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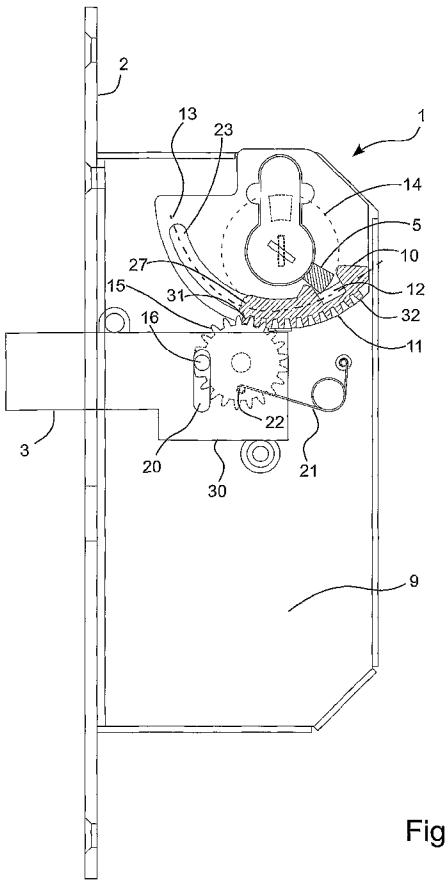



Fig. 3

(57) Abstract: The invention concerns a lock mechanism for a door or window prepared for receiving a lock cylinder with rotatable engagement means. The lock mechanism comprises a toothed element being movable along a curved path and having receiving means prepared for engaging with said engagement means, and arranged such that said engagement means are rotatable 360 degrees. The lock mechanism further comprises a toothed wheel in engagement with said toothed element such that displacement of said toothed element along said curved path causes a rotation of said toothed wheel. The lock mechanism comprises a bolt displaceable by a rotational movement of said toothed wheel. The curved path has a shape such that when the engagement means are rotated in one direction the engagement means will engage with the receiving means at one point of said curved path and disengage from the receiving means at a different point of said curved path.

WO 2009/003471 A1

## A lock mechanism

The invention concerns a lock mechanism for a door said lock mechanism being prepared for receiving a lock cylinder with rotatable engagement means. The lock mechanism comprises a toothed element being movable along a curved path and having receiving means prepared for engaging with said engagement means. The lock mechanism further comprises a toothed wheel in engagement with said toothed element such that displacement of said toothed element along said curved path causes a rotation of said toothed wheel. The lock mechanism comprises a bolt displaceable by a rotational movement of said toothed wheel.

Such lock mechanisms are known from e.g. WO 2004/040086 A1, and are typically housed in a lock case secured to a lock post which is fixedly mounted to a door.

According to some standards it should be possible to rotate the key for 360 degrees when it is inserted in the lock cylinder. Furthermore, for many applications it is important to have a relatively large displacement of the bolt. For example some standards demand a minimum of 20 mm bolt displacement. This displacement must be achieved by one rotation of the key, i.e. 360 degrees. If more than one rotation of the key is needed to achieve the 20 mm displacement, this may not always be performed in practice and this therefore implies a security risk.

Another issue is that the direction of rotation of the key should be logical to the user. Most users find that when locking a door, the upper part of the key should be moved towards the door post or in other words in the direction in which the bolt extends from the lock mechanism. Furthermore, it is advantageous if the same lock mechanism can be used with different types

of lock cylinders. Two examples of common lock cylinders are the "Euro Profile cylinder" and the "Scandinavian Oval cylinder".

All this has been achieved by a locking mechanism wherein the curved path has a shape such that when the engagement means are rotated in one direction the engagement means will engage with the receiving means at a first point on said curved path and disengage from the receiving means at a second point on said curved path, such that the engagement means can rotate 360 degrees.

In a preferred embodiment of the invention the engagement can also be rotated in the opposite direction whereby the engagement means will engage with the receiving means at the second point on said curved path and disengage from the receiving means at the first point on said curved path.

In a preferred embodiment of the invention the engagement means could be a protrusion. This will be the case for the Euro Profile cylinder. When the engagement means is a protrusion, the receiving means can be a recess in the toothed element.

In a preferred embodiment, the toothed element of the lock mechanism can be arranged to be slidable along said curved path. This offers a simple and reliable construction.

In a further embodiment the part of said curved path along which the engagement means could be in engagement with the receiving means, could have an average radius which is larger than the radius of rotation of said engagement means, and which has a centre different from the centre of rotation of said engagement means. This is a simple and reliable arrangement for ensuring an accurate engagement and disengagement between the engagement means and the receiving means.

In a further embodiment the toothed wheel can be connected with a tap which extends perpendicular to the plane of the toothed wheel into a slit connected to said bolt, such that when the toothed wheel is rotated, the rotational movement of the wheel is transferred to a rectilinear or substantially rectilinear displacement of said bolt. This is a simple and reliable arrangement for transferring the rotational movement of the toothed wheel to a displacement of the bolt. The toothed wheel including the tap is furthermore a simple way of transferring the movement of the toothed element to the displacement of the bolt.

In a further embodiment of the invention the slit could extend in its longitudinal direction transversely to the direction of displacement of the bolt. Thereby the component of the movement of the tap parallel with the direction of displacement of the bolt is transferred directly to the bolt. At the same time, due to the slit, the component of the movement transverse to the displacement of the bolt will not influence the displacement of the bolt.

In a further embodiment the lock mechanism is provided with means for preventing the bolt from being pressed into the lock case when the bolt is in a fully extended position. Thereby, the security of the lock mechanism is further improved.

In a further embodiment, the means for preventing the bolt from being pressed into the lock case is the tap connected with said toothed wheel and extending into said slit. Preferably the tap has an end position when the bolt is fully extended from the lock mechanism, said end position is placed on or above a line being parallel or substantially parallel with the direction of displacement of said bolt and passing through the centre of rotation of said toothed wheel, thus obtaining a simple and reliable solution.

In a further embodiment the position of said toothed element is biased such that the toothed element has two stable positions where the engagement means is disengaged from said receiving means. This will prevent accidental movement of the toothed element when the engagement means is disengaged from the receiving means. Such biasing could be by means of a spring load.

Embodiments of the invention are now described in further detail with reference to the figures. These embodiments are not limiting for the scope of protection defined in the claims.

Figure 1 shows a perspective view which illustrates the main parts of the lock mechanism arranged in a lock case.

Figure 2 illustrates an exploded view of the main parts for the lock mechanism.

Figure 3 shows a side view which illustrates the lock mechanism with the bolt fully extended.

Figure 4 shows a side view which illustrates the lock mechanism with the bolt in an intermediate position.

Figure 5 shows a side view which illustrates the lock mechanism with the bolt fully withdrawn.

Figure 6 is equivalent to figure 3 but for a Scandinavian Oval cylinder.

Figure 7a – d illustrates specific parts for the lock mechanism in figure 6.

Figure 8 is equivalent to figure 4 but for a Scandinavian Oval cylinder.

Figure 9 is equivalent to figure 5 but for Scandinavian Oval cylinder.

It should be noted that terms of orientation, for example above, clockwise etc. are to be interpreted according to the orientations of the figures. It should be understood by the person skilled in the art that the devices could be installed in other orientations.

Figures 1 – 5 shows a lock for a Euro Profile cylinder. This lock cylinder is drop shaped, and is extending through the lock case 1 from one side to the other. At an intermediate point of this drop shaped lock cylinder engagement means 5 are provided which are arranged such that they can perform a 360 degrees rotation.

In figures 1 – 3 the lock case 1 with one cover removed is shown. The lock mechanism is arranged within the lock case 1 comprising two covers each covering one of the major surfaces. The lock case 1 is connected to a lock post 2 which is to be secured to e.g. a door. The lock post 2 is provided with holes 8 for e.g. screws to secure the lock post 2 to a door. Within the lock case 1 the lock mechanism is arranged with an opening 6 for a lock cylinder 4. The lock cylinder will be extending out of the lock case 1 perpendicular to the plane of the paper when inserted in the opening 6. A rotational movement of a key inserted in the lock cylinder will cause rotation of engagement means 5, which are arranged such that they can be rotated 360 degrees. The engagement means 5 are in this case a protrusion in the shape of a tooth.

The opening 6 for the lock cylinder 4 is formed by a first 18 and a second 19 plate.

The lower part 9 of the lock case 1 illustrated in the figures is typically used for a handle and a latch controlled by this handle. This is, however, not essential for the invention and is therefore not shown.

The lock mechanism is further provided with a toothed element 11 movable along a curved path 13 and connected with receiving means 12. The receiving means 12 will in this case have the form of a recess, e.g. a notch, fitting together with a protruding engagement means 5. The engagement means 5 and the receiving means 12 are formed to fit together, such that when they are in engagement, rotation of the engagement means 5 will give rise to a displacement of the toothed element 11 along the curved path 13.

The curved path in which the toothed element 11 is movable is in this case formed as a groove 23 in said first plate 18 and in said second plate 19. The toothed element 11 is slidable in this groove 23 via a protrusion formed on the toothed element 11. The toothed element 11 is further in engagement with a toothed wheel 15 which is rotatably mounted. The toothed wheel 15 has a tap 16 eccentrically connected to the toothed wheel 15. This tap extends into a vertical slit provided in a base plate 30 of a bolt 3.

A displacement of the toothed element 11 will cause a rotation of the toothed wheel 15, which by means of the tap 16 and the slit 20 will cause a displacement of the bolt 3.

The bolt 3 is connected to the base plate 30 into which the slit 20 is arranged. The base plate, being part of the bolt 3, is prepared for being displaced within the lock case 1 following movement of the tap 16 connected to the toothed wheel 15, when the tap 16 is moved in the slit 20. As illustrated in figure 3 the base plate 30 is placed in front of the toothed wheel 15, and the slit 20 in the base plate 30 is preferably arranged such that the tap can be rotated with the toothed wheel for approximately 180 degrees.

Figures 3 – 5 show three different positions of the bolt 3 depending on the position of the engagement means 5, and thereby on the position of a key in a lock cylinder.

Figure 3 shows the lock mechanism with the bolt fully extended from the lock case 1. In this position the toothed element 11 has been moved as far anti-clockwise as possible, i.e. into the position opposite the direction of extension of the bolt 3 from the lock case 1. This means that the teeth of the toothed element 11 in engagement with the toothed wheel 15 are the outer teeth at one end of the row of teeth on the toothed element 11. This is the position where the engagement means 5 cannot move the toothed element 11 further in an anticlockwise direction. The engagement means 5 will loose contact or engagement with the receiving means 12 of the toothed element 11 when the engagement means 5 is moved further in an anticlockwise direction according to the figures. The engagement means 5 may, therefore, be rotated further in an anticlockwise direction without being engaged with the receiving means 12. This enables the key to rotate 360 degrees. The rotation stops when the engagement means 5 abuts the toothed element 11 again. This is shown by the tap shown with dotted lines in figure 3.

With the position of the toothed element 11 shown in figure 3, the position of the toothed wheel 15 and the bolt 3 will also be given. A spring 21 is arranged between one fixed point of rotation on the lock case 1 and one point connected to the toothed wheel 15 such that the spring 21 will exert a force holding the toothed wheel 11 in the position shown in figure 3 where the bolt 3 is fully extended. In this position the toothed element 11 is abutting against an end of the groove 23 preventing also the toothed wheel 15 from further clockwise rotation. The purpose is to prevent any movement of the toothed element 11 when the receiving means is not in engagement with the

engagement means 5. It should be mentioned that the friction in the mechanism should be enough, but a spring is useful to provide extra security.

When the bolt 3 is in this fully extended position as shown in figure 3 the tap 16 connected to the toothed wheel 15 will be positioned such that any attempt to force the bolt 3 into the lock case 1 will result in a force on the tap 16 directed directly towards the centre of rotation of the toothed wheel 15. Therefore there will be no component of this force acting tangentially on the toothed wheel, and therefore it cannot be rotated by such a force on the bolt. The lock mechanism is therefore self-locking.

Figure 4 shows the lock mechanism with the bolt in an intermediate position where it is being moved between the fully extended and the fully withdrawn positions. In this position the teeth of the toothed element 11 which are in engagement with the toothed wheel 15, are some of the middle teeth in the row of teeth on the toothed element 11. In this position, the toothed element 11 will follow movement of the engagement means 5 in both clockwise and anticlockwise direction. The spring 21 will exert a force on the toothed wheel seeking to rotate it into one of the two end positions where the bolt 3 is either fully extended or fully withdrawn. The turning point which decides which position the spring load will seek to force the toothed wheel into, is when the tap is halfway between the two stable positions.

It is seen from figures 3 – 5 that due to the dimensions and placement of the slit 20 it is only possible to move the bolt 3 from fully extended to fully withdrawn by rotating the toothed wheel 15 anticlockwise. In figure 3 the tap 16 is prevented by the slit 20 from being moved upwards. Likewise, it is only possible to move the bolt from fully withdrawn to fully extended by rotating the toothed wheel 15 clockwise. In figure 5 the tap 16 is prevented by the slit 20 from being moved upwards.

Figure 5 shows the lock mechanism with the bolt fully withdrawn in the lock mechanism. In this position the toothed element 11 has been moved as far clockwise as possible in the groove 23 forming the curved path 13, i.e. into the position in the direction where the bolt 3 is to be extended from the lock case 1. Further clockwise rotation of the engagement means 5 will course the engagement means 5 to loose contact or engagement with the receiving means 12 of the toothed element 11. The engagement means 5 are therefore free to complete their 360 degrees rotation.

In this position of the key, the bolt 3 is fully withdrawn. The spring 21 will be holding the toothed wheel 11 in the stable position shown in figure 5. In this position the toothed element 11 is abutting against the other end of the groove forming the curved path 13 preventing also the toothed wheel 15 from further anti clockwise rotation. Furthermore, the tap 16 abuts against the top of the slit 20 also preventing further anticlockwise rotation of the toothed wheel.

It is seen from figures 3 – 5 that the movement between the toothed element 11 and the toothed wheel ensures that turning the upper part of the key towards the lock post 2 will extend the bolt 3 from the lock case 1, thereby locking the door in which the lock mechanism has been arranged.

Correspondingly, turning the upper part of the key away from the lock post 2 will unlock the door by withdrawing the bolt 3 into the lock case 1. This is also the turning direction of the key for locking and unlocking, respectively, which intuitively will be the most logical turning direction for most people.

In figures 3 – 5 the circle 14 along which the engagement means 5 will rotate is indicated with dotted lines. It is seen that the radius of this circle is clearly smaller than the radius of the curved path 13 of the receiving means 12. Also, the centre of the curved path 13 is located differently than the centre for

the rotation of the engagement means 5. This arrangement of different radius and different centre of rotation facilitate that the engagement means 5 are only in engagement with the receiving means 12 for a part of a 360 degrees full circular rotation. This part of engagement is for the Euro Profile cylinder 110 degrees of the rotational movement of the engagement means 5 and for the Scandinavian Oval cylinder this part of the engagement is 125 degrees of the rotational movement of the engagement means 5. This means that 110 or 125 degrees of the rotation of the key is applied for displacement of the bolt 3, and during this part of the rotation there will be proportionality between the rotational position of the key and the position of the bolt 3. In a preferred embodiment of the lock mechanism the total displacement of the bolt will be 20 mm or approximately 20 mm.

The curved path 13 may have other shapes than part of a circle as illustrated. It may be formed from different circle parts having different radius and different centres. The important point is that when the engagement means 5 are rotated in one direction the engagement means 5 will engage with the receiving means 12 at one point of said curved path 13 and disengage from the receiving means 12 at a different point of said curved path.

The toothed element 11 is preferably formed as a sliding part being slideable in the curved path 13. Alternatively, the toothed element 11 is pivotable about a point such that it is movable in the curved path 13.

In figure 6 – 9 a Scandinavian Oval cylinder is used. This type of lock cylinder does not extend through the lock case 1. This means that two different cylinders can be entered into the opening 6 for cylinders, one from each side of the lock case 1. Inside the opening 6 for cylinders a transferring means 25 (shown in figure 7b) is arranged for transferring the rotational position of both of the two cylinders to the engagement means 5. The transferring means is provided with a cross recess or a cross opening for correspondence with

means on the cylinders rotatable with e.g. the key. The transferring means 25 may comprise the engagement means 5 or is in contact with the engagement means 5 when inserted in the opening 6 for cylinders.

Often the cylinder accessible from outside the door is to be opened by a key, while the cylinder accessible from inside the door is rotatable by a simple knob. Both cylinders have means for engaging with the transferring means 25.

When assembling the lock mechanism the transferring means 25 is arranged in the lock case 1, in the area between the first 18 and the second 19 plate.

In the embodiments shown in the figures the bolt 3 has been an integral component of the lock mechanism and has been arranged inside the lock case and is extendable from the lock case 1. However, it should be clear to the person skilled in the art that the bolt 3 could also be arranged distant from the lock case 1. The position of the bolt 3, i.e. extended or withdrawn, could then be controlled via a rod controlled by the position of the toothed wheel 15. A bolt 3 placed in the lock case 1 as shown in the figures could also be supplemented by one or two further external bolts controlled through one or two rods.

## Claims

1. A lock mechanism for a door or window, said lock mechanism being prepared for receiving a lock cylinder 4 with engagement means 5 which are rotatable 360 degrees, said lock mechanism comprising
   - a toothed element 11 being movable along a curved path 13 and having receiving means 12 prepared for engaging with said engagement means 5;
   - a toothed wheel 15 in engagement with said toothed element 11 such that displacement of said toothed element 11 along said curved path 13 causes a rotation of said toothed wheel 15;
   - a bolt 3 displaceable by a rotational movement of said toothed wheel 15;

   *characterised in*

   that said curved path 13 has a shape such that when the engagement means 5 are rotated in one direction the engagement means 5 will engage with the receiving means 12 at a first point on said curved path 13 and disengage from the receiving means 12 at a second point on said curved path 13, such that the engagement means 5 can rotate 360 degrees.

2. A lock mechanism according to claim 1, wherein when the engagement means 5 are rotated in the opposite direction, the engagement means 5 will engage with the receiving means 12 at the second point on said curved path 13 and disengage from the receiving means 12 at the first point on said curved path 13.

3. A lock mechanism according to claim 1 or 2, wherein said engagement 5 means is a protrusion, and said receiving means 12 is a recess in the toothed element 11.

4. A lock mechanism according to any one of the previous claims wherein said toothed element 11 is arranged to be slidable along said curved path 13.

5. A lock mechanism according to any one of the previous claims, wherein the part of said curved path 13 along which the engagement means 5 will be in engagement with the receiving means 12, has an average radius which is larger than the radius of rotation of said engagement means 5, and which has a centre different from the centre of rotation of said engagement means 5.

6. A lock mechanism according to any one of the previous claims, wherein said toothed wheel 15 is connected with a tap 16 extending perpendicular to the plane of the toothed wheel 15 into a slit 20 connected to said bolt, such that when the toothed wheel 15 is rotated, this rotational movement is transferred to a rectilinear or substantially rectilinear displacement of said bolt 3.

7. A lock mechanism according to claim 6, wherein said slit 20 is extending in its longitudinal direction transversely to the direction of displacement of said bolt 3.

8. A lock mechanism according to any one of the previous claims, wherein the lock mechanism is provided with means for preventing the bolt 3 from being pressed into the lock case 1 when the bolt 3 is in its extended position.

9. A lock mechanism according to claims 6 – 8, wherein said means for preventing the bolt 3 from being pressed into the lock 1 case is the tap 16 connected with said toothed wheel 15 and extending into said slit 20.

10. A lock mechanism according to claim 9, wherein said tap 16 has an end position when the bolt 3 is fully extended from the lock mechanism, said end position is placed on or above a line being parallel or substantially parallel with the direction of displacement of said bolt 3 and passing through the centre of rotation of said toothed wheel 15.

11. A lock mechanism according to any one of the previous claims, wherein the position of said toothed element 11 is biased in its two end positions, such that the toothed element 11 has two stable positions where the engagement means 5 is disengaged from said receiving means 12.

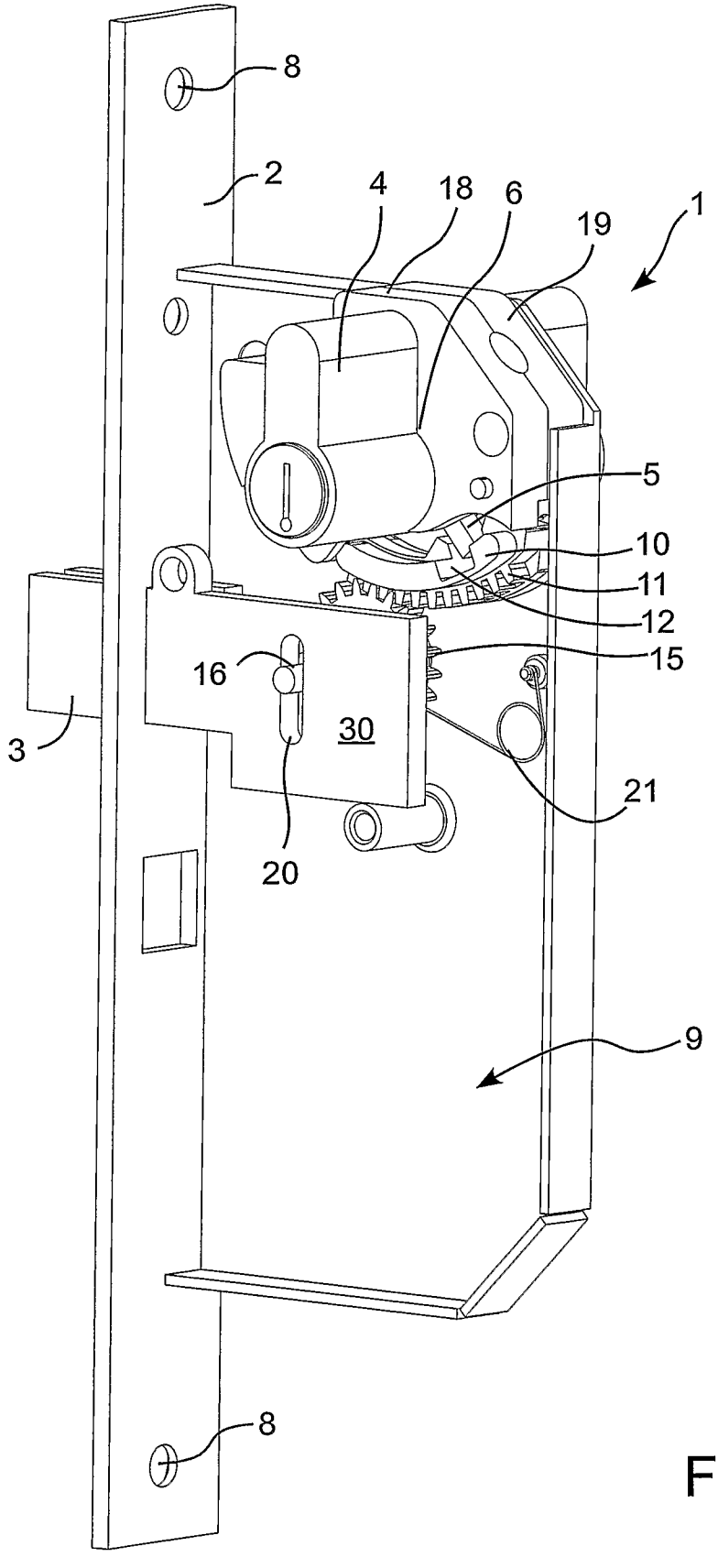



Fig. 1

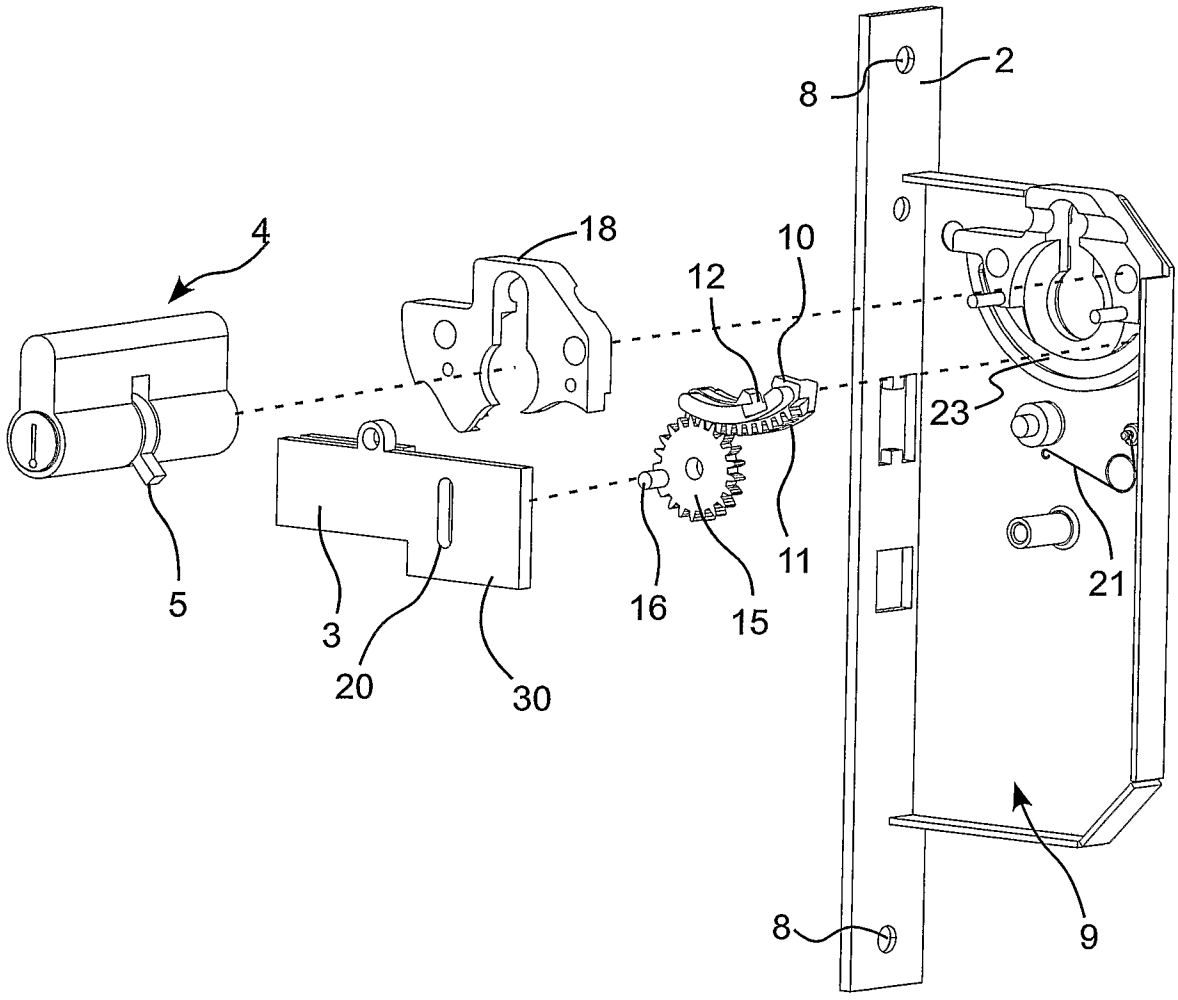



Fig. 2

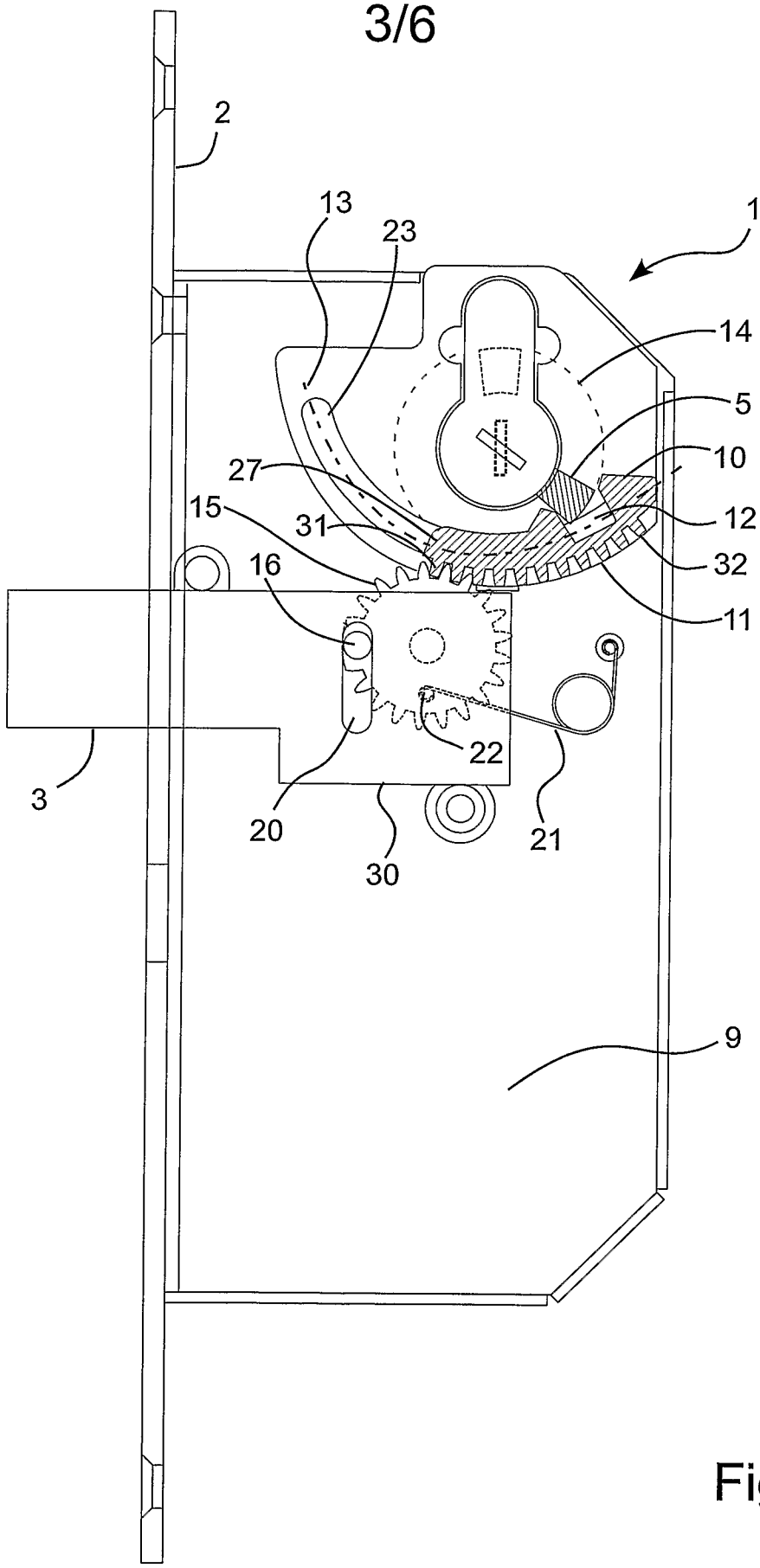



Fig. 3

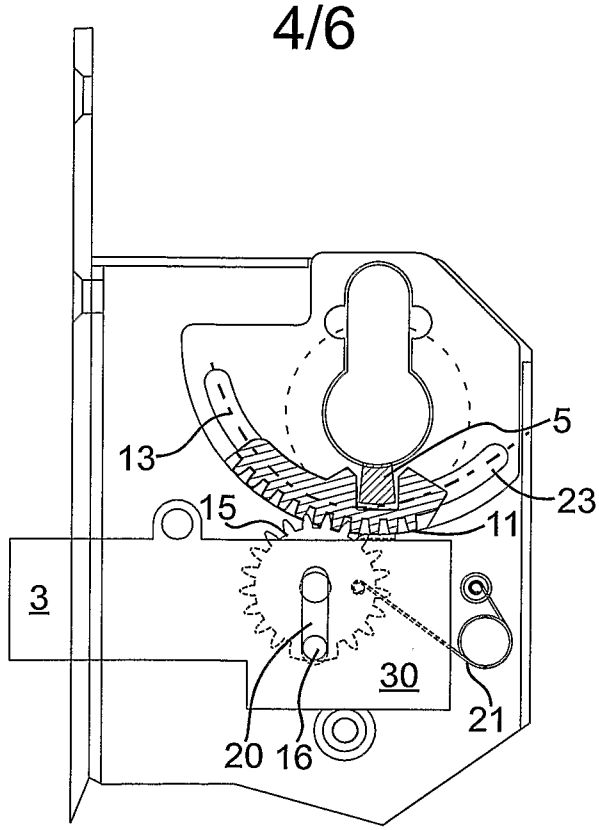



Fig. 4

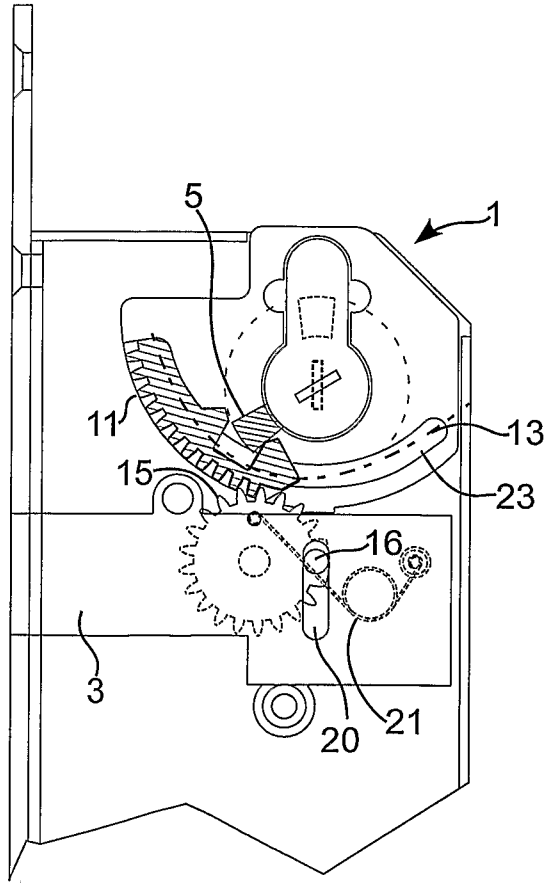



Fig. 5

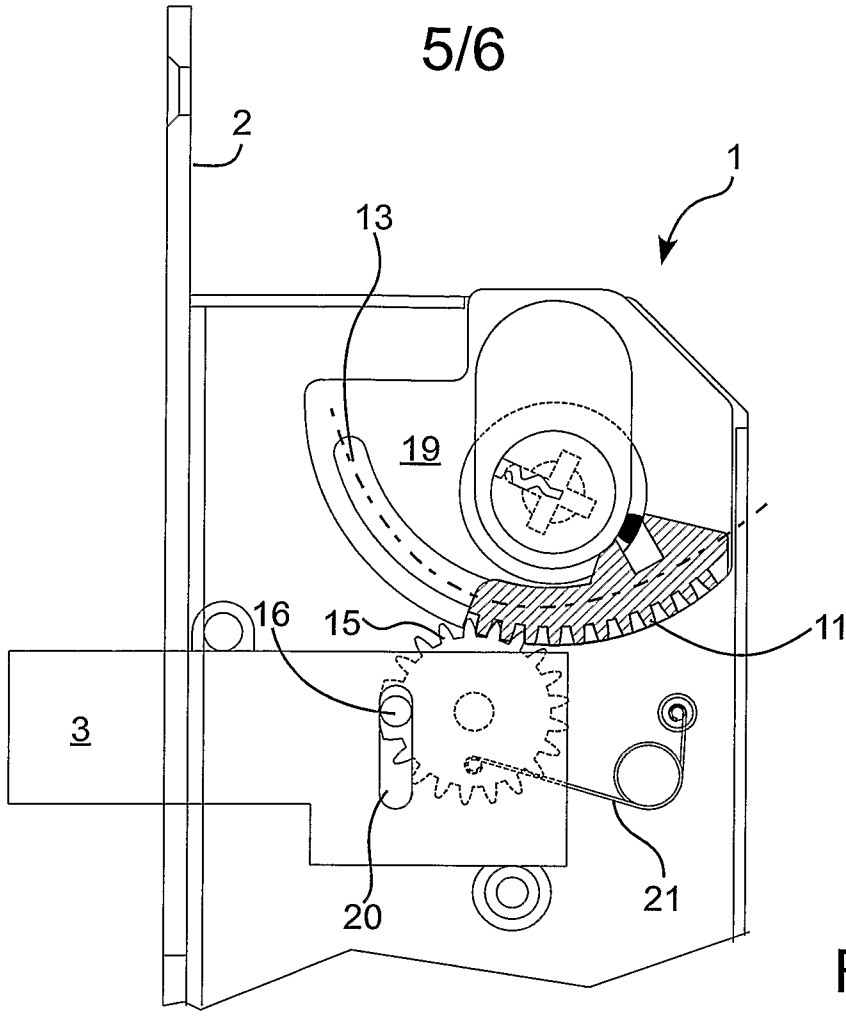



Fig. 6

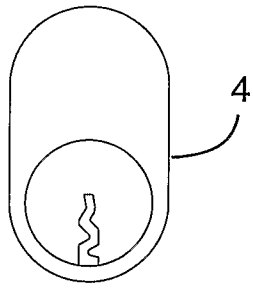



Fig. 7a

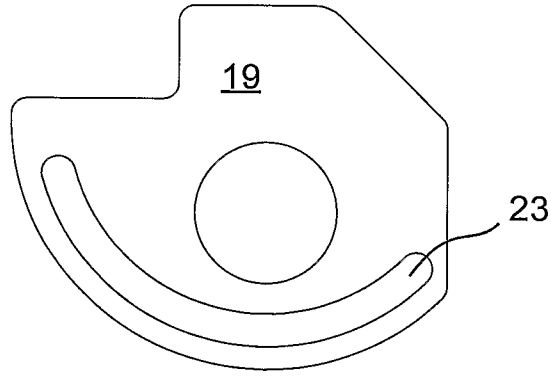



Fig. 7c

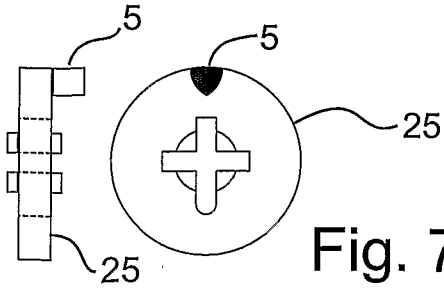



Fig. 7b

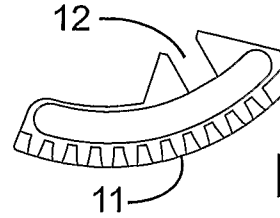



Fig. 7d

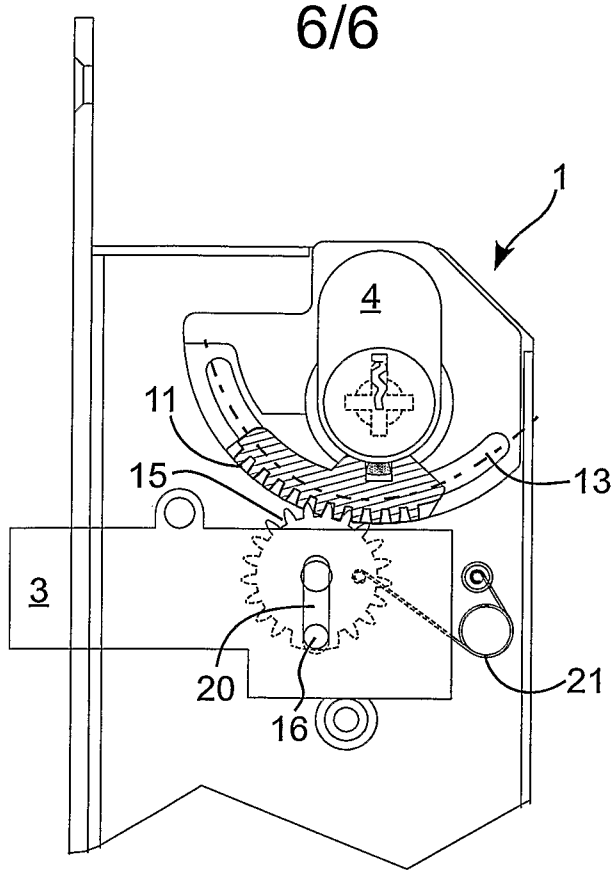



Fig. 8

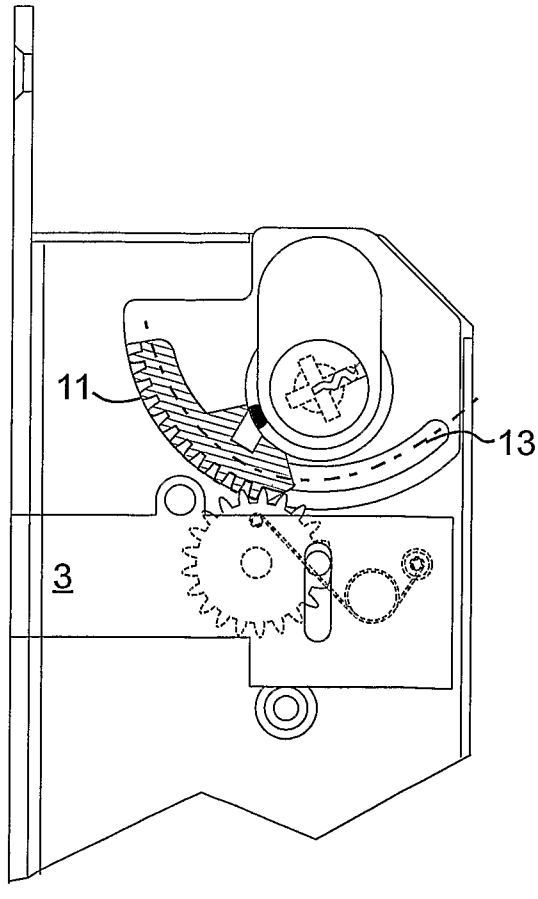



Fig. 9

# INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2007/000336

A. CLASSIFICATION OF SUBJECT MATTER
INV. E05B17/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 3 175 376 A (CANTWELL ROBERT G)<br>30 March 1965 (1965-03-30)<br>the whole document | 1-5,8 |
| Y | DE 195 38 320 A1 (HUEPPE FORM SONNENSCHUTZ [DE]) 2 May 1996 (1996-05-02)<br>the whole document | 1-6 |
| Y | WO 2004/040086 A (CCZ INTERNAT PTE LTD [SG]; CHENG CHNG ZAY [SG])<br>13 May 2004 (2004-05-13)<br>the whole document | 1-6 |
| A | NL 7 807 082 A (LIPS SLOTENFAB)<br>3 January 1980 (1980-01-03)<br>figures | 1 |

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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| 7 February 2008 | 19/02/2008 |

| Name and mailing address of the ISA/ | Authorized officer |
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| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Westin, Kenneth |

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