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(54) **A LOCK FOR A HINGED CLOSURE MEMBER**

(57) A lock (1) comprising: a frame (4); a dead bolt (3) and a latch bolt (2) both slideably mounted on the frame; a dead bolt lever (37) and a second turn latch bolt lever (55) both pivotally mounted on the frame; and a slideable second turn latch bolt driver (49) interposed between the dead bolt lever and the second turn latch bolt lever. The dead bolt lever and the second turn latch bolt driver comprise mutually cooperating guiding means to guide the second turn latch bolt driver. The mutually cooperating guiding means comprise: an elongated slot (54) and a separate guiding member (48) extending therethrough. The separate guiding member can be manufactured with a very low tolerance and can be accurately positioned with respect to the dead bolt lever or the second turn latch bolt driver. The elongated slot can be made narrower, thereby decreasing the leeway between the dead bolt lever and the second turn latch bolt driver.

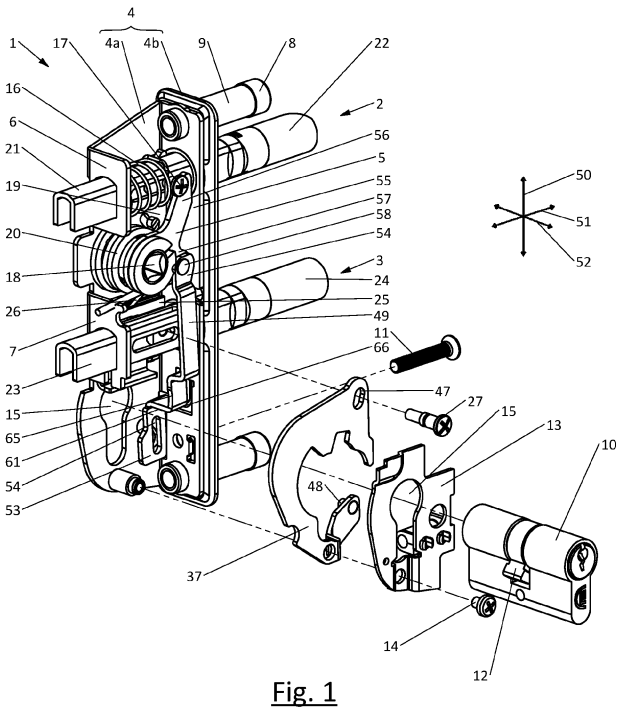

Fig. 1

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Description

Technical field

[0001] The present invention relates to a lock for a hinged closure member, such as a gate or door. The present invention particularly relates to a safety lock for outside gates, doors or fences which allows to open the gate or door with a key.

Background art

[0002] Locks for a hinged closure member are known in the art and examples are disclosed in EP 1 118 559 A1 and EP 2 915 939 A1.

[0003] The lock disclosed in EP 1 118 559 A1 has a dead bolt and a latch bolt, both operable to be moved in a retracted and a projecting position. The dead bolt is operated by a dead bolt lever. The latch bolt is operated by a latch bolt lever which is connected to a handle. The lock further has a key operated cylinder with a rotary driving bit. The rotary driving bit engages with the dead bolt lever to move the dead bolt between its retracted and projecting positions. In both of these positions the dead bolt is locked by means of locking means which can be moved upwards, against the action of a spring, by means of the rotary driving bit to unlock the dead bolt just before it is displaced by means of the rotary driving bit. The lock further has a second turn latch bolt lever rotatably mounted on the frame of the lock to move the latch bolt from its projecting position to its retracted position and a second turn latch bolt driver connected between the second turn latch bolt lever and the dead bolt lever to rotate the second turn latch bolt lever. The rotary driving bit is engaging the second turn latch bolt driver to move the latch bolt by operation of the key of the key actuated cylinder.

[0004] A problem with this known lock is that when the dead bolt is undergoing a lot of resistance during operation towards the projecting position of the dead bolt, the rotary driving bit and dead bolt lever may be forced into a relative positioning wherein it is no longer possible to rotate the dead bolt lever with the rotary driving bit. In particular the rotary driving bit may get stuck between the free extremity of the dead bolt lever and the engagement portion of the second turn latch bolt driver when the dead bolt is not correctly locked by the locking means of the lock and is pushed in again by a resilient force exerted onto the dead bolt. In case the rotary driving bit would have passed the engagement portion of the second turn latch bolt driver, it is stuck underneath that engagement portion. In those situations the dead bolt cannot be moved anymore and the lock is blocked. An intervention of a technician is needed to unlock the blocked lock.

[0005] This problem has already been addressed in the lock disclosed in EP 2 915 939 A1 which proposes to solve this problem by providing an auxiliary engagement portion on the dead bolt for engaging the rotary driving bit when said rotary driving bit is rotated in the locking direction. However, this has proven to be an extremely counter-intuitive motion for a user. More specifically, in order to unblock the rotary driving bit when a user desires to unlock the lock, a user has to rotate the key cylinder in the locking direction, i.e. the user has to further rotate in the locking direction when he desires to unlock the lock.

[0006] Another downside to the locks disclosed in EP 1 118 559 A1 and EP 2 915 939 A1 relates to the amount of leeway on the dead bolt in its projection position (up to 5 mm is not uncommon). Such a large tolerance is undesirable as this may lead to malfunctions of the lock, e.g. the dead bolt not properly being caught in a striker.

Disclosure of the invention

[0007] It is an object of the present invention to at least partially alleviate one or more of the above-mentioned disadvantages.

[0008] According to the present invention, a lock for a hinged closure member is disclosed, the lock comprising: a frame; a dead bolt slideably mounted on the frame between a retracted position and a projecting position along a first sliding direction; a latch bolt slideably mounted on the frame between a retracted position and a projecting position and urged to its projecting position by a latch bolt spring; a dead bolt lever pivotally mounted on the frame between a first angular position in which the dead bolt is in its retracted position and a second angular position in which the dead bolt is in its projecting position and configured to move the dead bolt between its retracted and its projecting position; a second turn latch bolt lever pivotally mounted on the frame and configured to move the latch bolt from its projecting position to its retracted position upon rotation in a first rotational direction; and a second turn latch bolt driver interposed between the dead bolt lever and the second turn latch bolt lever and being slideable in a second sliding direction between a rest position and an actuated position, wherein sliding the second turn latch bolt driver from its rest position to its actuated position rotates the second turn latch bolt lever in said first rotational direction to move the latch bolt from its projecting position to its retracted position, wherein the dead bolt lever and the second turn latch bolt driver comprise mutually cooperating guiding means to guide the second turn latch bolt driver between its rest position and its actuated position, wherein the dead bolt lever comprises: a pivot; a first arm extending from the pivot towards the dead bolt; and a second arm extending between a proximal end at the pivot towards a distal end at the second turn latch bolt driver, wherein the mutually cooperating guiding means comprise: an elongated slot extending in said second sliding direction, the elongated slot being provided in said second turn latch bolt driver; and a separate guiding member extending through said elongated slot, the guiding member being mounted on the distal end of said second arm of the dead bolt lever.

[0009] In the known locks disclosed in EP 1 118 559

A1 and EP 2 915 939 A1, the guiding members comprise an elongated slot provided in the bottom region of the second turn latch bolt driver and part of the dead bolt lever. More specifically, a free extremity of the dead bolt lever is folded over to form a transverse protruding section which extends into the elongated slot. The present invention is in part based on realizing that such a folded-over free extremity has a very high manufacturing tolerance. More specifically, it has been found that, due to the manufacturing tolerance, the elongated slot has to be made sufficiently wide. There is therefore a lot of leeway between the dead bolt lever and the second turn latch bolt driver, which leeway is detrimental. For example, in some extreme cases (e.g. very high outdoor temperatures and/or direct sunlight exposure may further increase the leeway) it may hamper normal operation of the second turn latch bolt driver, which may then no longer be able to sufficiently retract the latch bolt.

[0010] According to the present invention, the guiding means comprise (in addition to the elongated slot) a separate guiding member. Such a separate guiding member can firstly be manufactured with a severely decreased tolerance. Secondly, also the positioning of the separate guiding member with respect to the dead bolt lever or the second turn latch bolt driver can be very precise. In conclusion, the manufacturing tolerance is severely reduced so that the elongated slot can be made much narrower, thus decreasing the leeway between the dead bolt lever and the second turn latch bolt driver.

[0011] As the dead bolt lever is the driving component, it is more robust to put the driving component of the guiding means (i.e. the separate guiding member) on the dead bolt lever when compared to the mechanical inversion of placing the separate guiding member on the second turn latch bolt driver.

[0012] In an embodiment the separate guiding member is formed by a pin, in particular a rivet. Although various elements may be used to form the separate guiding member, e.g. a screw, a wheel, a bearing, etc., a pin can, due to its cylindrical shape, be mounted on the dead bolt lever or the second turn latch bolt driver in any orientation. A rivet is a well-known element that can be easily mounted on a plate-shaped part. Although other mounting means could be used, e.g. a screw, bolt, welding, etc., a rivet has the advantage of providing the pin member at the same time as mounting the pin.

[0013] In an embodiment the separate guiding member protrudes only on a single side of the dead bolt lever, the separate guiding member preferably being flush on the opposing side of the dead bolt lever. This allows other components to be placed adjacent the flat side of the dead bolt lever while avoiding interference of the pin.

[0014] In an embodiment the dead bolt lever comprises: a pivot; a first arm extending from the pivot towards the dead bolt; and a second arm extending from the pivot towards the second turn latch bolt driver, one of the elongated slot and the separate guiding member being provided in or on the second arm. This two-arm construction allows to place the dead bolt lever surrounding a key actuated cylinder of the lock with the first arm being preferably connected to the dead bolt and the second arm being connected to the second turn latch bolt driver. As explained in EP 1 118 559 A1, this allows to have a dead bolt with an enhanced stroke.

[0015] In an embodiment the lock further comprises a key actuated cylinder mounted on the frame and provided with a rotary driving bit having a free extremity arranged to travel along a circular path along a locking direction and an unlocking direction, opposite to said locking direction, upon actuation of said key actuated cylinder, wherein, when the dead bolt lever is in its second angular position, the second turn latch bolt driver is outside said circular path. Preferably, the mutually cooperating guiding means move the second turn latch bolt driver in a direction which is substantially perpendicular to the second sliding direction when the dead bolt lever is moved from its first angular position to its second angular position. Preferably, the frame comprises a front plate having an inner side and an outer side, the latch bolt and the dead bolt both projecting from the front plate in their projecting position, wherein the inner side of the front plate is provided with a recess, the second turn latch bolt driver being at least partially inside said recess when the dead bolt lever is in its second angular position. Having the second turn latch bolt driver outside said circular path when the dead bolt lever is in its second angular position (i.e. when the dead bolt is extended corresponding to a locked position) avoids any possible interference of the second turn latch bolt driver with the key actuated cylinder when unlocking the dead bolt. Using the guiding means to achieve this sideways motion of the second turn latch bolt driver is advantageous as this avoids additional components, i.e. the guiding means have a double function thereby avoiding the need for other components to perform this second functionality. The recess further allows to the lower end of the second turn latch bolt driver moved further radially away from the path of the free extremity of the rotary driving bit. Not providing such a recess would, for a same dimensioned lock, in turn decrease the angle over which the dead bolt lever rotates which, a.o., determines the stroke of the dead bolt. As such, the recess allows increasing the stroke of the dead bolt while maintaining the outer dimensions of the lock as compact as possible.

[0016] In an embodiment the dead bolt lever has a first plate-shaped part and the second turn latch bolt driver has a second plate-shaped part, the separate guiding member being provided on the first plate-shaped part and the elongated slot being provided in the second plate-shaped part. Preferably, the first plate-shaped part and the second plate-shaped part are adjacent one another over an area which is at least twice as wide as a width of the elongated slot, which width is measured in the first sliding direction. Providing the guiding means on or in (depending on which guiding means, e.g. the elongated slot is provided in something while the separate guiding

member is provided on something) plate shaped parts simplifies manufacture and assembly of the lock. Furthermore, using relatively wide plate shaped parts reduces the risk of a torsional motion of the second turn latch bolt driver about the second sliding direction. More specifically, in the known locks disclosed in EP 1 118 559 A1 and EP 2 915 939 A1 the second turn latch bolt driver is typically fixed at its top end to the second turn latch bolt lever while its bottom end is held in place by the guiding means. However, it has been found that the second turn latch bolt driver can undergo torsional motion about the second sliding direction (e.g. the vertical direction). By widening the lower end of the second turn latch bolt lever, which second end is adjacent the dead bolt lever, a torsional motion would cause the plate-shaped parts to abut against one another. By having wider plate-shaped parts, the amount of torsional motion is reduced.

[0017] In an embodiment the second turn latch bolt driver is a folded metal plate. It has been found that folding a metal plate to form the second turn latch bolt driver provides a high strength and robust element with a relatively low manufacturing cost.

[0018] In an embodiment the elongated slot has a width which is about equal to a width of the separate guiding element. There is thus no sideways leeway between the dead bolt lever and the second turn latch bolt driver.

[0019] In an embodiment the second turn latch bolt driver has a first end connected to the second turn latch bolt lever and a second end connected to the dead bolt lever by said separate guiding member. This avoids superfluous components between the second turn latch bolt driver and the dead bolt lever and the second turn latch bolt lever.

[0020] In an embodiment the lock further comprises a key actuated cylinder mounted on the frame and provided with a rotary driving bit having a free extremity arranged to travel along a circular path along a locking direction and an unlocking direction, opposite to said locking direction, upon actuation of said key actuated cylinder, wherein the second turn latch bolt driver is provided with a second turn engagement portion, the rotary driving bit engaging the second turn engagement portion upon rotation of the rotary driving bit in the unlocking direction. Preferably, the rotary driving bit and the second turn engagement portion overlap with one another over a distance of at least 2,5 mm, in particular at least 3 mm, more in particular at least 3,4 mm and most in particular at least 3,7 mm. Preferably, the second turn engagement portion has a width of at least 6 mm, in particular at least 7 mm, more in particular at least 7,5 mm and most in particular at least 8 mm.

[0021] In the known lock disclosed in EP 2 915 939 A1, there is also a second turn engagement portion. However, due to the high tolerances involved in the known lock, there is only an overlap of about 2 mm between the rotary driving bit and the second turn engagement portion, which overlap may even be as low as about 1 mm. However, in this embodiment, the overlap is increased thereby improving the lock robustness and reducing the malfunction risk. In particular, by increasing the overlap, the second turn latch bolt driver is more easily actuated and the risk that the rotary driving bit disengages from the second turn engagement portion prior to having fully actuated the second turn latch bolt driver is decreased.

[0022] Furthermore, in the known lock, the second turn engagement portion only has a width of about 5 mm. The width being measured in line with (i.e. transverse to the circular path) the rotary driving bit when this engages the second turn engagement portion. Furthermore, the known second turn engagement portion is not flat but has a curved region. This curved region is provided in order to strengthen the second turn engagement portion. In the present embodiment, the second turn engagement portion has an enlarged width which results in a stronger element. There is thus no longer a need to provide the curved region and the second turn engagement portion can be entirely flat. This reduces the complexity when manufacturing the second turn latch bolt driver.

[0023] In an embodiment a shortest distance between the pivot and a center of the separate guiding member is between 17 and 25 mm, particularly between 19 and 23 mm and more particularly between 20 and 22 mm, said shortest distance being most particularly about 21 mm. Although the separate guiding member, due to having to be placed on an existing element, cannot form the outer extremity of the second arm of the dead bolt lever (contrary to the known folded over lip), should theoretically be slightly closer to the pivot when compared to the known lock (for a same dimension of the dead bolt lever). It has surprisingly been found that, due to the decreased tolerances, the shortest distance can in fact be the same or slightly larger (1 to 2 mm). This in turn allows the dead bolt lever to rotate over a greater angle and may be used to increase the stroke of the dead bolt.

[0024] The following aspects and embodiments described below represent preferred features which may be used in combination with the present invention described above.

[0025] In a first aspect a lock for a hinged closure member is disclosed, the lock comprising: a frame; a dead bolt slideably mounted on the frame between a retracted position and a projecting position along a first sliding direction; a latch bolt slideably mounted on the frame between a retracted position and a projecting position and urged to its projecting position by a latch bolt spring; a dead bolt lever pivotally mounted on the frame between a first angular position in which the dead bolt is in its retracted position and a second angular position in which the dead bolt is in its projecting position and configured to move the dead bolt between its retracted and its projecting position; and a locking mechanism configured to lock the dead bolt in its retracted and its projecting position, the locking mechanism comprising: a retaining member slideably mounted on the frame between a locking position and an unlocking position, the retaining member comprising a slot extending in the first sliding direction

between a first end and a second end, the slot comprising a first catch at its first end and a second catch at its second end; a biasing member urging the retaining member into its locking position; and a projecting element provided on the dead bolt which extends into said slot, the projecting element being located in said first catch when the deadbolt is in its retracted position and in said second catch when the deadbolt is in its projecting position, wherein the second catch is delimited by a first edge contiguous with said slot, an opposing edge substantially parallel to the first edge, a far edge extending between the first edge and the opposing edge and an inclined edge extending between the first edge and the opposing edge and opposite to the far edge, and wherein the inclined edge has an inclination with respect to the first sliding direction of at least 60° and the opposing edge has length of at most 1,5 times a diameter of a minimal bounding circle of the projecting element.

[0026] In the known lock disclosed in EP 2 915 939 A1, the second catch is formed by a total of five edges: an edge at the bottom of the catch (comparable to the contiguous edge), an upstanding inner edge (comparable to the inclined edge), an upstanding outer edge (comparable to the far edge), a top edge (comparable to the opposing edge), and a sloping edge between the top edge and the upstanding inner edge. In the known lock, the top edge and the sloping edge do not stop a lateral sliding motion of the dead bolt, rather the sliding motion is allowed for the distance between the upstanding edges. In other words, the distance between the upstanding edges determines the dead bolt leeway when in the projecting position. However, the sloping edge does urge the dead bolt towards its most projection position, i.e. towards the projecting element being located at the top edge.

[0027] According to the first aspect, the second catch only has four edges, i.e. the sloping edge has in fact been left out. In particular, the functions of the upstanding outer edge and the sloping edge has been replaced with a single inclined edge having an inclination of at least 60°. This inclination ensures that a user (or other external force) cannot move the dead bolt (i.e. the projecting element thereon) backwards from the projecting position towards the retracted position. The inclination angle is such that this kind of horizontal force is negated without being able to unlock the retaining member in which the slot is located. Furthermore, the opposed (i.e. top) edge is at most 1,5 times a diameter of a minimal bounding circle of the projecting element which is much lower than the combined length of the known sloping edge and top edge. This reduced length determines the leeway on the dead bolt when in the projecting position and is thus minimized.

[0028] In an embodiment the first edge has a length of at least 1,1 times, preferably at least 1,3 times, and more preferably at least 1,4 times, said minimal bounding circle diameter and/or the first edge has a length of at most 2 times, preferably at most 1,7 times, and more preferably at most 1,6 times, said minimal bounding circle diameter, said length being most preferably about 1,5 times said minimal bounding circle diameter. The first edge is the maximal distance between the inclined edge and the far edge and thus provides the maximal leeway distance of the dead bolt in the projecting position. More specifically, while the second catch is formed as a trapezoid and the projecting element is, in ideal circumstances, located at the opposing edge, it may also be that the projecting element is located near the first edge (e.g. when the retaining member has not been able to fully move into the locking position). Due to the inclination of the inclined edge, the dead bolt will still remain locked with a maximal leeway between 1,1 and 2 times the minimal bounding circle diameter of the projecting element.

[0029] In an embodiment the inclined edge has an inclination with respect to the first sliding direction of at least 65° and preferably at least 70°. A higher inclination increases the robustness of the lock. More specifically, the higher inclination reduces the risk that a horizontal sliding force exerted on the dead bolt would somehow be able to slide the retaining member into its unlocking position without having to strengthen the biasing member.

[0030] In an embodiment the opposing edge has length of at most 1,4 times and preferably at most 1,35 times said minimal bounding circle diameter. In other words, in the optimal position of the projecting element when the dead bolt is locked, the dead bolt leeway is further reduced, which is desired.

[0031] In an embodiment the projecting element has a cylindrical form. In such a case the minimal bounding circle is actually the outer circumference of the cylinder. Moreover, this provides for an easy placement as, due to its cylindrical shape, it can be mounted on the dead bolt in any orientation.

[0032] In an embodiment the biasing member comprises a spring, in particular a torsion spring. A (torsion) spring is a known element which has been proven sufficiently strong and robust for outdoors lock applications. The desired or required strength can also be easily modified by revising the spring design.

[0033] In a second aspect a lock for a hinged closure member is disclosed, the lock comprising: a frame; a dead bolt slideably mounted on the frame between a retracted position and a projecting position along a first sliding direction; a latch bolt slideably mounted on the frame between a retracted position and a projecting position and urged to its projecting position by a latch bolt spring; a dead bolt lever connected to the dead bolt and pivotally mounted on the frame between a first angular position in which the dead bolt is in its retracted position and a second angular position in which the dead bolt is in its projecting position, the dead bolt lever being configured to move the dead bolt between its retracted and its projecting position; a locking mechanism configured to lock the dead bolt in its retracted and its projecting position, the locking mechanism having a predefined lee-

way such that, when the dead bolt is in its projecting position, said dead bolt lever is pivotable between its second angular position and an intermediate position; and a key actuated cylinder mounted on the frame and provided with a rotary driving bit having a free extremity arranged to travel along a circular path along a locking direction and an unlocking direction, opposite to said locking direction, upon actuation of said key actuated cylinder, wherein the dead bolt lever has a first engaging portion for engaging the rotary driving bit when the rotary driving bit is rotated in its locking direction to move the dead bolt lever from its first angular position to its second position and a second engaging portion for engaging the rotary driving bit when the rotary driving bit is rotated in its unlocking direction to move the dead bolt lever from its second angular position to its first angular position, wherein the dead bolt lever has an end portion extending to an end of the dead bolt lever, wherein the dead bolt lever has a cut-out portion extending between the first engaging portion and the end portion, the cut-out portion allowing the rotary driving bit to pass the first engaging portion when the dead bolt lever is in an angular position between its intermediate position and its second angular position.

[0034] In the known lock disclosed in EP 2 915 939 A1, the first engagement portion is contiguous with the end portion and a secondary engagement portion is provided on the dead bolt to prevent a blocked lock.

[0035] According to the second aspect, an alternative solution to prevent a blocked lock is provided. Namely by providing a cut-out portion extending between the first engagement portion and the end portion. For any position of the dead bolt in its projecting state (i.e. any angular position of the dead bolt lever between its second angular position and its intermediate position), the cut-out portion is shaped so as to allow the rotary driving bit to pass the first engagement portion when starting from the end portion. In other words, when the dead bolt is locked, the rotary driving bit can always be unlocked.

[0036] In an embodiment the dead bolt lever comprises: a pivot and a first arm extending from the pivot towards the dead bolt, the first engaging portion, the second engaging portion, the end portion and the cut-out portion being provided on the first arm. As explained in EP 1 118 559 A1, this allows to have a dead bolt with an enhanced stroke.

[0037] In an embodiment the dead bolt lever moves over at most 4°, preferably at most 3°, and more preferably at most 2,5°, between its intermediate position and its second angular position and/or the dead bolt lever moves over at least 1° and preferably at least 1,5° between its intermediate position and its second angular position, the dead bolt lever most preferably moving about 2° between its intermediate position and its second angular position. Ideally, the leeway (or movement angle) is as small as possible. However, as the key actuated cylinder is subject to internationally agreed dimensions and tolerances, a minimum leeway is required to account for key cylinder manufacturing tolerances.

[0038] In an embodiment the cut-out portion has a curved surface extending between a first end contiguous with the first engaging portion and a second end contiguous with the end portion, the rotary driving bit, when being rotated in the unlocking direction, having an initial contact point on the curved surface which is located between the first end and the second end, the initial contact point being dependent on the angular position of the dead bolt lever. Preferably, the rotary driving bit, when being rotated in the unlocking direction and when contacting the cut-out portion, urges the dead bolt lever to move towards its second angular position over an angle of at most 1°, preferably at most 0,75°, more preferably at most 0,6° and most preferably at most 0,5°, which angle depends on the initial contact point. When the dead bolt is in its preferred projecting position, the dead bolt lever should be in its second angular position in which case the rotary driving bit merely passes the cut-out portion without contacting it. However, as the predefined leeway (e.g. as defined above by the movement angles) may still be in the order of 2 mm, it proved easiest to shape the cut-out portion so that the rotation of the rotary driving bit is able to move the dead bolt lever towards its second angular position. More specifically, it proved very challenging to have a cut-out portion which allows passage of the rotary driving bit when unlocking for every angular position between the intermediate one and the second one, whilst at the same time reliably engaging the first engaging portion when desiring to lock the dead bolt.

[0039] In an embodiment the rotary driving bit, when being rotated in the unlocking direction and when contacting the cut-out portion, urges the dead bolt lever to move towards its second angular position. When the dead bolt is in its preferred projecting position, the dead bolt lever should be in its second angular position in which case the rotary driving bit merely passes the cut-out portion without contacting it. However, as the predefined leeway (e.g. as defined above by the movement angles) may still be in the order of 2 mm, it proved easiest to shape the cut-out portion so that the rotation of the rotary driving bit is able to move the dead bolt lever towards its second angular position. More specifically, it proved very challenging to have a cut-out portion which allows passage of the rotary driving bit when unlocking for every angular position between the intermediate one and the second one, whilst at the same time reliably engaging the first engaging portion when desiring to lock the dead bolt.

[0040] In an embodiment the dead bolt lever is directly connected to the dead bolt. This avoids superfluous components between the dead bolt and the dead bolt lever.

[0041] In an embodiment the first engaging portion and the second engaging portion are opposite one another. This provides for a space efficient design as a single cut-out, notch, groove or the like can form both engaging portions.

[0042] It will be readily appreciated that, as will also

become evident from the further description, that the above mentioned aspects of the invention and the various embodiments (incl. preferred, more preferred, advantageous, more advantageous, alternative, etc. embodiments and/or other optionally indicated features) should not be limited to individual elements, but may be combined with one another to achieve even other embodiments than those already described, which embodiments may also be part of the present invention as defined in the appended claims.

Brief description of the drawings

[0043] The invention will be further explained by means of the following description and the appended figures.

Figure 1 shows a partly exploded view of the lock according to an embodiment of the present invention.

Figures 2 to 9 show a same side view of the according to an embodiment of the present invention in various different positions from locked to opened:

- figure 2 shows a locked position of the lock with both bolts in the projecting position;
- figure 3 shows a locked position of the lock with both bolts in the projecting position with the rotary driving bit being moved in the unlocking direction and passing the cut-out portion of the dead bolt lever;
- figure 4 shows an intermediate position of the lock with the latch bolt in the projecting position and the dead bolt being moved towards its retracted position with the rotary driving bit being moved in the unlocking direction and engaging the second engaging portion of the dead bolt lever to move the dead bolt;
- figure 5 shows an unlocked position of the lock with the latch bolt in the projecting position and the dead bolt in the retracted position with the rotary driving bit being moved in the unlocking direction and having passed the second engaging portion;
- figure 6 shows an unlocked position of the lock with both bolts in the retracted position with the rotary driving bit being moved in the unlocking direction and engaging the second turn latch bolt driver;
- figure 7 shows an unlocked position of the lock with the latch bolt in the projecting position and the dead bolt in the retracted position with the rotary driving bit being moved in the locking direction and contacting the second engaging portion;
- figure 8 shows an intermediate position of the lock with the latch bolt in the projecting position and the dead bolt being moved towards its projecting position with the rotary driving bit being moved in the locking direction and engaging the first engaging portion of the dead bolt lever to move the dead bolt; and
- figure 9 shows a locked position of the lock with both bolts in the projecting position with the rotary driving bit being moved in the locking direction and passing the cut-out portion of the dead bolt lever.

Figure 10 shows the retaining member used in the lock according to an embodiment of the present invention.

Figure 11 shows the dead bolt lever used in the lock according to an embodiment of the present invention.

Figure 12 shows the cooperating guiding means on the dead bolt lever and the second turn latch bolt driver used in the lock according to an embodiment of the present invention.

Figure 13 shows a cross-section trough the separate guiding element mounted on the dead bolt lever.

Description of the invention

[0044] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes. The dimensions and the relative dimensions do not necessarily correspond to actual reductions to practice of the invention.

[0045] Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. The terms are interchangeable under appropriate circumstances and the embodiments of the invention can operate in other sequences than described or illustrated herein.

[0046] Moreover, the terms top, bottom, over, under and the like in the description and the claims are used for descriptive purposes. The terms so used are interchangeable under appropriate circumstances and the embodiments of the invention described herein can operate in other orientations than described or illustrated herein.

[0047] Furthermore, the various embodiments, although referred to as "preferred" are to be construed as exemplary manners in which the invention may be implemented rather than as limiting the scope of the invention.

[0048] Figure 1 shows a partly exploded view of a lock 1 according to the invention. The lock 1 comprises a latch bolt 2 and a dead bolt 3 which are both slideably mounted on a frame 4. The frame 4 comprises a base part 4a and a front plate 4b. The lock 1 is provided to be mounted

against a profile (not shown), in most cases a tubular profile, of a hinged closure member, e.g. a gate, fence, door, etc. The profile is provided with holes to receive both the latch bolt 2 and the dead bolt 3 which extend therethrough. As used herein, the term "retracted position" means that the respective bolt is retracted in the corresponding hole of the tubular profile where it is fixed to or that it extends over a small distance out of this profile and should not be taken to mean that the respective bolt is retracted within the lock 1 (i.e. behind the front plate 4b of the lock 1). As used herein, the term "projecting position" (or alternatively extended position) means that the respective bolt extends over a larger distance out of the profile where it is fixed to when compared to the retracted position. The difference in distance between the retracted position and the projecting position is called the stroke of the bolt.

[0049] Figure 1 further illustrates the three directions associated with the lock 1, namely the height direction 50, the depth direction 51, and the width direction 52.

[0050] The lock of the embodiment of figure 1 comprises the frame 4 composed of the base plate 4a and the front plate 4b connected to the base plate 4a. When mounting the assembly of the base plate 4a and front plate 4b in a cover box (not shown), the front plate 4b engages against the peripheral edge of the cover box. The base plate 4a has on its front side an upstanding edge 5 and on its back side two upstanding edge portions 6 and 7. The front plate 4b is connected to the base plate 4a by connecting the front plate 4b to the upstanding edge 5 of the base plate 4a. Two threaded inserts are connected to corresponding holes in the upstanding edge 5 and the front plate 4b. Screws 8 and spacers 9 are provided to fix the lock laterally to a profile of the gate.

[0051] A key actuated cylinder 10 is fixed to the base plate 4a by screw 11. In an embodiment of the invention the key actuated cylinder 10 is a so-called Euro-cylinder corresponding to standard DIN 18252/2020-04. The key operated key actuated cylinder 10 comprises a rotary driving bit 12 which rotates around a central axis of the cylinder to actuate the lock as described below. The screw 11 is screwed in a threaded opening of the key actuated cylinder 10 through corresponding holes in the front plate 4b and the upstanding edge 5 of the base plate 4a. A cylinder support member 13 is fixed on the base plate 4a by means of screw 14 such that the key actuated cylinder 10 is supported on two positions in two corresponding openings 15.

[0052] The lock 1 further comprises the latch bolt 2 which is slideably mounted (along the depth direction 51) on the frame 4 by moving in a corresponding opening in the upstanding edge portion 6 and in a second corresponding opening in the upstanding edge 5 and/or in the front plate 4b. A compression spring 16 is provided over the latch bolt 2 to urge this bolt to its projecting position. The compression spring 16 is acting between the upstanding edge portion 6 and a screw or pin 17 on the latch bolt 2. The latch bolt 2 may be actuated by means of handles (not shown) to its retracted position to open the hinged closure member. Specifically, a rectangular shaft of the handles is inserted in a corresponding rectangular hole 18 in a latch bolt lever 19. The handles are thus used to move the latch bolt lever 19 against the action of a main spring 20 which is a torsion spring positioned around the latch bolt lever 19. The main spring 20 pushes the latch bolt lever 19 and the handles to their rest positions. A free extremity of the latch bolt lever 19 engages the slide means 17 on the latch bolt 5. Consequently, actuation of the handles causes the latch bolt lever 19 to rotate against the action of the main spring 20 while the free extremity of the latch bolt lever acts upon the slide means 17 on the latch bolt 5 to move the latch bolt 5 against the compression spring 16 into its retracted position.

[0053] The latch bolt 2 in the illustrated embodiment is made of steel, more particularly of stainless steel which is a strong and weather resistant material but is difficult to be shaped in the usual way, e.g. by milling. As will become apparent hereinafter, the latch bolt may have indeed a quite complex shape, especially in order to allow adjusting the length over which it projects out of the lock. The latch bolt 2 has two separate parts, namely a hollow rod part 21 and a solid bolt part 22. The solid bolt part 22 is arranged to project out of the lock 1 into a lock catch, preferably a lock catcher as described in EP 3 239 440 A1. The solid bolt part 22 is removably mounted into the hollow rod part 21. The bolt part 22 can be mounted in two positions, namely in a first position wherein the oblique front face is directed in a first direction and in a second position wherein the oblique front face is rotated axially over about 180°. The distance between the hollow rod part 21 and the solid bolt part 22 can be adjusted by means of a set screw (not shown). The latch bolt 2 illustrated in the figures is further described in EP 1 118 559 A1.

[0054] The lock further comprises the dead bolt 3 which is slidably mounted (along the depth direction 51) on the frame 4 between a projecting position and a retracted position. The dead bolt 3 slides in corresponding openings in the upstanding edge 7 and the upstanding edge portion 5 of the base plate 4a. The dead bolt 3 is locked in both positions, i.e. the projecting position and the retracted position, by a locking mechanism that is operable by the key actuated cylinder 10 as described below. In the illustrated embodiment, the dead bolt 3 is made of two portions: a hollow rod part 23 and a bolt part 24. The hollow rod part 23 extends at least partially in the lock. The bolt part 24 is arranged to cooperate with a lock catch, preferably a lock catcher as described in EP 3 239 440 A1. The distance between the hollow rod part 23 and the bolt part 24 can be adjusted by means of a set screw (not shown). The dead bolt 3 illustrated in the figures is further described in EP 1 118 559 A1.

[0055] The dead bolt 3 is locked in both positions, projecting position and retracted position, by the locking mechanism. This locking mechanism comprises a retain-

ing member 25 (shown in detail in figure 10) which is slidably mounted up- and downward on the frame 4. The retaining member 25 is biased downwards by a biasing member 26, e.g. a torsion spring, which is also part of the locking mechanism together with a protrusion 27, e.g. a pin or screw, fixed to the dead bolt 2. As can be seen in the detail of figure 10, the retaining member 25 has an elongated slot 28 extending in the depth direction 51 between a first end 29 and a second end 30. A catch 31, 32 is provided at each end 29, 30 and is formed by an upwards notch. In the rest position the retaining member 25 is urged downwards so that the protrusion 27 is positioned into one of the catches 31, 32 of the retaining member 25 to lock the dead bolt 3 in one of its two extreme positions.

[0056] The second catch 32 is delimited by four edges, namely a first edge 33 contiguous with the elongated slot 28, a second edge 34 opposite the first edge 33, a far edge 35, and an inclined edge 36. The inclined edge 36 has an angle α with respect to the depth direction 51 of at least 60°, which angle α is about 72° in the illustrated embodiment. The first edge 33 has a length of between 1 and 2 times the protrusion diameter D (which is about 4 mm in the illustrated embodiment), which length is about 1,5 times D in the illustrated embodiment. The top edge has a length between 1 and 1,5 times the protrusion diameter D, which length is about 1,34 times D in the illustrated embodiment. As described above, these lengths and inclinations determine the dead bolt leeway in the projecting position.

[0057] The movement of the dead bolt 3 is controlled by rotating the key in the key actuated cylinder 10 and thus by rotation of the rotary driving bit 12. More specifically, the rotary driving bit 12 engages a dead bolt lever 37 which is shown in detail in figure 11. The dead bolt lever 37 is pivotally mounted on the frame 4 between a first angular position and a second angular position. The dead bolt lever 37 has a pivot 38 from which extends a first arm 39 and a second arm 40. The first arm 39 is provided with a first engaging portion 42 and a second engaging portion 41 which are both formed by a single notch 43. The first arm 39 is further provided with an end portion 44 and a cut-out portion 45 interposed between the first engaging portion 41 and the end portion 44. An auxiliary portion 46 is also provided on the first arm 39 together with an opening 47 through which the protrusion 27 is placed thereby fixing the first arm 39 of the dead bolt lever 37 to the dead bolt 3. The function of each of the portions mentioned above will be described below. The second arm 40 extends away from the pivot 38 in the opposite direction of the first arm 39 and is provided with a separate guiding element 48 at its end.

[0058] The separate guiding element 48 is formed as a pin, in particular a rivet, and is shown in detail in figure 13. The second arm 40 is provided with an opening through which the separate guiding element 48 is positioned. The opening preferably includes a conical part. The separate guiding element 48 comprises a protruding part 67, a narrow part 68 and a head 69. The shape of the head 69 corresponds to the conical part of the opening thus allowing to countersink the separate guiding element 48 in the dead bolt lever 37. The distance between the separate guiding element 48, in particular the centre thereof, and the pivot 38 is indicated in figure 11 as d5 and is between 17 and 25 mm, particularly between 19 and 23 mm and more particularly between 20 and 22 mm, said shortest distance d5 being particularly about 21 mm in the illustrated drawings.

[0059] The lock 1 further comprises a second turn latch bolt driver 49 extending in the height direction 50 between a first end 53 and a second end 54. At the first end 53, the second turn latch bolt driver 49 has an elongated slot 54 in which the protrusion 48 is located. The elongated slot 54 and the separate guiding element 48 act as guiding means for moving the second turn latch bolt driver 49 from its rest position to its actuated position. The guiding means are shown in detail in figure 12. The second turn latch bolt driver 49 is at its second end 54 pivotally connected to a second turn latch bolt lever 55 which is pivotally mounted on the frame 4. The second turn latch bolt lever 55 is arranged to move the latch bolt 2 against the action of the compression spring 16 from its projecting position to its retracted position. The second turn latch lever 55 has a first lever arm 56 to engage the sliding means 17 on the latch bolt 2 and a second lever arm 57 to pivotally connect with the second turn driver 49 about pivot 58.

[0060] The operation of the lock 1 will be described with reference to figures 2 to 9. Figure 2 shows a locked position of the lock 1 with both bolts 2, 3 in the projecting position, i.e. the hinged closure member on which the lock 1 is mounted is in the closed position. A user desiring to open the hinged closure member has to first unlock the dead bolt 3 by actuating the key actuated cylinder 10. More specifically, the user has to rotate the key in the unlocking (i.e. counter clockwise) direction 59 as shown in figure 3. During this rotation, the rotary driving bit 12 passes the cut-out portion 45 of the dead bolt lever 37.

[0061] The cut-out portion 45 has been shaped so that the rotary driving bit 12 can always pass this portion (thereby moving beyond the first engaging portion 41) as long as the dead bolt 3 is in its projecting position irrespective of the leeway. More specifically, when the dead bolt 3 is in its projecting position the protrusion 27 is in the second catch 32. As the second catch 32 is wider that the diameter of the protrusion 27 (see figure 10), there is an amount of leeway on the dead bolt 3 position. In general, this leeway is limited to at most twice the diameter D of the protrusion 27. Since the dead bolt lever 37 is fixed to the dead bolt 3, any leeway on the dead bolt 3 also has a corresponding leeway on the dead bolt lever 37.

[0062] As used herein, the term "second angular position of the dead bolt lever" is used to indicate the most extreme position of the dead bolt lever with the dead bolt

in its most projecting position (i.e. the protrusion 27 abuts the top edge 34 and the far edge 35 of the second catch 32), while the term "intermediate angular position of the dead bolt lever" is used to indicate the intermediate position of the dead bolt lever with the dead bolt in its projecting position in the most inward possible position (i.e. the protrusion 27 is near the first edge 33 and abuts the inclined edge 36 of the second catch 32). According to the invention, the angular difference between the intermediate and second angular positions is at most 4° and is about 2° in the illustrated embodiments. This corresponds to a leeway on the dead bolt 3 of at most 4 mm and is about 2 mm in the illustrated embodiments.

[0063] In the illustrated embodiment, the cut-out portion 45 is so shaped that, when the dead bolt lever 37 is in its second angular position, the rotary driving bit 12 passes this portion without (or with minimal) contacting the dead bolt lever 37. However, when the dead bolt lever 37 is in its intermediate position, the rotary driving bit 12 will engage the cut-out portion 45 and urge the dead bolt lever 37 towards its second angular position, thereby forcing itself past the second engaging portion 41. In the illustrated embodiments, the dead bolt lever 37 can be rotated over about 1° in this manner (or the dead bolt 3 can be slid over about 1 mm). Although it would be possible to enlarge the cut-out portion 45 so that the rotary driving bit 12 passes this portion without (or with minimal) contacting the dead bolt lever 37 even when in the intermediate position, this would reduce the size of the second engaging portion 41 which could lead to malfunctions as described below.

[0064] As illustrated in Figure 3, when in the projecting position, movement of the rotary driving bit 12 in the counter clockwise direction 59 results in engagement of the rotary driving bit 12 with the bottom edge of the retaining member 25 so that the retaining member 25 is lifted and the dead bolt 3 is unlocked. When subsequently the rotation in the counter clockwise direction 59 is continued as illustrated in figure 4, the rotary driving bit 12 passes the second engaging portion 41 and will engage the first engaging portion 42 of the dead bolt lever 37. The first arm 39 of the dead bolt lever 37 is connected to the dead bolt 3 such that a rotation of the dead bolt lever 37 about pivot 38 in the counter clockwise direction 59 results in a translation movement of the dead bolt 3 in the direction of arrow 60 (i.e. along the depth direction 51 of the lock 1). In this way, the dead bolt 3 is moved from its projecting position to its retracted position and the dead bolt lever 3 is moved from its second angular position to its first angular position. Once the dead bolt 3 nears its retracted position, the biasing member 26 urges the retaining member 25 downwards thus locking the protrusion 27 in the first catch 31. This state of the lock 1 is shown in figure 5.

[0065] During unlocking of the dead bolt 3, the second turn latch bolt driver 49 has also been moved as is clear from comparing figures 3 and 5 with one another. More specifically, the separate guiding element 48 on the second arm 40 of the dead bolt lever 37 cooperates with the slot 54 in the second end 53 of the second turn latch bolt driver 49 to move the second end 53 of the second turn latch bolt driver 49 inwards (i.e. along the depth direction 51 of the lock 1) into the circular path of the rotary driving bit 12. More particularly, in the first angular position of the dead bolt lever 37, i.e. in the position as illustrated in figure 5 wherein the dead bolt 3 is locked in its retracted position, the second turn latch bolt driver 49 is in the path of the rotary driving bit 12 whilst in the second angular position of the dead bolt lever 37, i.e. in the position as illustrated in figure 3 wherein the dead bolt 3 is locked in its projecting position, the second turn latch bolt driver 49 is out of the path of the rotary driving bit 12.

[0066] It is noteworthy that the upstanding edge 5 of the frame 4 is provided with a recess 66 (indicated in figure 1). The recess 66 may also be a complete opening of the wall part which forms the upstanding edge 5. In the closed state of the lock 1, the first end 53 of the second turn latch bolt driver 49 is located partially in this recess 66. The front plate 4b, in particular the inner side thereof, may act as a limiter, i.e. the first end 53 of the second turn latch bolt driver 49 may abut against the inner side of the front plate 4b thus limiting a further possible pivoting of the dead bolt lever 37 (in addition to the limiting function of the second catch 32 acting on the dead bolt 3).

[0067] As illustrated in figure 6, further rotation of the rotary driving bit 12 in the counter clockwise direction 59 enables to retract the latch bolt 2 by means of the second turn latch bolt driver 49 and the second turn latch bolt lever 55. More specifically, the second turn latch bolt driver 49 is provided with a second turn engagement portion 61. Upon further rotation of the rotary driving bit 12 in the counter clockwise direction 59 (i.e. a second turn in the counter clockwise direction), the rotary driving bit 12 engages the second turn engagement portion 61. This engagement pushes the second turn latch bolt driver 49 upwards (as indicated by arrow 62 - i.e. along the height direction 50 of the lock 1) to rotate the second turn latch bolt lever 55 and thus to retract the latch bolt 2 as indicated with arrow 63 (i.e. along the depth direction 51 of the lock 1). This allows the user to fully open the lock 1 thereby enabling to open the hinged closure member.

[0068] As illustrated in figure 6, the second turn engagement portion 61 has a width d1. The width d1 is measured along the depth direction 51 of the lock 1 and is preferably at least 6 mm, in particular at least 7 mm, more in particular at least 7.5 mm and most in particular at least 8 mm. The rotary driving bit and the second turn engagement portion overlap with one another over a distance d2 of at least 2,5 mm, in particular at least 3 mm, more in particular at least 3,4 mm and most in particular at least 3,7 mm.

[0069] As can be seen in figure 6, the end portion 44 of the dead bolt lever 37 limits the upward movement of the second turn latch bolt driver 49 by the rotary driving bit 12. In addition thereto, also the separate guiding member 48 and the elongated slot 54 limit this upwards mo-

tion. In this way, there is no risk that the rotary driving bit 12 could pass the second turn engagement portion 61 when it would be rotated too far in the unlocking direction 59.

[0070] When the dead bolt 3 is in the retracted position (as illustrated in figures 6 and 7) and the rotary driving bit 12 is rotated back in the locking (i.e. clockwise) direction 63, the rotary driving bit 12 engages a second engagement portion 41 of the dead bolt lever 37. Because the dead bolt lever 37 is connected with the dead bolt 3 as discussed above, rotation of the dead bolt lever 41 in the second direction 63 results in a translation movement of the dead bolt 3 in the direction of arrow 64 (i.e. along the depth direction 51 of the lock 1). As also shown in figure 7, rotation of the rotary driving bit 12 in the clockwise direction 63 results in engagement of the rotary driving bit 12 with the bottom edge of the retaining member 25 so that the retaining member 25 is lifted and the dead bolt 3 is unlocked. In case the cut-out portion 45 would be made large enough to always allow a non-contact passage of the rotary driving bit 12 in the unlocking direction 59, the rotary driving bit 12 could pass underneath the second engaging portion 41 in the lock position shown in figure 7. In other words, the dead bolt 3 could not be moved towards its projecting position in such a case. Figure 8 illustrates the rotation and movement at a position substantially halfway between the retracted position and the projecting position of the dead bolt 3. The retaining member 25 is at that position fully lifted. In figure 9, the rotary driving bit 12 is further rotated in the clockwise direction 63 until the retaining member 25 is no longer lifted and the dead bolt 3 is locked in its projecting position.

[0071] In some situation, e.g. when forces are acting on the dead bolt 3 in the opposite direction of the translation movement 64, the rotary driving bit 12 may pass the second engaging portion 41 of the dead bolt lever 37 without the retaining member 25 moving downwards into the locked position of the dead bolt 3. This could allow the dead bolt 3 to be moving back in the lock 1 while the rotary driving bit 12 is no longer in contact with the second engaging portion 41. A further rotation in the locking direction 63 will result in that the rotary driving bit 12 engages the auxiliary portion 46 of the dead bolt lever 37 positioned such that the engagement allows to rotate the dead bolt lever 37 about pivot 38 in clockwise direction and thus moves the dead bolt 3 again towards its projecting position.

[0072] The dead bolt 3 has only two extreme positions (apart from the fact that the distance over which it projects out of the lock can be adjusted), namely a projecting position and a retracted position. These two extreme positions correspond respectively to the second and the first angular positions of the dead bolt lever 37. These extreme positions are defined and delimited by the slot 28 in the retaining member 25. In the illustrated lock 1 both the second engaging portion 41 and the auxiliary portion 45 of the dead bolt lever 37 are intended to enable to move the dead bolt lever 37 by means of the rotary driving bit 12 to the same second angular position.

[0073] The second turn latch bolt driver 49 does not only have a second turn engagement portion 61 allowing to push the second turn latch bolt driver 49 upwards by means of the rotary driving bit 12 but it has also a lateral engagement portion 65 which is intended to prevent the rotary driving bit 12 to get stuck between the dead bolt lever 37 and the second turn engagement portion 61. The lateral engagement portion 65 extends, in the projecting position of the dead bolt 3, i.e. in the second angular position of the dead bolt lever 37, from the second turn engagement portion 61 upwards. It is arranged to laterally engage the rotary driving bit 12 when the rotary driving bit 12 has passed the second engaging portion 41 of the dead bolt lever 37 and the dead bolt 3 has not been locked by the locking mechanism and moves back into the lock 1 by an external force as described in EP 2 915 939 A1.

[0074] As best shown in figure 1, the second end 53 of the second turn latch bolt driver 49 has a widened part with a width d4 that is at least twice the width d3 of the elongated slot 54. This widened part is adjacent the second arm 40 of the dead bolt lever 37 and increase the stability of the second turn latch bolt driver 49 in particular against torsional motion along the height direction 50 of the lock 1.

[0075] The key actuated cylinder 10 is in the illustrated embodiment is provided between the dead bolt 3 and the pivot 38. The pivot 38 is so positioned that the dead bolt lever 37 engages the dead bolt 3 on a first distance from the pivot 38 and the rotary driving bit 12 engages the dead bolt lever 37 on a second distance from the pivot 38 with the second distance being smaller than the first distance in each position of the dead bolt lever 37. This ensures an increased stroke of the dead bolt 3 as explained in EP 1 118 739 A1.

[0076] Although aspects of the present disclosure have been described with respect to specific embodiments, it will be readily appreciated that these aspects may be implemented in other forms within the scope of the invention as defined by the claims.

Claims

1. A lock (1) for a hinged closure member, the lock comprising:

   - a frame (4);
   - a dead bolt (3) slideably mounted on the frame between a retracted position and a projecting position along a first sliding direction (51);
   - a latch bolt (2) slideably mounted on the frame between a retracted position and a projecting position and urged to its projecting position by a latch bolt spring (16);
   - a dead bolt lever (37) pivotally mounted on the

frame between a first angular position in which the dead bolt is in its retracted position and a second angular position in which the dead bolt is in its projecting position and configured to move the dead bolt between its retracted and its projecting position;
- a second turn latch bolt lever (55) pivotally mounted on the frame and configured to move the latch bolt from its projecting position to its retracted position upon rotation in a first rotational direction; and
- a second turn latch bolt driver (49) interposed between the dead bolt lever and the second turn latch bolt lever and being slideable in a second sliding direction (50) between a rest position and an actuated position, wherein sliding the second turn latch bolt driver from its rest position to its actuated position rotates the second turn latch bolt lever in said first rotational direction to move the latch bolt from its projecting position to its retracted position,
wherein the dead bolt lever and the second turn latch bolt driver comprise mutually cooperating guiding means to guide the second turn latch bolt driver between its rest position and its actuated position,
wherein the dead bolt lever comprises:

- a pivot (38);
- a first arm (39) extending from the pivot towards the dead bolt; and
- a second arm (40) extending between a proximal end at the pivot towards a distal end at the second turn latch bolt driver,

characterized in that the mutually cooperating guiding means comprise:

- an elongated slot (54) extending in said second sliding direction, the elongated slot being provided in said second turn latch bolt driver; and
- a separate guiding member (48) extending through said elongated slot, the guiding member being mounted on the distal end of said second arm of the dead bolt lever.

2. The lock according to claim 1, **characterized in that** the separate guiding member is formed by a pin, in particular a rivet.

3. The lock according to claim 1 or 2, **characterized in that** the separate guiding member protrudes only on a single side of the dead bolt lever, the separate guiding member preferably being flush on the opposing side of the dead bolt lever.

4. The lock according to any one of the preceding claims, **characterized in that** the lock further comprises a key actuated cylinder (10) mounted on the frame and provided with a rotary driving bit (12) having a free extremity arranged to travel along a circular path along a locking direction (63) and an unlocking direction (59), opposite to said locking direction, upon actuation of said key actuated cylinder, and
in that the second turn latch bolt driver is provided with a second turn engagement portion (61), the rotary driving bit engaging the second turn engagement portion upon rotation of the rotary driving bit in the unlocking direction.

5. The lock according to claim 4, **characterized in that** the rotary driving bit and the second turn engagement portion overlap with one another over a distance (d2) of at least 2,5 mm, in particular at least 3 mm, more in particular at least 3,4 mm and most in particular at least 3,7 mm.

6. The lock according to claim 4 or 5, **characterized in that** the second turn engagement portion has a width (d1) of at least 6 mm, in particular at least 7 mm, more in particular at least 7,5 mm and most in particular at least 8 mm.

7. The lock according to any one of the preceding claims, **characterized in that** the lock further comprises a key actuated cylinder (10) mounted on the frame and provided with a rotary driving bit (12) having a free extremity arranged to travel along a circular path along a locking direction (63) and an unlocking direction (59), opposite to said locking direction, upon actuation of said key actuated cylinder,
wherein, when the dead bolt lever is in its second angular position, the second turn latch bolt driver is outside said circular path.

8. The lock according to claim 7, **characterized in that** the mutually cooperating guiding means move the second turn latch bolt driver in a direction (51) which is substantially perpendicular to the second sliding direction when the dead bolt lever is moved from its first angular position to its second angular position.

9. The lock according to claim 7 or 8, **characterized in that** the frame comprises a front plate having an inner side and an outer side, the latch bolt and the dead bolt both projecting from the front plate in their projecting position, wherein the inner side of the front plate is provided with a recess, the second turn latch bolt driver being at least partially inside said recess when the dead bolt lever is in its second angular position.

10. The lock according to any one of the preceding claims, **characterized in that** the dead bolt lever has a first plate-shaped part and the second turn

latch bolt driver has a second plate-shaped part, the separate guiding member being provided on the first plate-shaped part and the elongated slot being provided in the second plate-shaped part, and **in that** the first plate-shaped part and the second plate-shaped part are adjacent one another over an area (d4) which is at least twice as wide as a width (d3) of the elongated slot, which width is measured in the first sliding direction.

11. The lock according to any one of the preceding claims, **characterized in that** the second turn latch bolt driver is a folded metal plate.

12. The lock according to any one of the preceding claims, **characterized in that** the elongated slot has a width (d3) which is about equal to a width of the separate guiding element.

13. The lock according to any one of the preceding claims, **characterized in that** the second turn latch bolt driver has a first end (54) connected to the second turn latch bolt lever and a second end (53) connected to the dead bolt lever by said separate guiding member.

14. The lock according to any one of the preceding claims, **characterized in that** the lock further comprises a locking mechanism configured to lock the dead bolt in its retracted and its projecting position, the locking mechanism comprising:

- a retaining member (25) slideably mounted on the frame between a locking position and an unlocking position, the retaining member comprising a slot (28) extending in the first sliding direction between a first end (29) and a second end (30), the slot comprising a first catch (31) at its first end and a second catch (32) at its second end, the second catch being delimited by a first edge (33) contiguous with said slot, an opposing edge (34) substantially parallel to the first edge, a far edge (35) extending between the first edge and the opposing edge and an inclined edge (36) extending between the first edge and the opposing edge and opposite to the far edge, the inclined edge having an inclination (a) with respect to the first sliding direction of at least 60°;
- a biasing member (26) urging the retaining member into its locking position; and
- a projecting element (27) provided on the dead bolt which extends into said slot, the projecting element being located in said first catch when the deadbolt is in its retracted position and in said second catch when the deadbolt is in its projecting position, the opposing edge having a length of at most 1,5 times a diameter (D) of a minimal bounding circle of the projecting element.

15. The lock according to any one of the preceding claims, **characterized in that** a shortest distance between the pivot and a center of the separate guiding member is between 17 and 25 mm, particularly between 19 and 23 mm and more particularly between 20 and 22 mm, said shortest distance being most particularly about 21 mm.

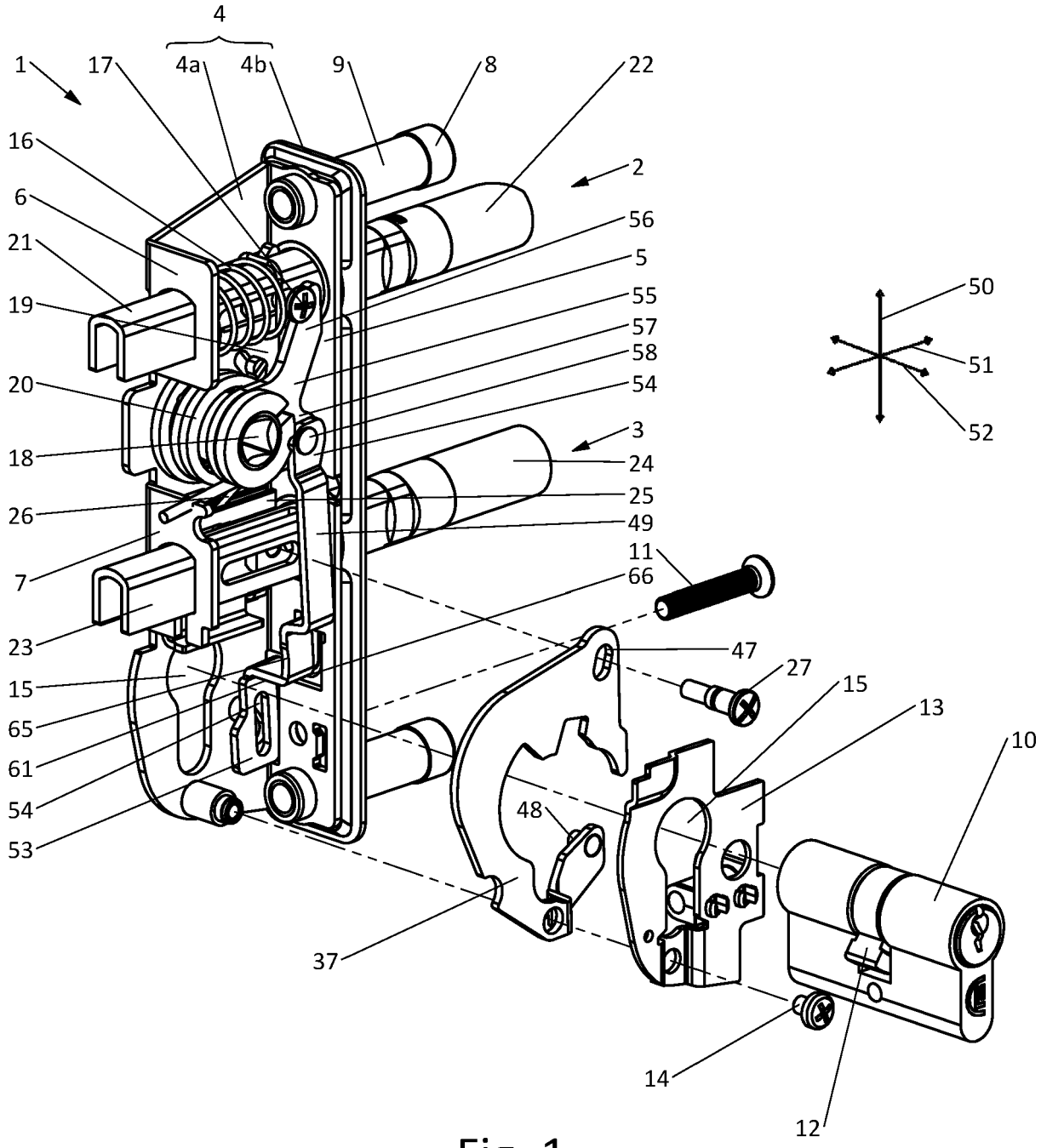
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Fig. 1

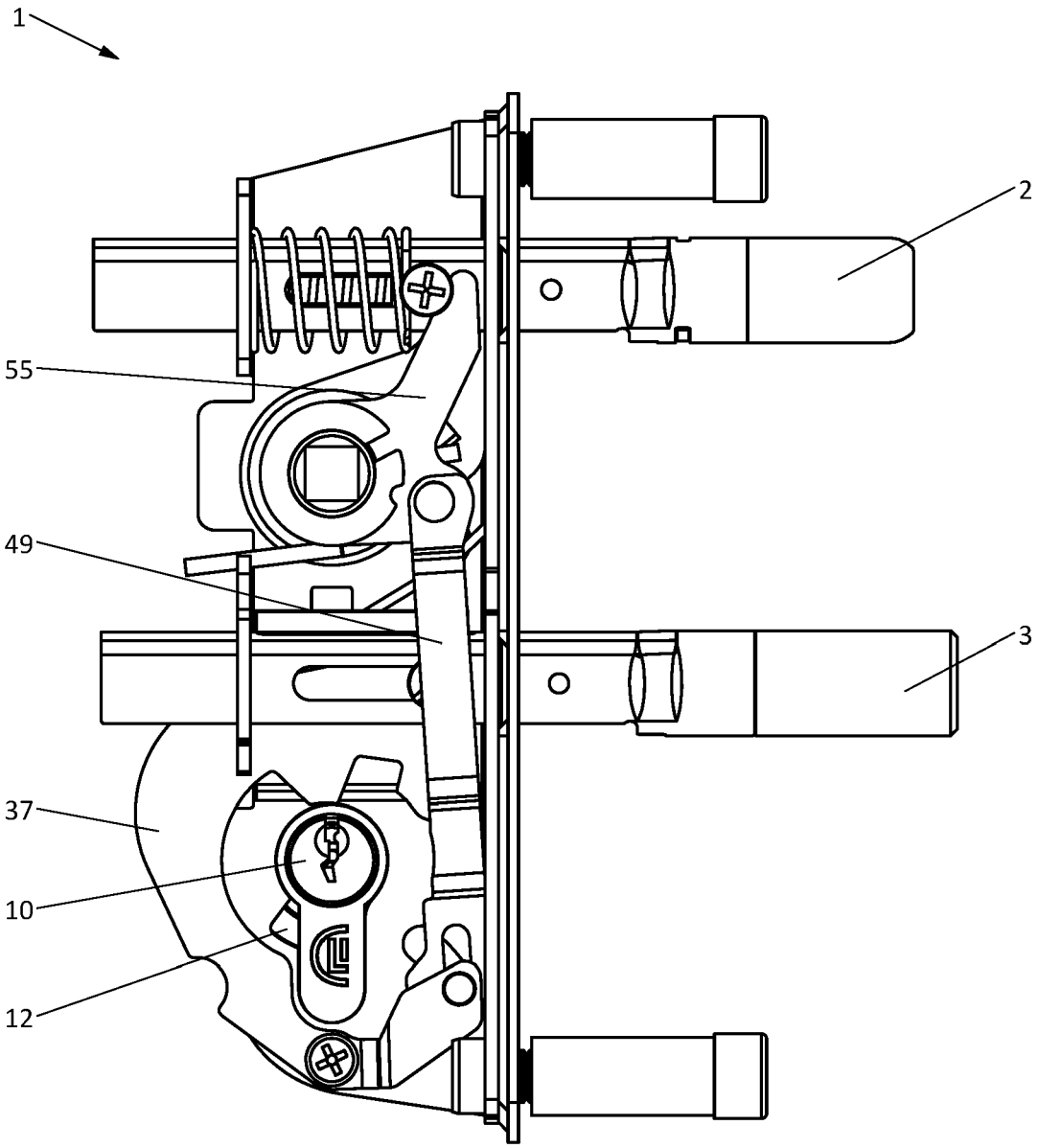

Fig. 2

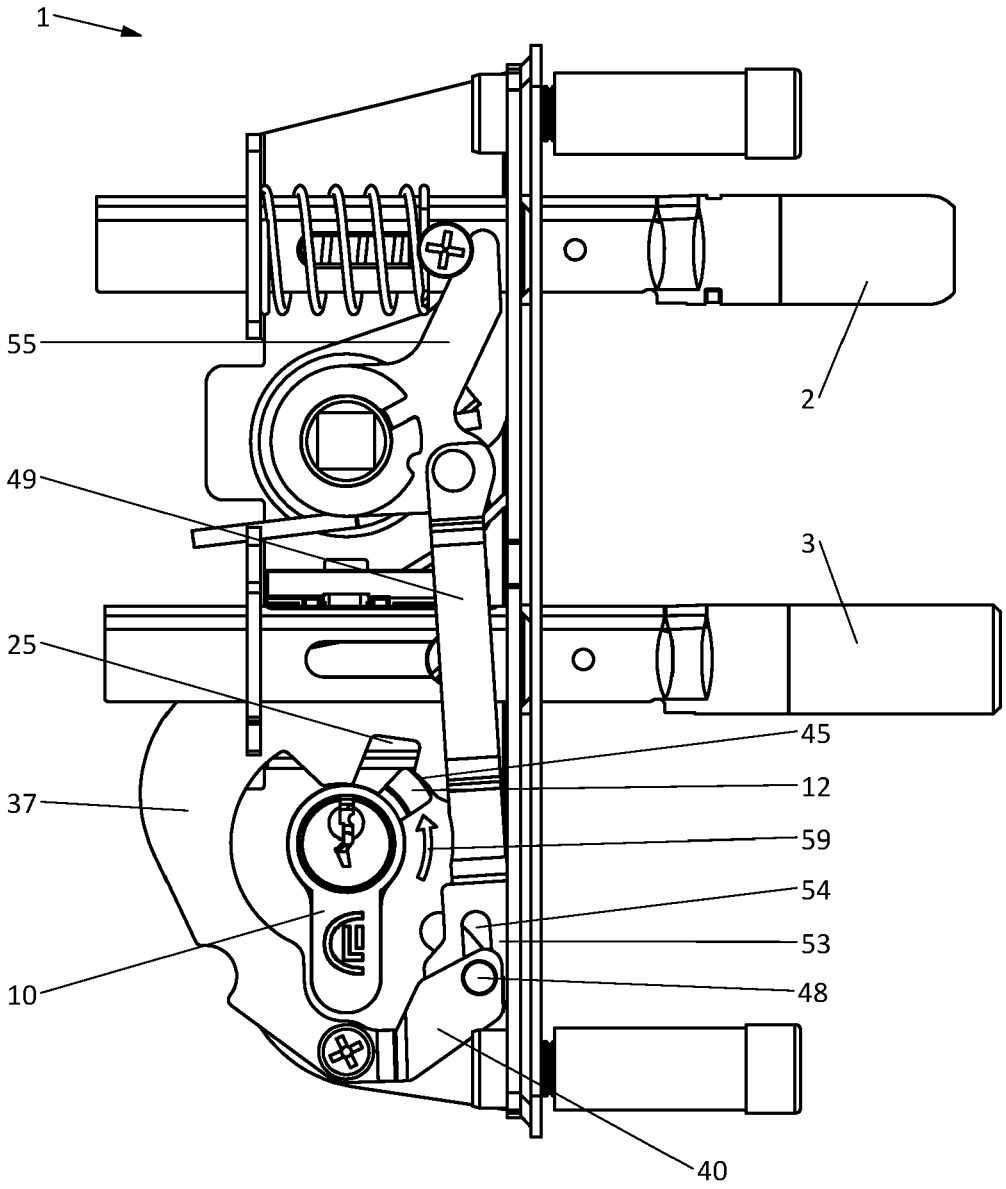

Fig. 3

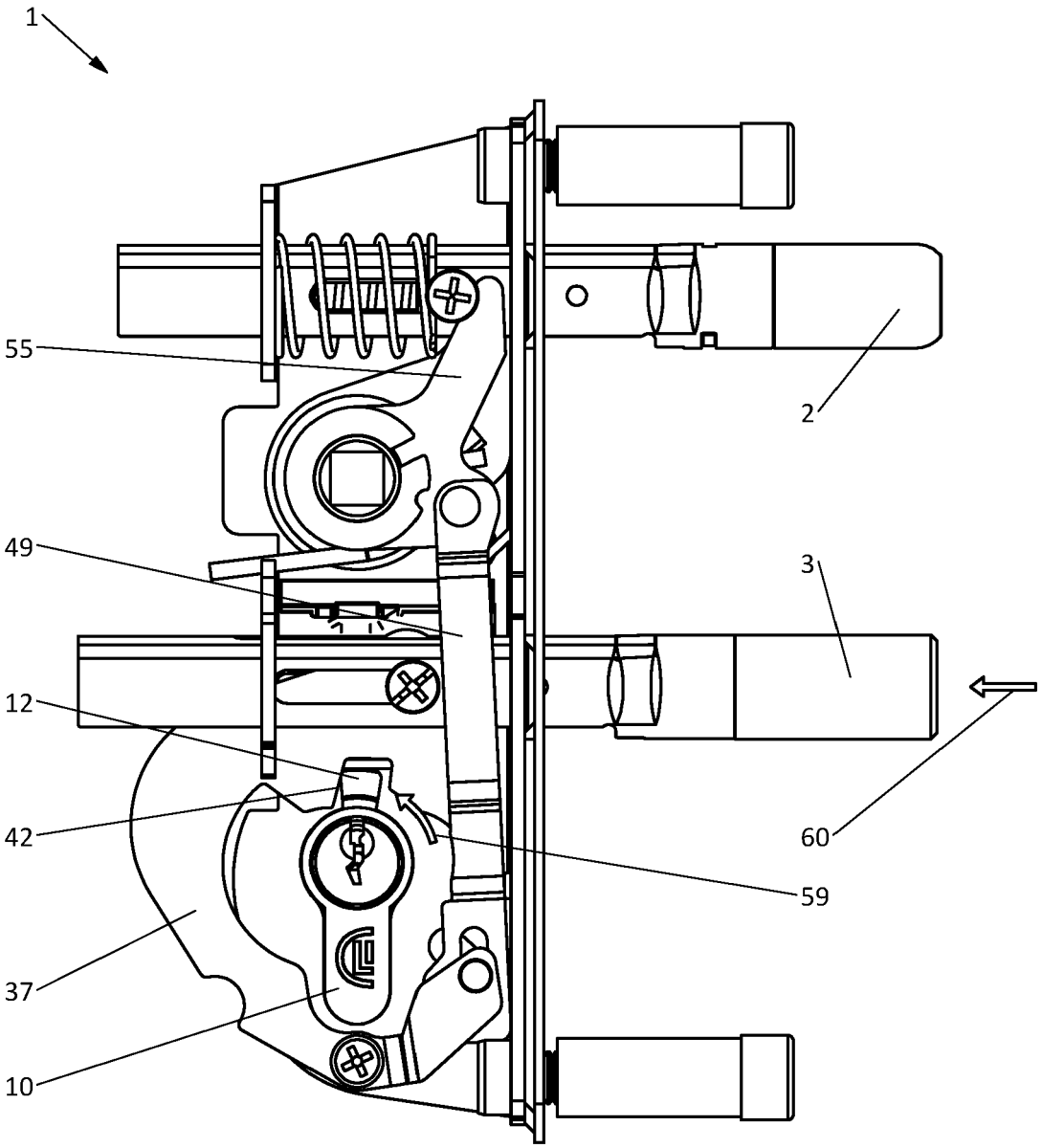

Fig. 4

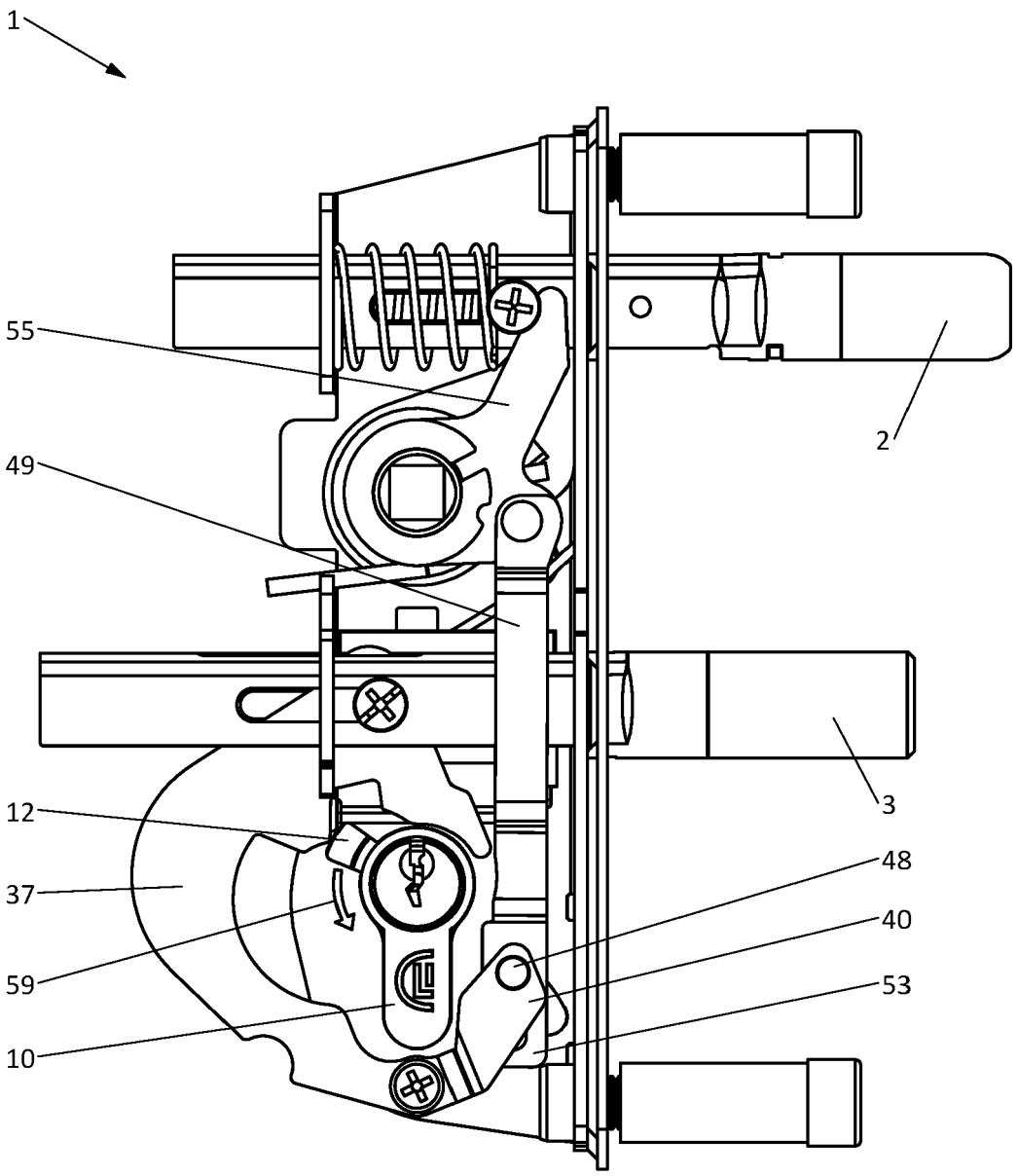

Fig. 5

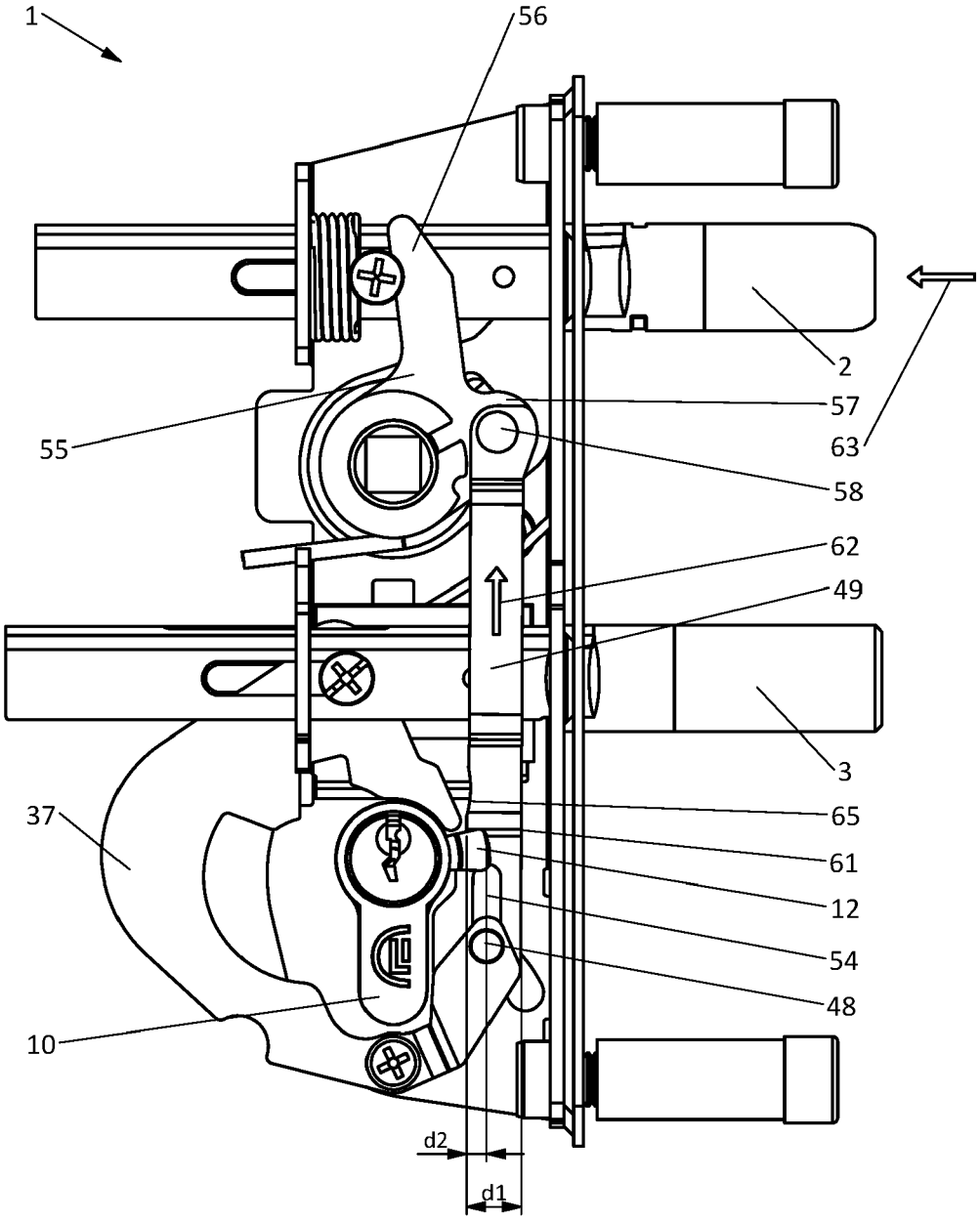

Fig. 6

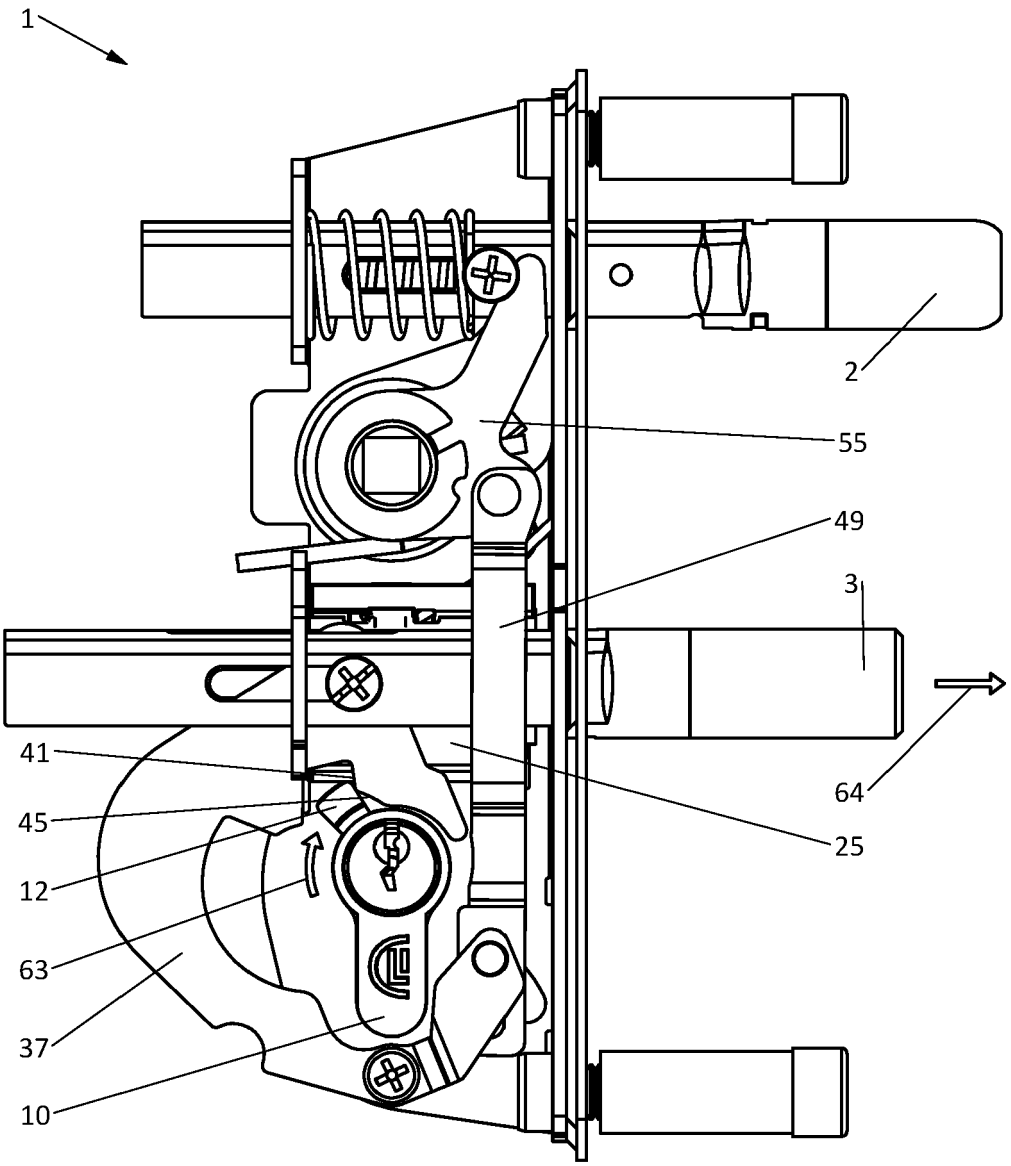

Fig. 7

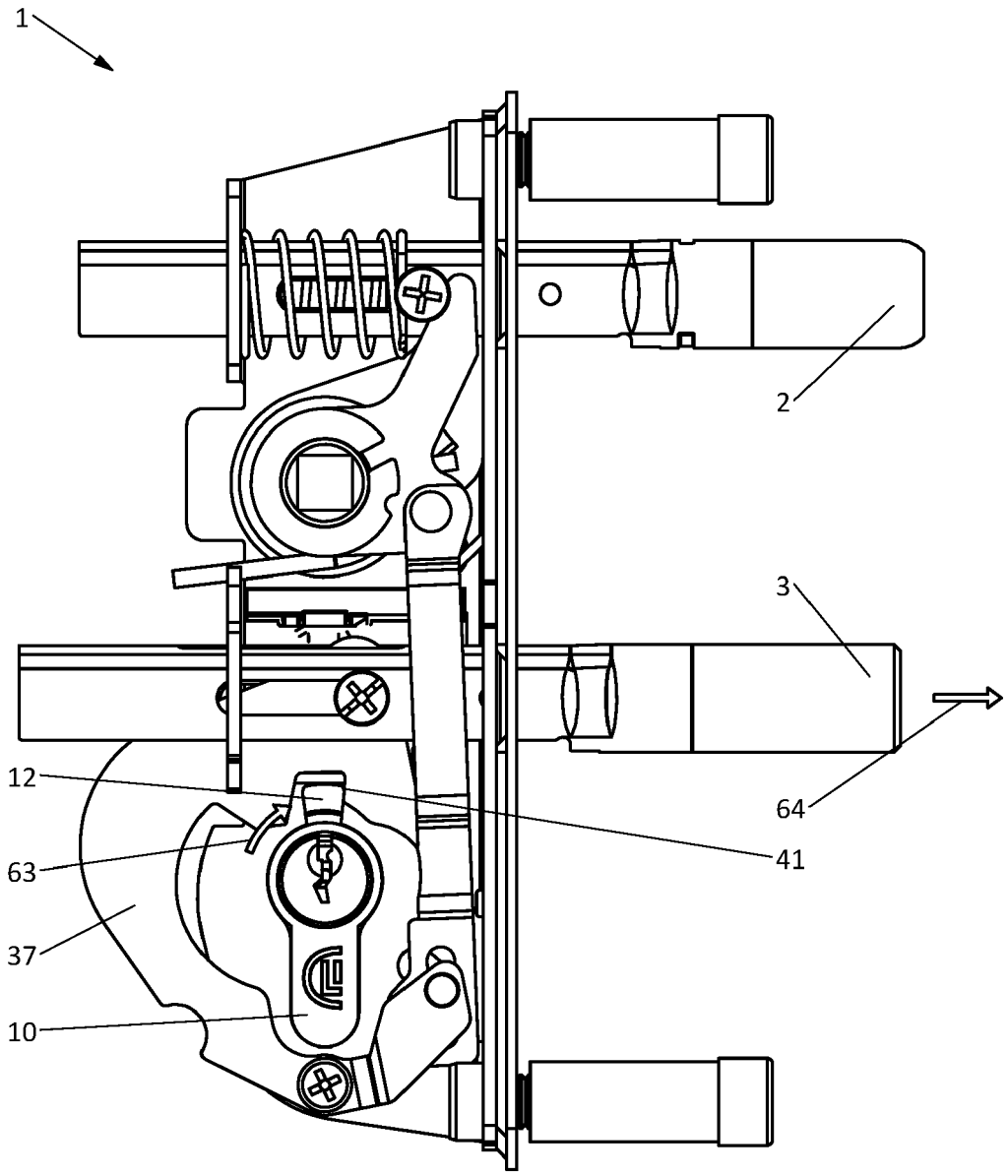

Fig. 8

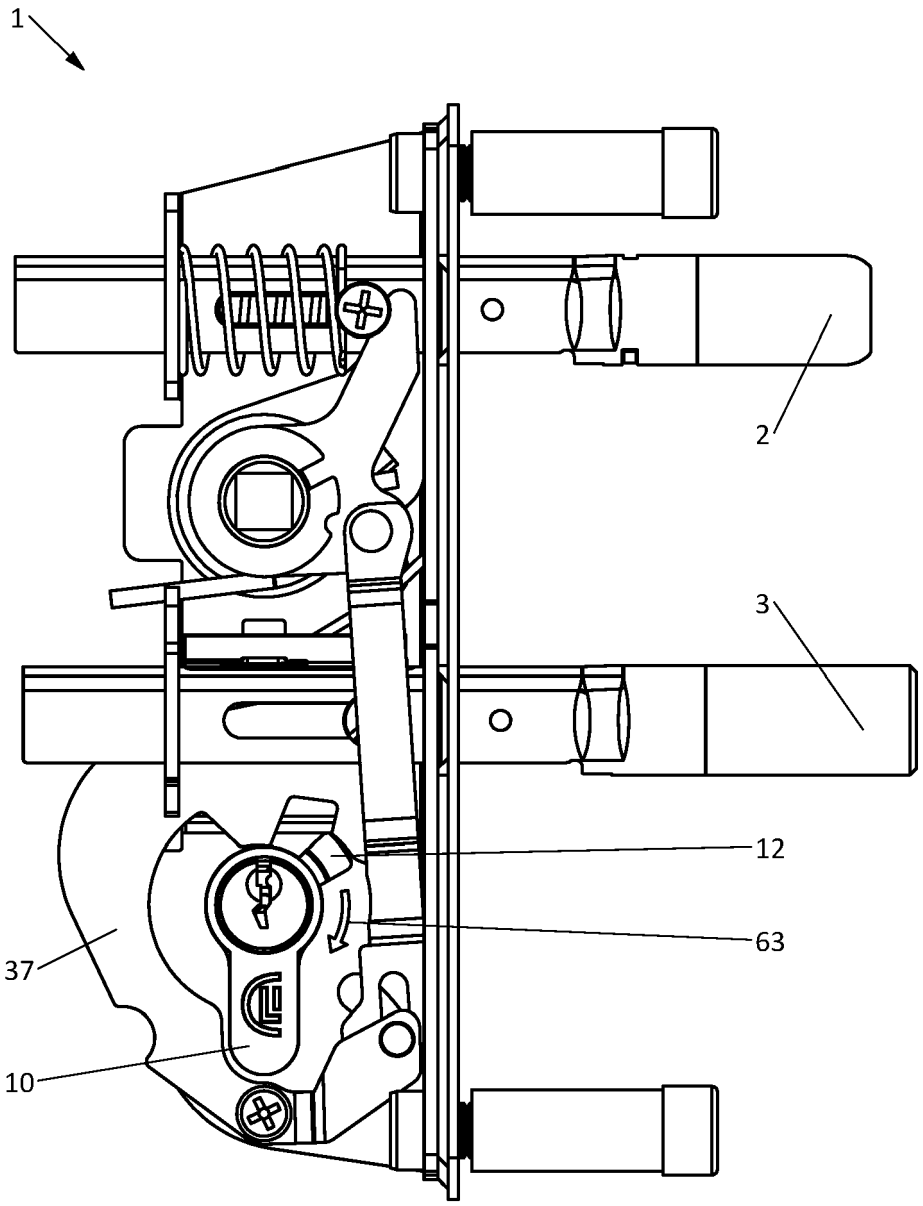

Fig. 9

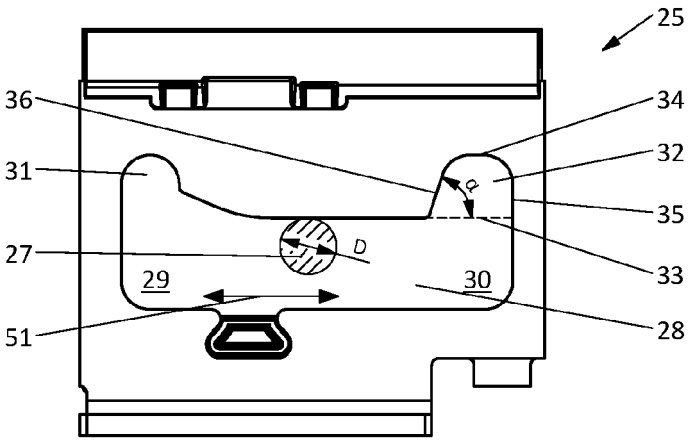

Fig. 10

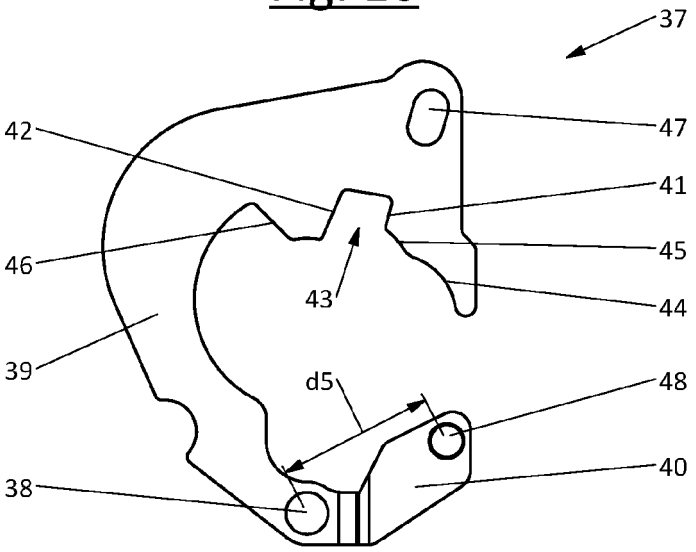

Fig. 11

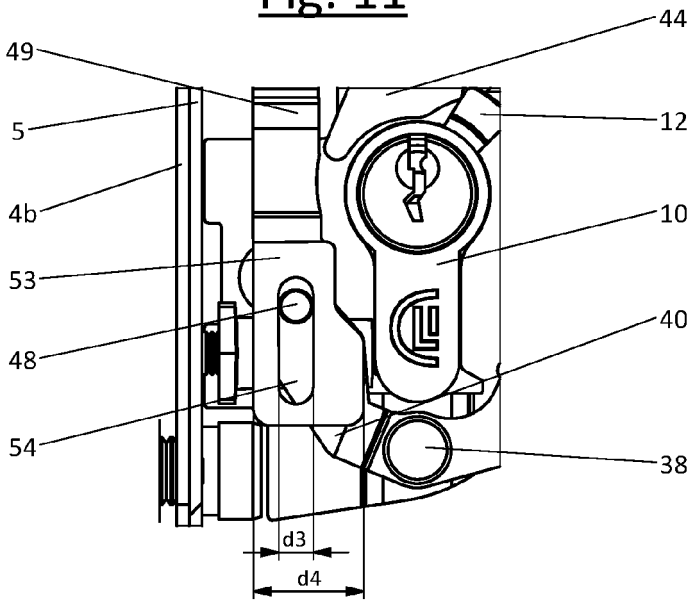

Fig. 12

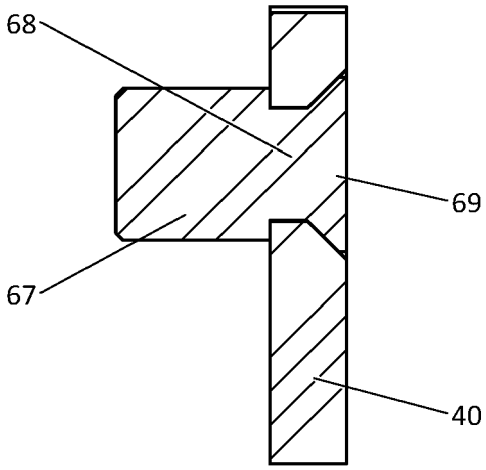

Fig. 13

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 April 2023	Boufidou, Maria

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