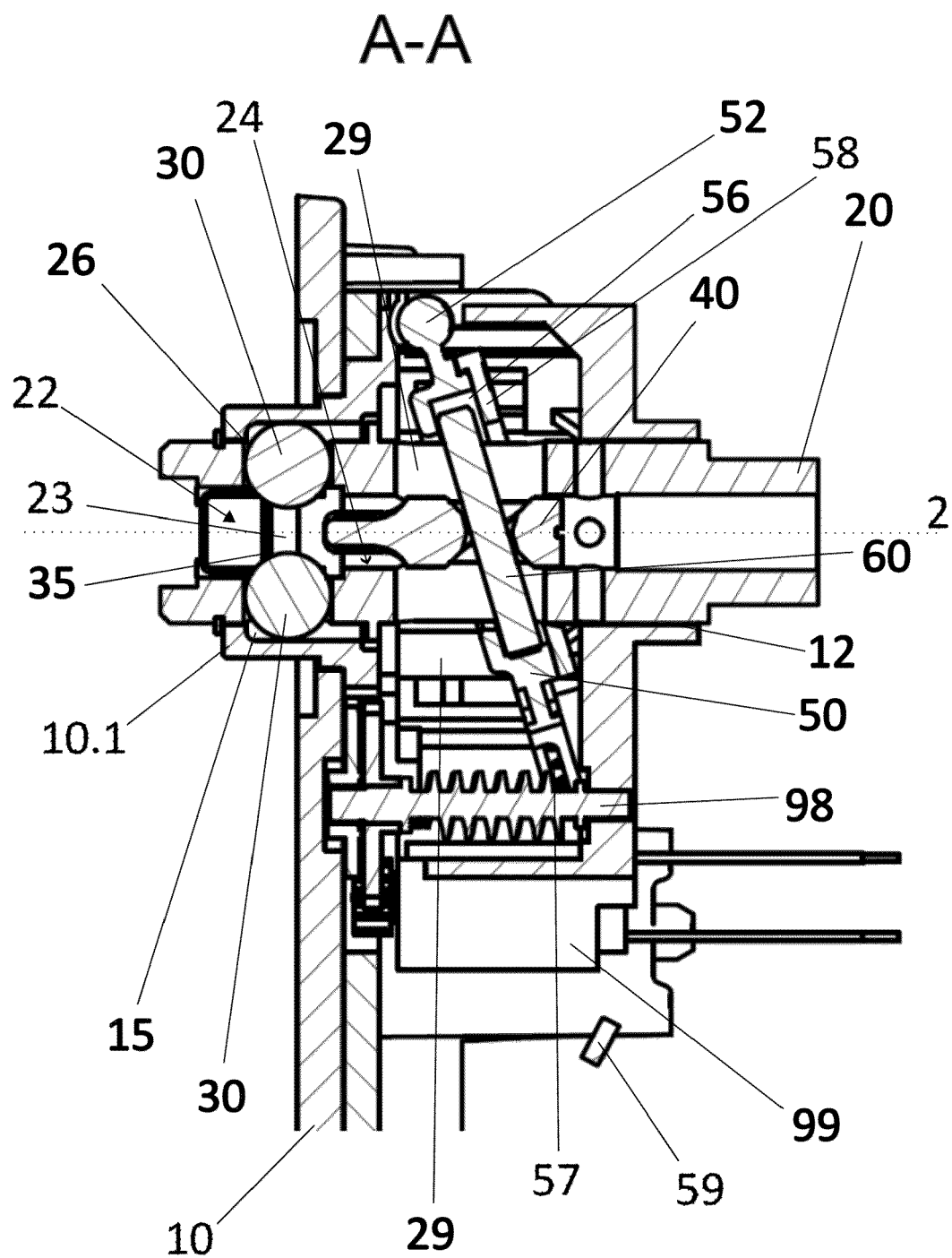


Fig. 4

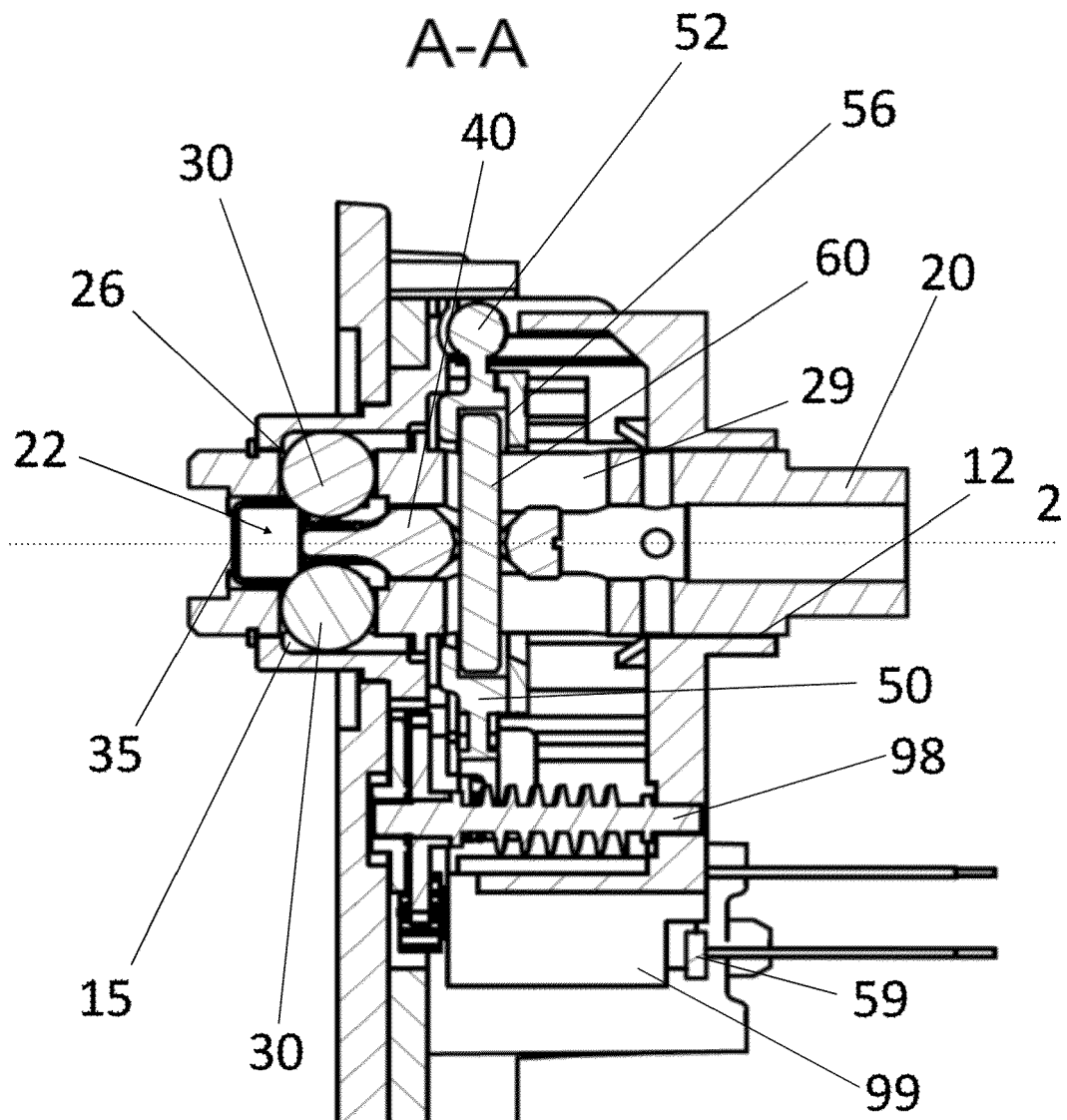
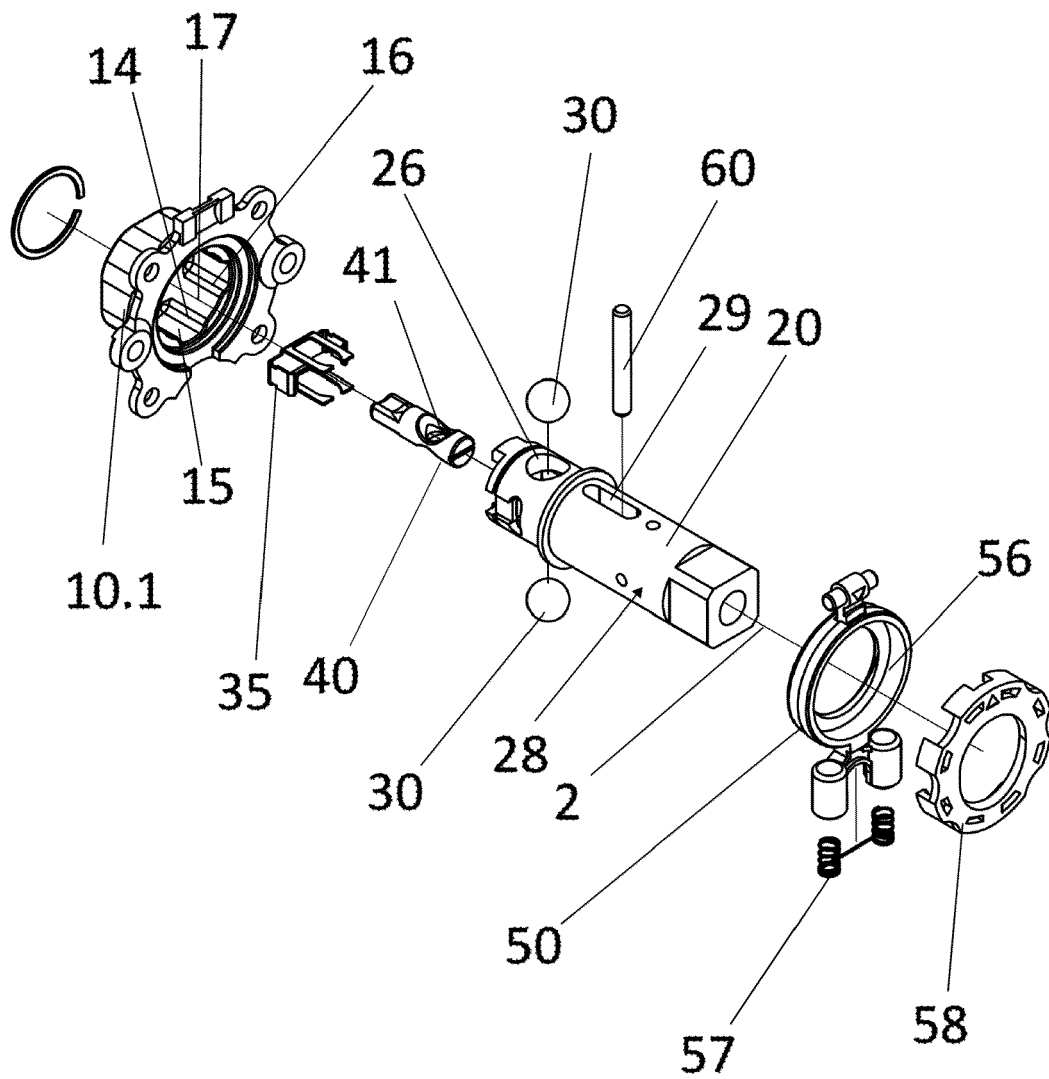


Fig. 5





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