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(54) RECESSED LOCK WITH IMPROVED OPERATING MECHANISM FOR THE LATHS OF A WINDOW, DOOR OR THE LIKE

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Description

[0001] The present invention relates to a recessed lock with an operating mechanism for the laths of a window, a door or the like.

[0002] Such a recessed lock is usually built into the space between the fixed frame and the movable leaf of the window, door or the like in order to convert the rotational movement of the window or door handle into a linear movement of the locking mechanism, more specifically of the laths which can slide along the perimeter of the leaf. Such a recessed lock is usually milled into the leaf profile.

[0003] In its simplest embodiment, the operating mechanism of the recessed lock may consist of a gear wheel and a gear rack cooperating with the latter, wherein the operation of the handle causes the gear wheel to rotate, so that the rotation of the gear wheel causes a shift of the rack, which in turn causes the hinges to move.

[0004] A gear rack is a rectangular bar with teeth on one side complementary to the teeth of a co-operating gear wheel. By rotating the gear wheel, the bar can be moved in a longitudinal direction.

[0005] Usually, one or more gear transmissions are used in such locks, one of which is often a gear-rack transmission, to go from rotational to linear. A gear transmission or gear-rack transmission is usually characterised by a constant gear ratio.

[0006] The gear ratio is the ratio of the revolution of the gear wheel. With a constant gear ratio of the gear wheel is induced a constant movement of the gear rack.

[0007] This also means that the speed of travel of the carriage is constant over the entire length of the carriage. With a rotation of 180° of the gear wheel on the rack, the speed of travel of the rack will be constant. As is known, this is achieved by a symmetrical gear wheel (with a circular outline), provided with a central gear shaft.

[0008] A typical recessed lock with an operating mechanism for the laths of a window, door or the like, has a gear transmission for driving the laths, the gear transmission comprising a rotatable drive gear and a sliding carriage. The carriage is constructed as an elongated element having a gear rack at one end cooperating with the drive gear for sliding the carriage.

[0009] The gear rack has teeth into which the teeth of the drive gear engage. The carriage is typically bar-shaped, with all the teeth of the gear rack being provided in a straight line and with constant toothing.

[0010] A specific application of such a lock is a lock for windows such as among others turning windows, turn-tilt, tilt-turn windows and the like. This lock is part of a system, for example a turn-tilt system, a system with corner transmissions, locking points and the like.

[0011] For various reasons, a larger course or a larger rectilinear travel is desirable, for example to compensate for course loss in the various system components or to allow for a larger placement tolerance on locking elements.

[0012] The course is defined as the total travel in case of a rotation of 90° or 180°. However, this total distance is fixed and specific to the lock.

[0013] In the case of windows, locking cams and locking elements are usually used to close the window. The locking cams are usually located on the leaf and are driven in translation by the lock. The locking elements are placed on the frame, preferably at a fixed distance from the locking cam. The position of the locking cams depends on many, often unknown factors, making the positioning of the locking elements in relation to the locking cams a task that is usually done manually by the craftsman on the basis of his craftsmanship. It is desirable, however, that these locking elements be positioned independently of the locking cams in preferably fixed positions by means of a CNC machine.

[0014] This could be achieved by using a gear wheel with a larger pitch circle diameter. However, there is a trend towards increasingly narrower profile surfaces and hence a small installation space for the lock. A lock with a slightly larger course appears to be impossible to install in narrow profiles without performing additional operations on these profiles and any glazing beads.

[0015] It is known that the aforementioned space in the leaf profile, and between the fixed frame and the movable leaf in which the recessed lock is to be fitted, is rather limited.

[0016] It is also known that a sufficiently large travel of the laths is difficult to achieve with a simple gear-rack transmission within this limited space.

[0017] GB2227273A, EP3287578A1, DE2925147A1 and WO2006079492 describe known systems. A disadvantage of such known systems is that there is no optimum space-saving for the gear in the housing, more specifically in the space transverse to the gear rack.

[0018] The present invention aims to provide a solution to one or several of the aforementioned and/or other disadvantages by providing the following features according to the claims.

[0019] The present invention provides a recessed lock with an operating mechanism for the closing laths of a window, a door or the like, wherein the mechanism comprises a housing with a pronounced longitudinal direction X-X' and an operating bar which can slide in an axial direction with respect to the housing and a gear transmission for driving the operating bar and the closing laths connected thereto, wherein the gear transmission comprises a gear wheel which van be rotated about its axis Y-Y' by a handle or other drive, wherein the operating bar comprises a carriage provided with a gear rack cooperating with the gear wheel for sliding the carriage in the housing, characterised in that the gear ratio between the gear wheel and the carriage is variable wherein the axis (6) of the gear wheel (7) is off-centre, wherein the gear wheel (7) has two identical radii (R1) at 0° and 180°, a shortest radius (R0) between a rotation of 180° and 360° and a largest radius (R2) between a rotation of 0° and 180° of the gear wheel, wherein the gear wheel (7) undergoes a rotation of maximum 180° +/- 5° and the gear rack (11) has a shape which is complementary to the 180° rotation of the gear wheel (7).

[0020] The carriage therefore has a variable speed of travel. The gear ratio between the gear wheel and the carriage is not constant.

[0021] The course is determined by the gear ratio. The variable speed of travel is determined by the varying gear ratio in relation to the angle of the gear wheel. The gear ratio is variable because the gear is not circular around its axis of rotation.

[0022] The course is defined as the total travel at a rotation of 90° or 180°. This distance is fixed and not variable. However, the speed at which this travel is covered is variable.

[0023] In a preferred embodiment of a recessed lock according to the invention, the travel of the carriage is different in certain segments of the rotation or parts of the course.

[0024] The carriage does not have a toothing line which is rectilinear as usual. The pitch line of the toothing of the gear rack has a shape which is different from a single straight line.

[0025] The shape of the pitch line of the gear wheel is at least partly complementary to the shape of the pitch line of the toothing of the gear rack, and the position of the axis of the gear wheel is such that the gear wheel cooperates with the teeth of the gear rack while rotating about this axis.

[0026] In a particular embodiment of a recessed lock according to the invention, the gear wheel is circular and the gear wheel has an eccentric axis.

[0027] In another embodiment of a recessed lock according to the invention, the gear wheel is not circular.

[0028] In a particular embodiment of a recessed lock according to the invention, the gear wheel has a composite shape of several circular, logarithmic spiral or other pitch lines.

[0029] In a particular embodiment of a recessed lock according to the invention, the pitch line of the toothing of the gear rack has a composite shape of several straight and/or curved segments, complementary to the shape of the gear wheel or the part of the gear wheel that cooperates with the gear rack.

[0030] In a preferred embodiment of a recessed lock according to the invention, the recessed lock has a symmetry around the 90° position of the gear wheel, with the first part of the course accelerating from 0° to 90° and the second part decelerating from 90° to 180°, the total course of both parts being equal.

[0031] To this end, the invention relates to a recessed lock having a symmetry around the 90° position of the gear wheel, with the first part of the course accelerating from 0° to 90° and the second part decelerating, the total course of both parts being equal, wherein the gear wheel has a largest radius and shortest radius and two identical radii spread over 360°. The largest radius is situated at 90°, the two identical radii at 0° and 180°, and the shortest radius at 270°.

[0032] In another preferred embodiment of a recessed lock according to the invention, the recessed lock has an asymmetry around the 90° position of the gear wheel, wherein the course is different from the 0° to 90° rotation compared to that from 90° to 180°.

[0033] The gear wheel is preferably partially toothed.

[0034] In a specific embodiment, the gear wheel is toothed over a wide angle of 180°.

[0035] In a particular embodiment, the gear wheel is circular and toothed at the largest radius relative to an eccentric axis of rotation and up to +90° and -90° therefrom.

[0036] In a particular embodiment of a recessed lock according to the invention, the gear wheel has a variable gear ratio, such that the acceleration is linear. As a result, the carriage accelerates or decelerates linearly at a constant angular rotation of the gear wheel.

[0037] The gear wheel comprises a pitch line in the shape of several toothed segments, each with their own contour shape. Each segment contains a specific number of teeth.

[0038] In a specific embodiment, the gear wheel comprises one or several segments with a pitch line in the shape of a logarithmic spiral.

[0039] With a recessed lock according to the invention, the course is larger than the course obtained with a gear wheel having a central shaft fitting in the same space.

[0040] Thanks to the variable gear ratio, an optimisation of the operating torque can be provided for, especially in the segment where the highest operating torque is expected, the gear ratio ensuring a reduction of the operating force.

[0041] The gear rack extends in the longitudinal direction X-X' and has a flat side parallel to the longitudinal direction X-X' which fits against the carriage and the hinges, and an opposite side with teeth, whereby the side with teeth represents an imaginary flat side passing through the middle of the teeth, wherein the perpendicular distance between the flat side and the imaginary side of the teeth varies along the length of the gear rack complementary to the variable radius between the axis of rotation and the circumference of the gear wheel depending on the rotated position of the gear wheel on the gear rack.

[0042] In a preferred embodiment of a recessed lock according to the invention, the gear rack is arc-shaped or comprises several rectilinear parts at a certain angle in accordance with the shape or the segments of the gear wheel. Each rectilinear part of the gear rack has a certain number of teeth in accordance with the number of teeth of the segments of the gear wheel.

[0043] The gear wheel can also be designed as a double gear wheel.

[0044] The drive mechanism may comprise several gear wheels.

[0045] The advantage of the recessed lock according to the invention is to obtain a more compact lock in which the total course is nevertheless somewhat larger than in a typical recessed lock as mentioned above. Whereas a known recessed lock has a theoretical travel of 34 mm at 180° rotation, the recessed lock of this embodiment has, within the same dimensions, a greater travel of 36.8 mm at 180° rotation due to the use of a gear wheel with a pitch line which is not circular around its axis of rotation. The lock is compact because the compact installation space can be maximally used by the gear wheel.

[0046] A gear rack is a rectangular rod with teeth on side, like a gear wheel. The pinion, a small gear wheel that engages in the teeth, allows the rod to be moved lengthwise.

[0047] They are rectangular rods with teeth on one side, just like a gear wheel. By using a gear wheel with complementary teeth that engage with the teeth of the rack, it is possible to make the gear rack move in a longitudinal direction. Gear racks are used where a rotating movement needs to be converted into a rectilinear travel.

[0048] The rack is defined by a pitch height and a pitch.

[0049] The shape of the rack, more specifically the shape of the side with the teeth, is another aspect. With a known rectangular gear rack, the teeth follow the rectangular shape of the rod, in other words the teeth are placed in a straight line. Such a gear rack cooperates with a circular gear wheel having a central axis. This results in a constant gear ratio between the gear wheel and the gear rack. A rotation of the gear wheel results in a constant travel of the gear rack, since the distance that the gear wheel teeth travel on the gear rack is the same as the length of the gear rack itself. For most devices, the only requirement is a constant transmission of a rotational movement into travel.

[0050] The gear rack of the invention has a non-rectilinear form of toothing. As a result, a gear wheel will travel a longer distance over the teeth of the gear rack, so that a greater rotation of the gear wheel can be obtained, and yet the same distance of rectilinear travel is covered via the gear rack. As a result, however, the gear ratio between the gear wheel and the gear rack is not constant but variable. The advantage of such an embodiment is that the gear rack can be installed and moved in the same compact space as a known gear rack. The toothed bar can therefore be longer than a conventional straight toothed bar.

[0051] The rack basically still has the shape of a rectangular bar, wherein the opposite side of the teeth is rectilinear, so that the gear rack causes a rectilinear travel.

[0052] The pitch line of the toothing of the gear rack is not a straight line and can take any other shape, for example a combination of one or more rectilinear parts or one or more curved parts. Thus, the shape of the gear wheel and the pitch line of the gear teeth are complementary. The pitch line of the gear wheel has a complementary shape, related to the position of the axis of the gear wheel, so that a gear wheel, while rotating about its axis, cooperates with the teeth of the gear rack. For example, the gear wheel may be circular with an eccentric axis, or the gear wheel may be other than circular with the axis located anywhere. As a result, the gear ratio between the gear wheel and the gear rack is variable or not constant.

[0053] In the gear-rack transmission, the gear wheel will typically undergo a maximum rotation of 180°. This can be slightly more, over 180°, due to an over-turn, where the gear undergoes a rotation of 180° +/- 5°.

[0054] In a first embodiment of a recessed lock according to the invention, the lock has a symmetry at about the 90° position of the gear wheel, wherein the first part of the course is accelerating from 0° to 90° and the second part is decelerating from 90° to 180°. The speed of travel is variable. The total course of both parts is equal. For windows that open to the left or right respectively, the lock is mounted upside down (bottom-top symmetry).

[0055] The advantage is that more course is obtained in a small installation space.

[0056] When rotated 90°, the gear wheel requires less space than with the conventional system of a circular gear wheel where the axis is central.

[0057] After all, the gear wheel is only rotated over a wide angle of 180°. The shortest distance from the off-centre axis to the circumference of the gear wheel is smaller than the distance from a central axis to the circumference. No teeth are provided over a circumference of +90° and -90° from the point of the circumference up to the axis of rotation.

[0058] The gear rack translates the rotational movement of the gear wheel into a linear movement.

[0059] The gear wheel is a cylindrical gear wheel in which the profile of the teeth is the involute of the base circle.

[0060] The teeth of the gear wheel are straight (or partly bevelled) and parallel to the axis of the gear wheel. The teeth of the gear rack are also straight (or partly bevelled) and complementary to the teeth of the gear wheel.

[0061] Gear and rack move in the same plane when assembled. A rotation to the right of the gear wheel causes a linear travel to the right of the gear rack and a linear travel to the right of the carriage onto which the gear rack is attached, and vice versa for a movement to the left.

[0062] In a conventional recessed lock with a constant gear ratio, the gear rack is flat and straight along its length, and the gear wheel rotates symmetrically about its axis.

[0063] In the recessed lock, the axis of the gear wheel is placed off-centre and the gear rack has a shape that is complementary to a preferably 180° rotational movement of the gear wheel.

[0064] The gear wheel is decentralised, the axis of the gear wheel being placed off-centre. Consequently, the gear wheel has a longest and shortest radius spread over 360°, or spread over 90° each time, and two identical radii, the identical radius being smaller than the longest radius. The longest radius is located at 90°, the two identical radii at 0° and 180°, and the shortest radius at 270°.

[0065] The gear wheel is provided in a space which is sufficiently large for the 180° rotation of the gear wheel. However, the installation space for such an embodiment of a gear and rack is minimal, the installation height of the gear wheel in the housing being the sum of the largest radius and an identical radius.

[0066] The gear rack is arc-shaped or composed of straight lines with different directions. The profile of the gear rack is complementary to the gear wheel. When assembled, the gear rack provides for the largest distance to the gear wheel axis, i.e. the largest radius, in the centre. To the left and right, the gear rack provides for the distance equal to the two identical radii.

[0067] In an alternative embodiment of a recessed lock according to the invention, also with a variable speed of travel, the lock has an asymmetry at about the 90° position of the gear wheel, wherein the course is different from 0° to 90° compared to that from 90° to 180°.

[0068] The rotation may also be greater than 180°. Intermediate gears can be provided to provide additional acceleration.

[0069] The idea is to use a small course for switching between a turning and tilting position and to use a larger course for closing, and thus a larger position tolerance for positioning the locking elements.

[0070] The recessed lock according to the invention provides for a smaller, respectively a larger course for switching between turning and tilting positions, and a larger, respectively a smaller course in the closing area between the turning (or tilting) position and the closing position.

[0071] The manufacturer is largely in control of the switch positions between turn and tilt. Many factors play a role in the position of the locking points which are beyond the manufacturer's control. By providing more course, the manufacturer wants to obtain a robust system wherein the window constructor can work with locking elements in fixed positions without any problems (e.g. by means of CNC).

[0072] One consequence of the fact that the course between 0° and 90° differs from that between 90° and 180° is that no bottom/top symmetry can be applied to left or right opening windows. If one and the same lock is used for both opening types, the lock must have a front/back symmetry.

[0073] Providing for a larger course in the closing area results in a larger operating torque with the same run-in at the locking elements. This is compensated for by not providing a single linear acceleration, but a combination of three connecting components. Together, they result in a compromise between operating force and positioning tolerance for the locking elements.

[0074] In order to obtain a variable speed of travel with linear acceleration, a gear wheel is used whose pitch circle has the shape of a segment of a logarithmic spiral.

[0075] The variable speed of travel also reduces the operating force. By ensuring that the gear ratio is most favourable at the moment of maximum load, the usual peak in the torque when pulling at the window or door during the closing movement can be reduced, which should lead to a higher comfort level when operating a window or door.

[0076] Thanks to the above-mentioned construction method, the recessed lock can be built compactly and still provide a sufficiently large course.

[0077] In order to better explain the characteristics of the invention, a preferred embodiment of a recessed lock according to the invention is described below, as an example without being limitative in any way, with reference to the accompanying drawings, in which:

- figure 1 schematically and in perspective shows an exploded view of the recessed lock with an operating mechanism according to the invention;
- figure 2 schematically shows the assembled operating mechanism of figure 1, with a part of the housing being omitted, in a 0°, 90° and 180° rotated gear wheel;
- figure 3 represents a front view and side view of the recessed lock with operating mechanism according to the invention;
- figure 4 is a view in perspective of the recessed lock with the operating mechanism according to the invention;
- figure 5 shows a section of the recessed lock with the operating mechanism according to the invention;
- figures 6 shows an alternative embodiment of the recessed lock with the operating mechanism according to the invention, in a gear wheel rotated 0°, 90° and 180°;
- figure 7 schematically and in perspective shows an assembled operating mechanism of the embodiment in figure 6;
- figure 8 shows a detail of the gear wheel and the gear rack of the embodiment in figure 6.

[0078] The recessed lock 1 of figure 1 and figures 2 comprises a housing 2 with a pronounced longitudinal direction X-X', wherein the housing 2 in the illustrated embodiments is always two-piece with a base 3 on the one hand and a cover 4 on the other hand. The housing 2 is intended to be built into the space between the frame and the leaf, and into the leaf provided with a recess, of a window or door, wherein the longitudinal direction X-X' of the housing 2 is parallel to the outer perimeter of the frame or leaf.

[0079] In the aforementioned cover 4, a cylindrical recess 6 is provided in which the gear wheel 7 is rotatably mounted about a geometric axis Y-Y'.

[0080] In a practical embodiment of the invention, the gear wheel 7 is provided with a slightly square or rectangular recess 8, which cooperates with the pin of a handle of the window or door not shown in the figures.

[0081] According to the invention, the recess 8, and more specifically the axis 6 Y-Y' about which the gear wheel 7 can be rotated, is eccentric or off-centre in the gear wheel.

[0082] In this embodiment, the gear wheel is quasi circular. The circumference of the gear wheel 7 is partly in the shape of a circle and partly in the shape of a logarithmic spiral with a symmetry over 90°, at least for that part of the circumference that has teeth 9. The toothed circumference extends 180° in relation to the axis of the gear wheel, the longest distance R2 from the axis to the circumference being situated at 90°. The gear wheel specifications are as follows: radius R1 at 0°= 10.2 mm; part from 0° to 63.45° has the shape of a logarithmic spiral defined by the function $r(\theta) = 10.2* e^{\wedge}(0.19438* \theta)$; transition at 63.45° to circular gear wheel centred on the Y-Y' axis with radius R2 90°= 12.65 mm; symmetrical over 90°.

[0083] In the embodiments shown, the gear wheel 7 is provided with teeth 9 which can interact with an operating bar 10 which is slidable in relation to the housing 2 via a guide 15 of the base 3 and a guide 16 of the cover 4 and which extends according to the longitudinal direction X-X' of the housing 2.

[0084] The operating bar 10 is designed as an elongated element. The operating bar 10 comprises two parts 12 and 13 which are joined together by bolts or rivets through holes 14. The operating bar 10 comprises a gear rack 11 which cooperates with the gear wheel 7.

[0085] To this end, the gear rack is provided with teeth 17 (not shown in figure 1).

[0086] The cover 4 of the housing 2 is mounted between the two parts 12 and 13 of the operating bar 10.

[0087] The teeth 9 of the gear wheel 7 engage in the teeth 17 of the gear rack 11 which is part of the operating bar 10 of the locking mechanism. The gear rack, carriage and operating bar are made in one piece.

[0088] The shape of the gear rack 11 is complementary to the shape that the gear wheel 7 travels in cooperation with the gear rack at 180° rotation.

[0089] The use of bolts is not essential for the proper functioning of the recessed lock, the parts 12 and 13 can also be connected in other known ways to join two parts together.

[0090] There are recesses 5 in the housing 2, which can receive the taps 5'.

[0091] Figure 2 schematically shows the assembled operating mechanism of figure 1.

[0092] By using a variable speed of travel to obtain a more compact lock, the overall course is greater. The known lock has a theoretical course of 34 mm at 180° rotation; by applying the variable speed of travel, a course of 36.8 mm at 180° can be obtained within the same dimensions.

[0093] The lock has a symmetry around the 90° position. The first part of the course from 0° to 90° is accelerating, the second part is decelerating. The total course of both parts is equal. For windows which open to the left or right, the lock is mounted upside down (bottom-up symmetry).

[0094] The operating bar 10 is slidable in the housing 2. The operating bar 10 is drawn as an exploded view, so that the gear rack 11 and its teeth 17 are visible.

[0095] Figures 2A to 2C successively show the cooperation between the gear rack 11 and the gear wheel 7 when the gear wheel is rotated 180° to the right, wherein figure 2A shows 0° rotation, figure 2B 90° and figure 2C 180°.

[0096] The shape of the gear rack 11 matches the logarithmic spiral parts and the circular segment of the gear wheel 7. The gear rack 11 consists of three rectilinear parts, one part of which is incrementally rotated at an angle of 11° with respect to the axis X-X', one part of which is parallel and one part of which descends at 11° with respect to the axis X-X'.

[0097] The distance from the gear rack 11 to the housing 2 is smallest in the 0° and 180° rotated position of the gear wheel 7 and largest at 90°. In the 90° rotated position, the gear wheel 7 protrudes furthest from the top of the housing and the distance to the gear rack is greater. This explains the specific shape of the gear rack adapted to the rotation of the gear wheel with decentralised rotational axis.

[0098] The operation of a recessed lock according to the invention is very simple and as follows.

[0099] When the gear wheel 7 is rotated, for example by means of a crank, the cooperation with the gear rack 11 causes the latter to be shifted over a length L in the longitudinal direction X-X' of the housing 2. This will cause the operating bar 10 to move in an axial direction.

[0100] Figure 2A shows for example the starting position of the operating mechanism at 0° rotation of the gear wheel, wherein the gear wheel 7, at the level of the first tooth 26' on radius R1, is the first to act on the first notch 26 of the gear rack 11 on an imaginary tooth line Z-Z'.

[0101] By turning the gear wheel 7 to the right over 90°, the situation of figure 2B is obtained, wherein the gear wheel 7, at the height of the central tooth 27' on the largest radius R2, now acts on the central notch 27 of the gear rack 11. The gear rack 11 is hereby moved to the right (arrow P) over half its length. Since R2 is greater than R1, the central notch 27 of the rack 11 lies at a distance from the imaginary tooth line Z-Z', further away from the housing, and the rack 11 has a shape 29 which is curved above the imaginary tooth line Z-Z'.

[0102] With a further 90° rotation of the gear wheel 7 to the right, i.e. with a total 180° rotation of the gear wheel, the end position of figure 2C is obtained. The gear wheel now acts, at the height of the tooth 28' on the radius R1, on the last notch 28 of the gear rack 11. The gear rack 11 is thereby moved to the right (arrow P) over its full distance or maximum length. The last notch 28 of the gear rack 11 lies again on the imaginary tooth line Z-Z'.

[0103] The gear rack 11 is symmetrical to the left and right of the central notch 27. The gear wheel is symmetrical +90° and -90° from the central tooth 27' on the largest radius R2.

[0104] The shortest radius R0 is located at 270° rotation of the gear wheel.

[0105] The travel of the operating bar 10 is greater in the embodiment according to the invention than in a conventional embodiment.

[0106] In a conventional embodiment, the gear ratio of the gear wheel to the gear rack (operating bar) is constant. The gear rack is straight-lined.

[0107] In the embodiment according to the invention, in which the gear wheel 7 is arranged off-centre, the gear ratio is variable. This is also noticeable in the special shape of the gear rack 11, as explained above. It is not in one straight line but "curved", or in several parts of straight lines which together form a variably curved line. The distance covered by the pitch line of the gear wheel when rotated 180° over such a form of gear rack is larger than the distance over one straight gear rack. Consequently, the linear travel of the operating bar 10 is also greater. The gear wheel-rack combination for this 180° rotation must fit within the same space as the known gear wheel-rack combination.

[0108] The advantage of a gear wheel of the invention, if it is to fit in the same available space, is that a larger distance is covered compared to with a normal gear wheel.

[0109] It is also possible, according to the invention, to rotate the gear wheel 7 in the opposite direction (left).

[0110] Due to the specific circumference and off-centre axis of rotation of the gear wheel 7, a more compact recessed lock is obtained. The gear wheel is toothed over approximately 180°. The deeper cut shape of the gear rack, compared to a flat gear rack, results in a greater course in the locking area in a compact space.

[0111] The installation space for such an embodiment of a gear wheel and gear rack is minimal, wherein the installation height H of the gear wheel in the housing is the sum of the largest radius R2 and an identical radius R1. The installation height H is perpendicular to the X-X' axis of the housing 2.

[0112] Figures 3 show a front view (3A and 3C) and side view (3B) of the embodiment of figure 2, wherein the position of the housing 2 in relation to the operating bar 10 is shown in figure 3A at 90° rotation of the gear wheel 7, and in figure 3C at 180° rotation.

[0113] Figures 4A and 4B show a view in perspective of the operating bar 10 which is slidable with respect to the housing 2 via the guides 16 and 18 of the cover 4 of the housing 2.

[0114] Figures 5A and 5B show a cross-section of a side view of an embodiment of the recessed lock according to the invention, figure 5A at 90° (in analogy with figure 2B) and figure 5B at 0° and 180° rotation of the gear wheel (in analogy with figures 2A and 2C).

[0115] The installation space of the gear wheel and the gear rack is minimal, the installation height H of the gear wheel in the housing being the sum of the largest radius R2 and an identical radius R1.

[0116] The installation height H of the gear wheel in the housing 2 is thus maximised. As a result, the installation height is minimal and a lock can be installed in a small space, smaller than the space of a conventional lock having the same course.

[0117] In the 90° position of the gear wheel (fig. 5A), the maximum installation space above the axis with length R2 is fully utilised. In the 0° and 180° positions of the gear wheel (fig. 5B), the maximum installation space under the axis with length R1 is fully utilised.

[0118] Figures 6 (exploded version) and 7 (closed version) show an alternative embodiment of a recessed lock according to the invention with one gear wheel having an off-centre rotational axis. Figure 8 shows a detail of the cooperation between the gear wheel 7 and the gear rack 11.

[0119] As in the previous embodiment, the speed of travel is variable, but now the course is different from 0° to 90° compared to that of 90° to 180°. Thus, a small course can be used to switch between the turning and tilting position and a larger course for closing, and thus a larger position tolerance for positioning the locking elements.

[0120] This embodiment differs from the previous embodiment in that the circumference of the gear wheel is not quasi circular or symmetrical, resulting in an even greater course in the specific closing section in a compact space.

[0121] The gear wheel has several outline shapes over its circumference, each with its own centre and radius.

[0122] Another difference with the preceding embodiment is that the shape of the gear rack 11 is more variable or not symmetrical as in the first embodiment. The gear rack 11 includes several straight tooth lines, each positioned at a different angle with respect to the longitudinal direction X-X'. Each tooth line 19, 20, 21 on the gear rack 11 corresponds to a cooperating shape of the circumferential portion of the gear wheel 7.

[0123] As shown in figures 6 and in more detail in figure 8, the gear wheel has three contour shapes 22, 23, 24. The gear wheel is rotated 0° in figure 6A, 90° in figure 6B and 180° in figure 6C.

[0124] The course between 0° and 90° is different from that between 90° and 180°. This means that no bottom-up symmetry can be applied to left or right opening windows. If we want to use the same lock for both types of opening, the lock must have a front-to-back symmetry.

[0125] The off-centre axis of rotation is closest to a first contour shape 22 with the smallest radius and comprises three teeth. The second and subsequent contour shape 23 has a larger radius and includes three teeth. The third contour shape 24 has the largest radius and includes six teeth. The gear wheel specifications are described below.

[0126] Contour shape 22 is circular with radius 5.5 mm from 0° to 96.37°, corresponding to a crank angle of 116.4° to 180°.

[0127] Contour shape 23 has the shape of a logarithmic spiral determined by the formula $r(\theta) = 5.5 * e^{(0.57735 * \theta)}$ from 96.37° to 189.09° on the gear wheel, corresponding to a crank rotation of 55.2° to 116.4°.

[0128] Contour shape 24 has the shape of a logarithmic spiral determined by formula r(θ) = 7* e^(0.176327* θ) from 189.09° to 272.73° on the gear wheel, corresponding to a crank rotation of 0° to 55.2°.

[0129] Part 19 of the gear wheel is parallel to the longitudinal X-X' direction of the lock. Part 20 is at an angle of 30° to the axis X-X'. Part 22 is at an angle of 10° to the axis X-X'.

[0130] The teeth of the circumference 22, 23 and 24 cooperate with the teeth 19, 20 and 21 respectively of the gear rack 11.

[0131] In figure 8, A represents the tilt-turn course and B the turn-close course (for a turn window or turn-and-tilt window) or tilt-close (for a tilt window or tilt-and-turn window). The latter has a more gradual course.

[0132] Arrow C shows the position of the largest radius 25 in relation to the off-centre axis of rotation 6 in neutral. Arrow D shows where the relevant radius decreases at the moment of decreasing the handle when closing.

[0133] The gear wheel 7 is rotatable about its geometric axis (Y-Y') by means of a handle or another drive. Although in the figures 1-5, a square recess 8 is always shown in the gear wheel 7 for attaching a handle, it is also possible to have the gear wheel 7 rotate about its axis by means of another drive, as in the alternative embodiment of figures 6-8. In this embodiment, with a gear ratio of 0.66 to 180° crank rotation, is obtained a 272.7° gear wheel rotation.

[0134] Thus, it is possible for the gear wheel 7 to be driven by a system of one or more drive gears. In this way, the rotation of a latch, for example, is converted into the appropriate drive of the gear wheel 7 acting on the gear rack 11 of the operating bar 10.

[0135] It is also possible for the gear wheel 7 to comprise two sets of teeth, wherein both sets have the same number of teeth and one set of teeth is slightly rotated at a certain angle with respect to the other, such that the teeth of both sets are not in line with each other.

[0136] The teeth from both sets preferably have the same dimensions.

[0137] The carriage of the operating bar 10 is then, by analogy, provided with two gear racks whose teeth are shifted along the pitch line(s) and wherein each set of teeth of the drive gear 7 engages with one of the aforementioned gear racks, wherein at least one tooth of the one set and one tooth of the other set engage simultaneously in the one rack and the other gear rack, respectively.

[0138] Both sets of teeth may be separated from each other by a rib on the gear wheel 7, which rib is slidable in a groove provided to that end between the gear racks.

[0139] Of course, it is also possible to provide a rib between the gear racks and to provide the gear wheel 7 with a groove. In an example where the gear wheel 7 contains two sets of seven teeth, fourteen tooth transitions can thus be achieved, all in such a way as to ensure a smoother movement of the carriage.

[0140] Of course, for a given number of tooth transitions, the number of teeth per set can be reduced, so that the teeth can be made larger and more solid while still allowing a smooth movement.

[0141] It goes without saying that three or more sets of teeth may also be provided in the gear wheel 7 which in that case cooperate with the respective tooth racks 11 on the carriage of the operating bar 10.

[0142] The present invention is by no means limited to the embodiments described by way of example and shown in the figures; on the contrary, a recessed lock according to the claims can be made in all shapes and dimensions while still remaining within the scope of the invention. The scope of the invention is solely defined by the appended claims.

Claims

1. Recessed lock (1) with an operating mechanism for the closing laths of a window, a door or the like, wherein the mechanism comprises a housing (2) with a pronounced longitudinal direction X-X' and an operating bar (10) which can slide in an axial direction with respect to the housing (2) and a gear transmission for driving the operating bar (10) and the closing laths connected thereto, wherein said gear transmission comprises a gear wheel (7) which can be rotated about its axis Y-Y' (6) by a handle or another drive, wherein the operating bar (10) comprises a carriage provided with a gear rack (11) cooperating with the gear wheel (7) for sliding the carriage in the housing (2), wherein the gear ratio between the gear wheel (7) and the carriage is variable, **characterised in that** the axis (6) of the gear wheel (7) is off-centre, wherein the gear wheel (7) has two identical radii (R1) at 0° and 180°, a shortest radius (R0) between 180° and 360° and a largest radius (R2) between 0° and 180° rotation of the gear wheel, wherein the gear wheel (7) undergoes a rotation of maximum 180° +/- 5°, and the gear rack (11) has a shape which is complementary to the 180° rotation of the gear wheel (7).

2. Recessed lock (1) according to claim 1, **characterised in that** the recessed lock has a symmetry around the 90° position of the gear wheel (7), with the first part of the course accelerating from 0° to 90° and the second part decelerating, the total course of both parts being equal, wherein the gear wheel (7), spread over 3600°, has a largest radius (R2) and shortest radius (R0) and two identical radii (R1).

3. Recessed lock (1) according to claim 2, **characterised in that** the largest radius (R2) is situated at 90°, the two identical radii (R1) at 0° and 180° and the shortest radius (R0) at 270°.

4. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the gear wheel

(7) has a composite shape of several circular, logarithmic spiral or other pitch lines.

5. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the pitch line of the teeth of the gear rack (11) has a composite shape of several straight and/or curved segments.

6. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the gear wheel (7) is partially toothed.

7. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the gear wheel (7) is toothed over 180°.

8. Recessed lock (1) according to claims 2 to 7, **characterised in that** the gear wheel (7) is toothed at the largest radius (R2) with respect to an eccentric rotary axis (6) and up to +90° and -90° rotation of the handle.

9. Recessed lock (1) according to claims 2 to 8, **characterised in that** the gear rack (11) is symmetrical to the left and right of a central notch (27) and a) the gear wheel (7), at the level of the first tooth (26') and radius R1, acts on the first notch (26) of the gear rack on an imaginary tooth line Z-Z', b) when rotating the gear wheel (7) 90° to the right, the gear wheel will act, at the height of the central tooth (27') and the largest radius R2, on the central notch (27) of the gear rack (11), wherein the gear rack (11) is moved to the right (arrow P) over half its length; wherein R2 is larger than R1 and the central notch (27) of the gear rack is situated at a distance from the imaginary tooth line Z-Z', c) when rotating the gear wheel (7) 90° further to the right, the gear wheel will act, at the height of the last tooth (28') and the other radius R1, on the last notch (28) of the gear rack on an imaginary tooth line Z-Z', wherein the gear rack (11) is moved to the right (arrow P) over its maximum length.

10. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the installation height (H) of the gear wheel (7) in the housing (2) is minimal and equal to the sum of the largest radius (R2) and an identical radius (R1).

11. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the carriage accelerates or decelerates linearly with a constant angular rotation of the gear wheel.

12. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the gear wheel (7) is quasi circular, the circumference of the gear wheel (7) being partly in the shape of a circle and partly in the shape of a logarithmic spiral with a symmetry over 90°, at least over the part of the circumference that is provided with teeth (9), wherein the circumference provided with teeth extends over 180° with respect to the axis (6) of the gear wheel, the greatest distance from the axis (6) to the circumference being at 90°.

13. Recessed lock (1) according to claim 12, **characterised in that** the shape of the gear rack (11) is adapted to the logarithmic spiral parts and the circular segment of the gear wheel (7), wherein the gear rack (11) consists of three rectilinear parts, one part of which is rotated upwardly at an angle of 11° with respect to the axis X-X', one part of which is parallel and one part of which descends at 11° with respect to the axis X-X'.

14. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the course is larger than the course obtained with a gear wheel having a central axis that fits within the same space.

15. Recessed lock (1) according to any one of the preceding claims, wherein the gear rack (11) extends in the longitudinal direction X-X' and has a flat side parallel to the longitudinal direction X-X' that fits against the carriage and the hinges, and an opposite side provided with teeth (17), wherein the side with teeth represents an imaginary flat side passing through the centre of the teeth (17), **characterised in that** the perpendicular distance between the flat side and the imaginary side of the teeth (17) varies along the length of the gear rack (11) complementary to the variable radius between the axis of rotation (6) and the circumference of the gear wheel (7) depending on the rotated position of the gear wheel (7) on the gear rack (11).

16. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the gear wheel (7) is designed as a double gear wheel.

17. Recessed lock (1) according to any one of the preceding claims, **characterised in that** the drive mechanism comprises several gear wheels.

Patentansprüche

1. Einbauschloss (1), das einen Betätigungsmechanismus für die Schließlatten eines Fensters, einer Tür oder dergleichen umfasst, wobei der Mechanismus ein Gehäuse (2) mit einer ausgeprägten Längsrichtung X-X' und eine in Bezug auf das Gehäuse (2) in einer axialen Richtung verschiebbare Betätigungsstange (10) und ein Zahnradgetriebe zum Antrieb der Betätigungsstange (10) und der damit verbundenen Schließlatten umfasst, wobei das oben genannte Zahnradgetriebe ein um seine Achse Y-Y' (6) durch einen Handgriff oder einen anderen Antrieb drehbares Zahnrad (7) aufweist, wobei die Betätigungsstange (10) einen mit einer Zahnstange (11) vorgesehenen Schlitten umfasst, der mit dem Zahnrad (7) zum Schieben des Schlittens in dem Gehäuse (2) zusammenwirkt, wobei das Übersetzungsverhältnis zwischen dem Zahnrad (7) und dem Schlitten variabel ist, **dadurch gekennzeichnet, dass** die Achse (6) des Zahnrads (7) exzentrisch ist, wobei das Zahnrad (7) zwei identische Radien (R1) bei 0° und 180°, eine kürzesten Radius (R0) zwischen 180° und 360° und einen größten Radius (R2) zwischen 0° und 180° Drehung des Zahnrads aufweist, wobei das Zahnrad (7) eine Drehung von maximal 180° +/- 5° erfährt, und die Zahnstange (11) eine Form aufweist, die der 180° Drehung des Zahnrads (7) entspricht.

2. Einbauschloss (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Einbauschloss eine Symmetrie um die 90° Position des Zahnrads (7) aufweist, wobei der erste Teil des Verlaufs von 0° auf 90° beschleunigt, und der zweite Teil verzögert, wobei der Gesamtverlauf beider Teile gleich ist, wobei das über 360° ausgebreitete Zahnrad (7) einen größten Radius (R2) und einen kürzesten Radius (R0) und zwei identische Radien (R1) aufweist.

3. Einbauschloss (1) nach Anspruch 2, **dadurch gekennzeichnet, dass** der größte Radius (R2) bei 90°, die beiden identischen Radien (R1) bei 0° und 180° und der kürzeste Radius (R0) bei 270° liegen.

4. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Zahnrad (7) eine Verbundform von mehreren kreisförmigen, logarithmischen Spiralen oder anderen Steigungslinien aufweist.

5. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Steigungslinie der Zähne der Zahnstange (11) eine Verbundform aus mehreren geraden und/oder gekrümmten Segmenten aufweist.

6. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Zahnrad (7) teilverzahnt ist.

7. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Zahnrad (7) über 180° verzahnt ist.

8. Einbauschloss (1) nach den Ansprüchen 2 bis 7, **dadurch gekennzeichnet, dass** das Zahnrad (7) bei dem größten Radius (R2) in Bezug auf eine exzentrische Drehachse (6) und bis zu +90° und -90° Drehung des Griffs verzahnt ist.

9. Einbauschloss (1) nach den Ansprüchen 2 bis 8, **dadurch gekennzeichnet, dass** die Zahnstange (11) links und rechts einer zentralen Kerbe (27) symmetrisch ist, und a) das Zahnrad (7), auf der Höhe des ersten Zahns (26') und des Radius R1 auf die erste Kerbe (26) der Zahnstange auf einer imaginären Zahnlinie Z-Z' wirkt, b) beim Drehen des Zahnrads (7) 90° nach rechts wird das Zahnrad, auf der Höhe des Zentralzahns (27') und des größten Radius, auf die zentrale Kerbe (27) der Zahnstange (11) wirken, wobei die Zahnstange (11) über die Hälfte ihrer Länge nach rechts bewegt wird (Pfeil P); wobei R2 größer als R1 ist, und die zentrale Kerbe (27) der Zahnstange sich in einem Abstand von der imaginären Zahnlinie Z-Z' befindet, c) beim Drehen des Zahnrads (7) 90° weiter nach rechts wird das Zahnrad, auf der Höhe des letzten Zahns (28') und des anderen Radius R1, auf die letzte Kerbe (28) der Zahnstange auf einer imaginären Zahnlinie Z-Z' wirken, wobei die Zahnstange (11) nach rechts (Pfeil P) über ihrer maximalen Länge bewegt wird.

10. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Einbauhöhe (H) des Zahnrads (7) in das Gehäuse (2) minimal und gleich der Summe aus dem größten Radius (R2) und einem identischen Radius (R1) ist.

11. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Schlitten bei konstanter Winkeldrehung des Zahnrades linear beschleunigt oder verzögert.

12. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Zahnrad (7) quasi kreisförmig ist, wobei der Umfang des Zahnrads (7) teils kreisförmig und teils in Form einer logarithmischen Spirale mit einer Symmetrie über 90°, zumindest über den mit Zähnen (9) versehenen Umfangsteil, wobei der mit Zähnen versehene Umfang sich über 180° in Bezug auf die Achse (6) des Zahnrads erstreckt, wobei der größte Abstand von der Achse (6) zum Umfang bei 90° liegt.

13. Einbauschloss (1) nach Anspruch 12, **dadurch gekennzeichnet, dass** die Form der Zahnstange (11) an die logarithmischen Spiralteile und das Kreissegment des Zahnrads (7) angepasst ist, wobei die Zahnstange (11) aus drei geradlinigen Teilen besteht, von denen ein Teil in einem Winkel von 11° in Bezug auf die Achse X-X' nach oben gedreht ist, von der ein Teil parallel in Bezug auf die Achse X-X' ist und ein Teil mit 11° zu dieser abfällt.

14. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der

Verlauf größer ist als der Verlauf, der mit einem Zahnrad mit einer Mittelachse erhalten wird, die in den gleichen Raum passt.

15. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, wobei die Zahnstange (11) sich in Längsrichtung X-X' erstreckt und eine flache Seite parallel zur Längsrichtung X-X', die an den Schlitten und den Scharnieren anliegt, und eine gegenüberliegende mit Zähnen (17) versehene Seite, aufweist, wobei die Seite mit Zähnen eine imaginäre Flachseite darstellt, die die Mitte der Zähne (17) durchsetzt, **dadurch gekennzeichnet, dass** der senkrechte Abstand zwischen der Flachseite und der imaginären Seite der Zähne (17) entlang der Länge der Zahnstange (11) ergänzend zum variablen Radius zwischen der Drehachse (6) und dem Umfang des Zahnrads (7) in Abhängigkeit von der Drehposition des Zahnrads (7) auf der Zahnstange (11) variiert.

16. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Zahnrad (7) als Doppelzahnrad ausgebildet ist.

17. Einbauschloss (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Antriebsmechanismus mehrere Zahnräder umfasst.

Revendications

1. Serrure encastrée (1) comprenant un mécanisme de commande pour les lattes de fermeture d'une fenêtre, d'une porte ou analogue, dans laquelle le mécanisme comprend un boîtier (2) présentant une direction longitudinale prononcée X-X' et une barre de commande (10) qui peut glisser dans une direction axiale par rapport au boîtier (2) et une transmission à engrenages pour l'entraînement de la barre de commande (10) et des lattes de fermeture qui y sont reliées, dans laquelle ladite transmission à engrenages comprend une roue dentée (7) qui peut effectuer des rotations autour de son axe Y-Y' (6) par l'intermédiaire d'une poignée ou d'un autre entraînement, dans laquelle la barre de commande (10) comprend un chariot muni d'une crémaillère (11) coopérant avec la roue dentée (7) pour faire glisser le chariot dans le boîtier (2), dans laquelle le rapport de transmission entre la roue dentée (7) et le chariot est variable, **caractérisée en ce que** l'axe (6) de la roue dentée (7) est décentré, dans laquelle la roue dentée (7) possède deux rayons identiques (R1) à 0° et 180°, un rayon le plus court (R0) entre 180° et 360° et un rayon le plus grand (R2) entre des rotations de 0° et de 180° de la roue dentée, dans laquelle la roue dentée (7) est soumise à une rotation maximale de 180° +/- 5°, et la crémaillère (11) possède une forme qui est complémentaire à la rotation de 180° de la roue dentée (7).

2. Serrure encastrée (1) selon la revendication 1, **caractérisée en ce que** la serrure encastrée possède une symétrie autour de la position de 90° de la roue dentée (7), la première partie de la course accélérant de 0° à 90° et la seconde partie décélérant, la course totale des deux parties étant égale, dans laquelle la roue dentée (7), s'étendant sur 360°, possède un rayon le plus grand (R2) et un rayon le plus court (R0) et deux rayons identiques (R1).

3. Serrure encastrée (1) selon la revendication 2, **caractérisée en ce que** le rayon le plus grand (R2) est situé à 90°, les deux rayons identiques (R1) à 0° et 180° et le rayon le plus court (R0) à 270°.

4. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la roue dentée (7) possède une forme composite de plusieurs spirales circulaires, logarithmiques ou d'autres lignes de pas.

5. Serrure encastré (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la ligne de pas des dents de la crémaillère (11) possède une forme composite de plusieurs segments droits et/ou courbes.

6. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la roue dentée (7) est partiellement dentée.

7. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la roue dentée (7) est dentée sur 180°.

8. Serrure encastrée (1) selon les revendications 2 à 7, **caractérisée en ce que** la roue dentée (7) est dentée au rayon le plus grand (R2) par rapport à un axe rotatif excentrique (6) et jusqu'à des rotations de +90° et de -90° de la poignée.

9. Serrure encastrée (1) selon les revendications 2 à 8, **caractérisée en ce que** la crémaillère (11) est symétrique à gauche et à droite d'une encoche centrale (27), et a) la roue dentée (7), au niveau de la première dent (26') et du rayon R1 agit sur la première encoche (26) de la crémaillère sur une ligne de dent imaginaire Z-Z', b) lors de la rotation de la roue dentée (7) de 90° vers la droite, la roue dentée agira, à la hauteur de la dent centrale (27') et du rayon le plus grand R2, sur l'encoche centrale (27) de la crémaillère (11), dans laquelle la crémaillère (11) est déplacée vers la droite (flèche P) sur la moitié de sa longueur ; dans laquelle R2 est plus grand que R1 et l'encoche centrale (27) de la crémaillère est située à une distance de la ligne de dent imaginaire Z-Z', c) lors de la rotation de la roue dentée (7) de 90° plus loin vers la droite, la roue dentée agira, à la hauteur de la dernière dent (28') et de l'autre rayon R1, sur la dernière encoche (28) de la crémaillère sur une ligne de dent imaginaire Z-Z', dans laquelle la crémaillère (11) est déplacée vers la droite (flèche P) sur sa longueur maximale.

10. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la hauteur de montage (H) de la roue dentée (7) dans le boîtier (2) est minimale et égale à la somme du rayon le plus grand (R2) et d'un rayon identique (R1).

11. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le chariot accélère ou décélère de manière linéaire en conformité avec une rotation angulaire constante de la roue dentée.

12. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la roue dentée (7) est quasi circulaire, la circonférence de la roue dentée (7) étant réalisée en partie sous la forme d'un cercle et en partie sous la forme d'une spirale logarithmique avec une symétrie supérieure sur 90°, au moins sur la partie de la circonférence qui est munie de dents (9), dans laquelle la circonférence munie de dents s'étend sur 180° par rapport à l'axe (6) de la roue dentée, la plus grande distance entre l'axe (6) et la circonférence étant située à 90°.

13. Serrure encastrée (1) selon la revendication 12, **caractérisée en ce que** la forme de la crémaillère (11) est adaptée aux parties en spirale logarithmique et au segment circulaire de la roue dentée (7), dans laquelle la crémaillère (11) est constituée par trois parties rectilignes, une desdites parties ayant effectué une rotation vers le haut en formant un angle de 11° par rapport à l'axe X-X', une partie étant parallèle et une partie descendant à 11° par rapport à l'axe X-X'.

14. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la course est plus longue que la course que l'on obtient avec une roue dentée dont l'axe central qui vient s'adapter dans le même espace.

15. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, dans laquelle la crémaillère (11) s'étend dans la direction longitudinale X-X' et possède un côté plat parallèle à la direction longitudinale X-X' qui vient s'adapter contre le chariot et les charnières, et un côté opposé muni de dents (17), dans laquelle le côté muni de dents représente un côté plat imaginaire passant par le centre des dents (17), **caractérisée en ce que** la distance perpendiculaire entre le côté plat et le côté imaginaire des dents (17) varie sur la longueur de la crémaillère (11) de manière complémentaire au rayon variable entre l'axe de rotation (6) et la circonférence de la roue dentée (7) en fonction de la position de rotation de la roue dentée (7) sur la crémaillère (11).

16. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la roue dentée (7) est conçue sous la forme d'une roue dentée double.

17. Serrure encastrée (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le mécanisme d'entraînement comprend plusieurs roues dentées.

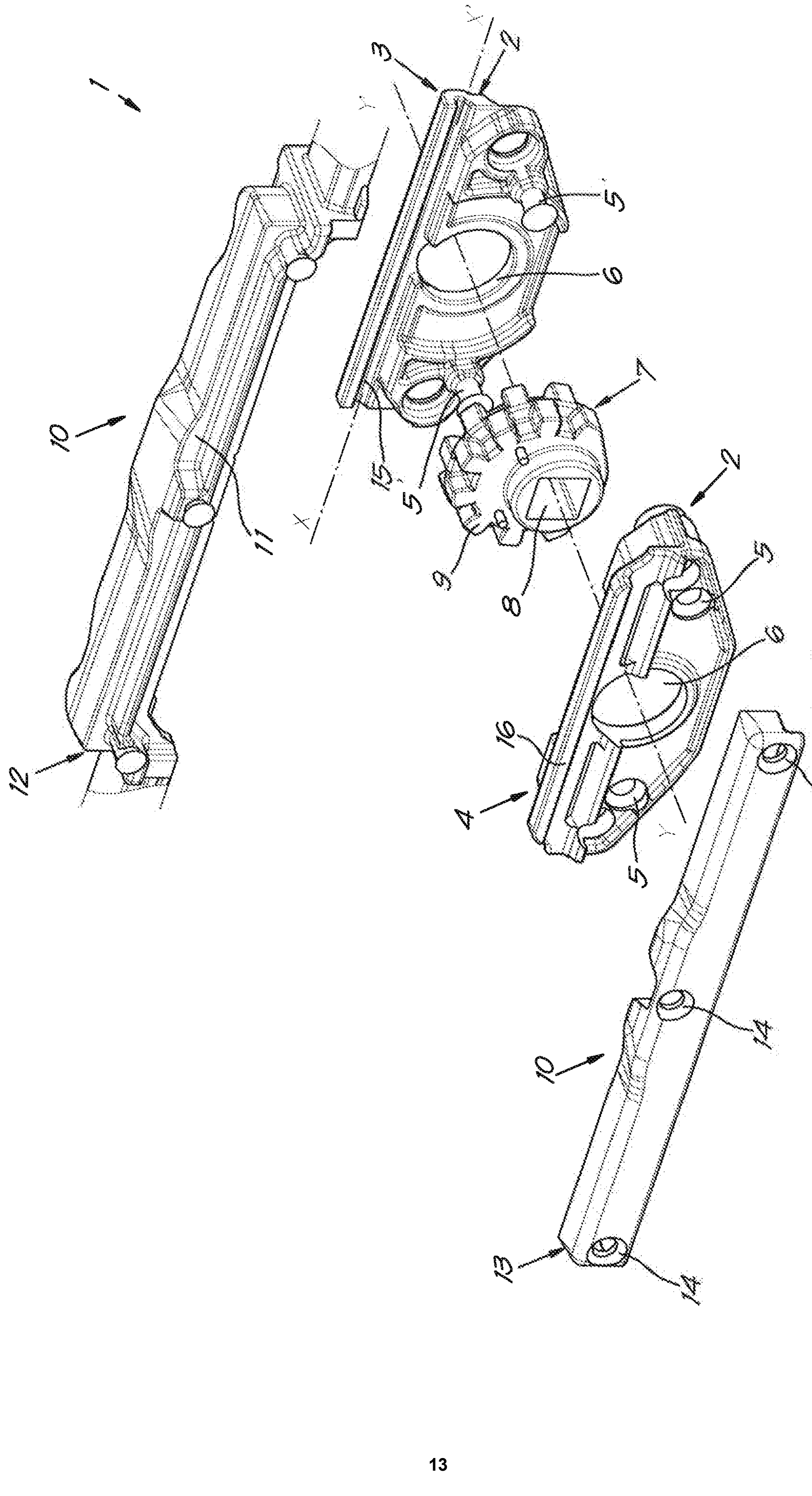
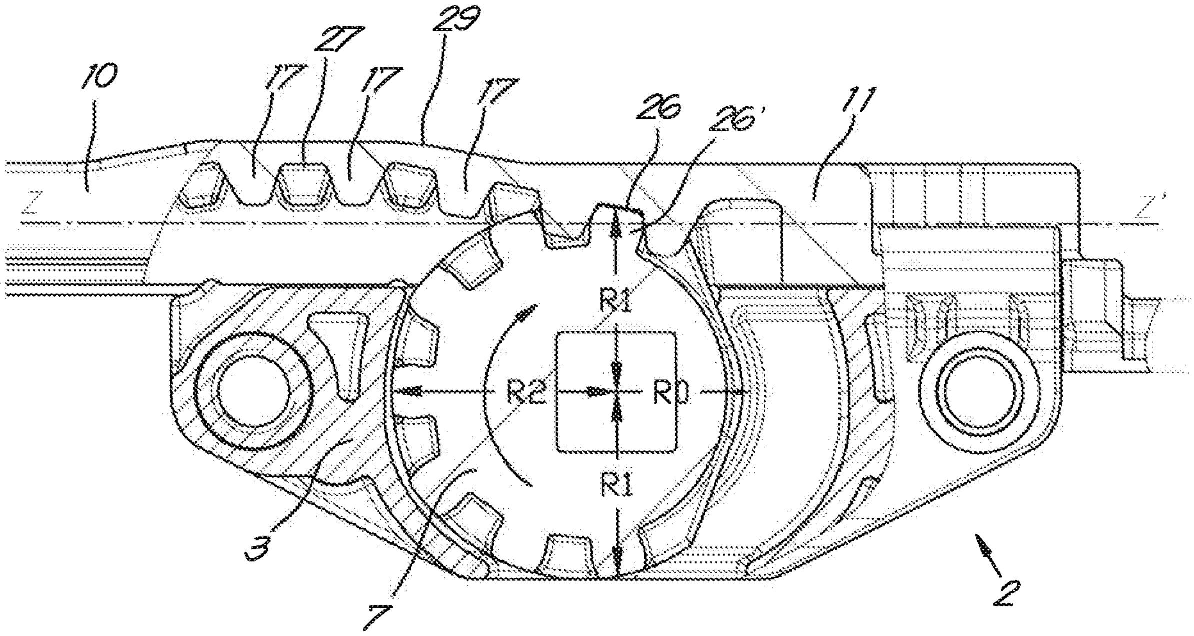


Fig. 1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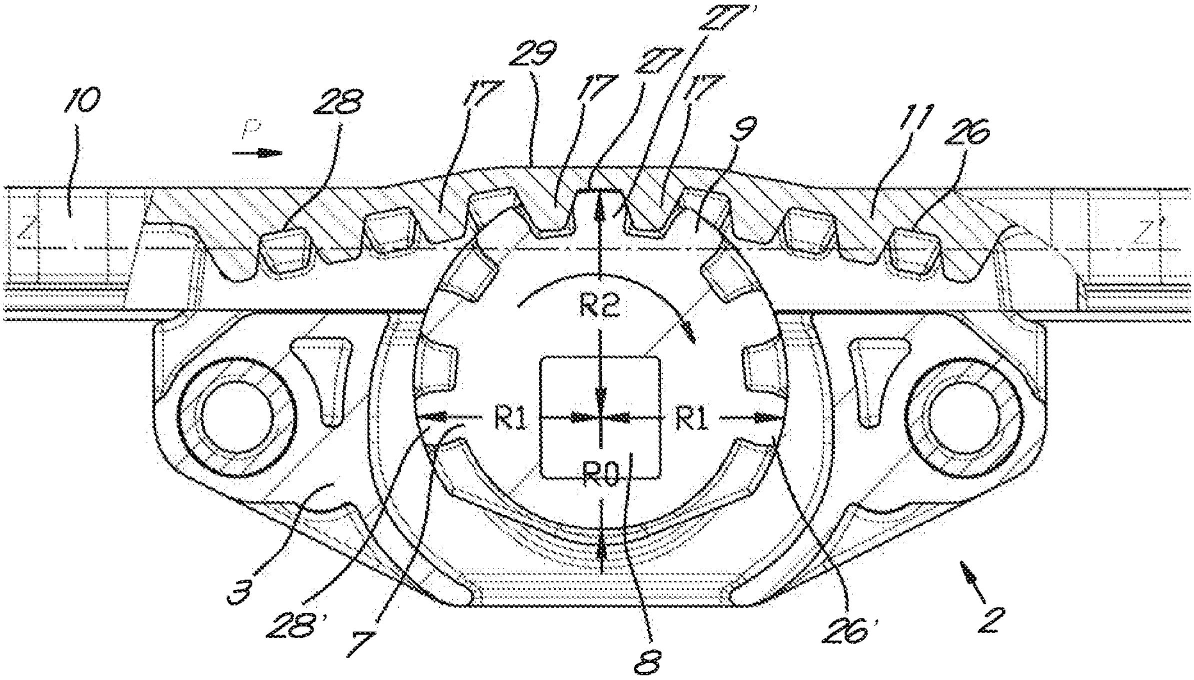
17
27
17
29
17
26
26'
11
Z
Z'
R1
R2
R0
R1
3
7
2

Fig.2A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P
28
29
17
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27
27'
17
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R2
R1
R1
R0
3
28'
7
8
26'
2

Fig.2B

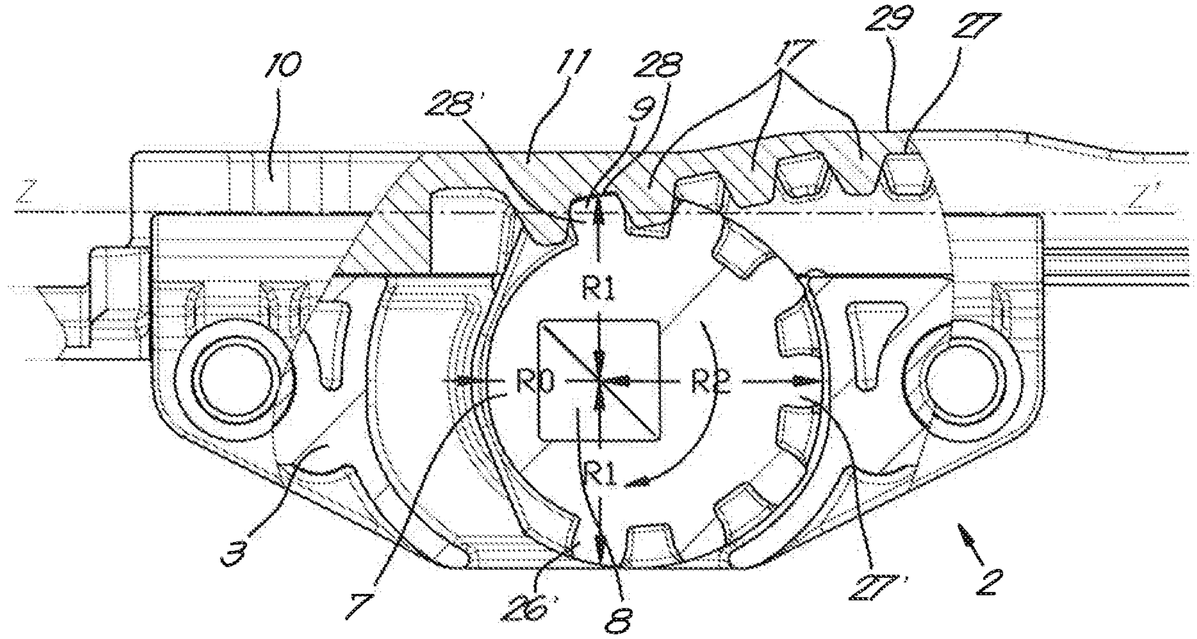


Fig.2C

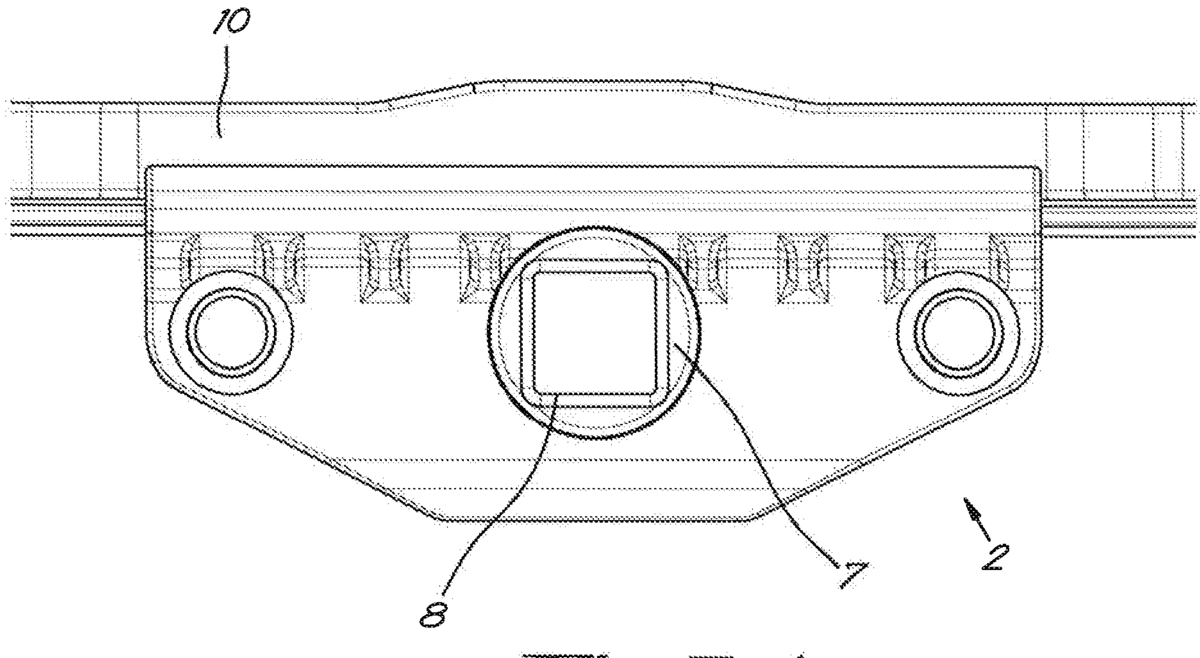


Fig.3A

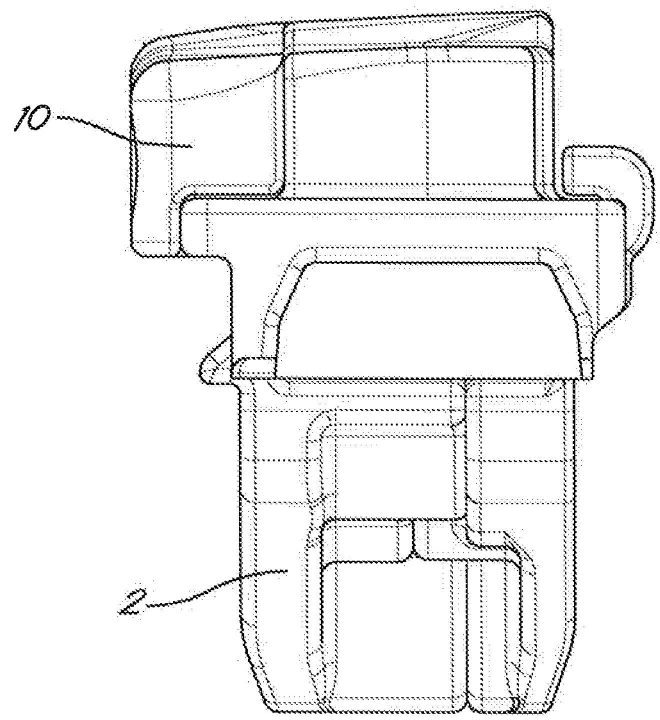


Fig.3B

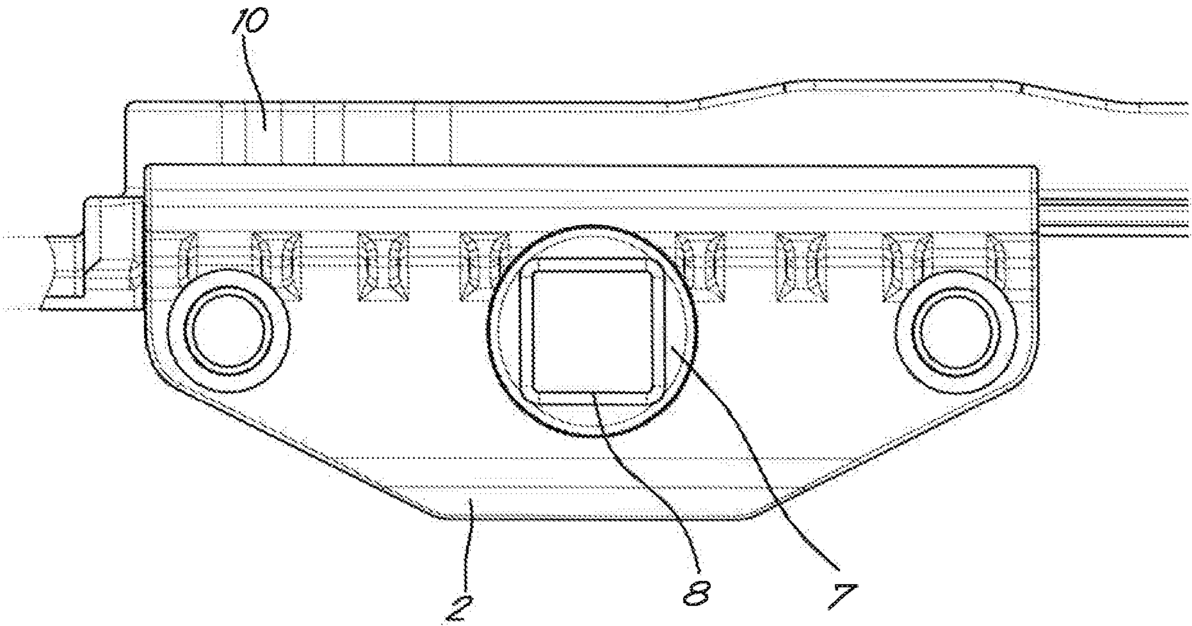


Fig.3C

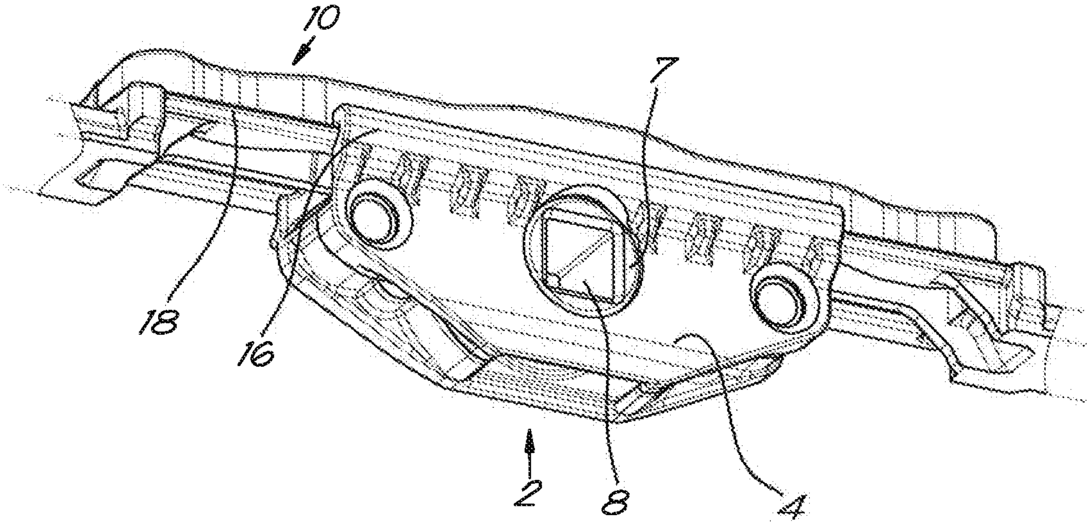


Fig.4A

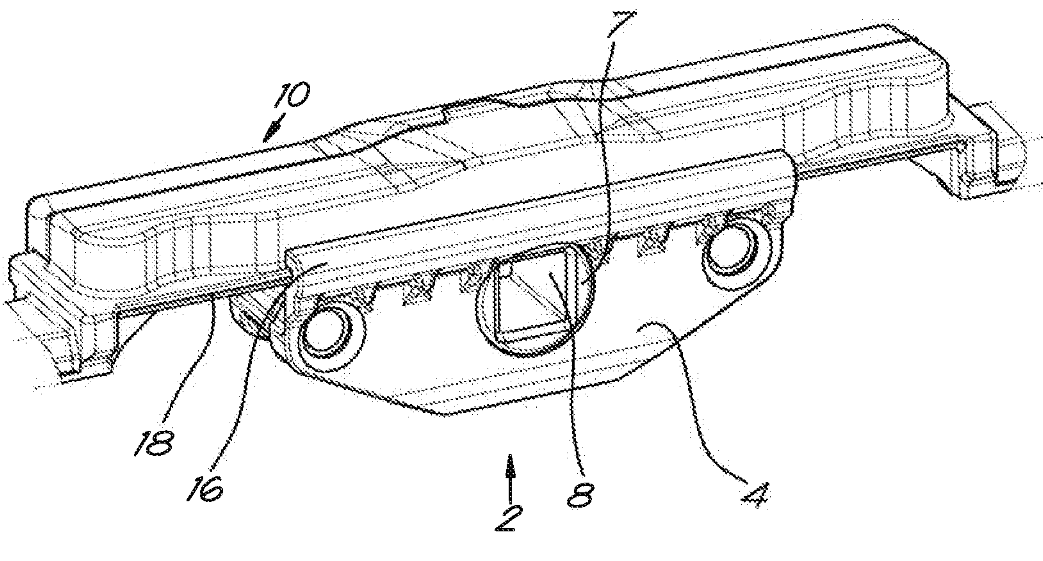
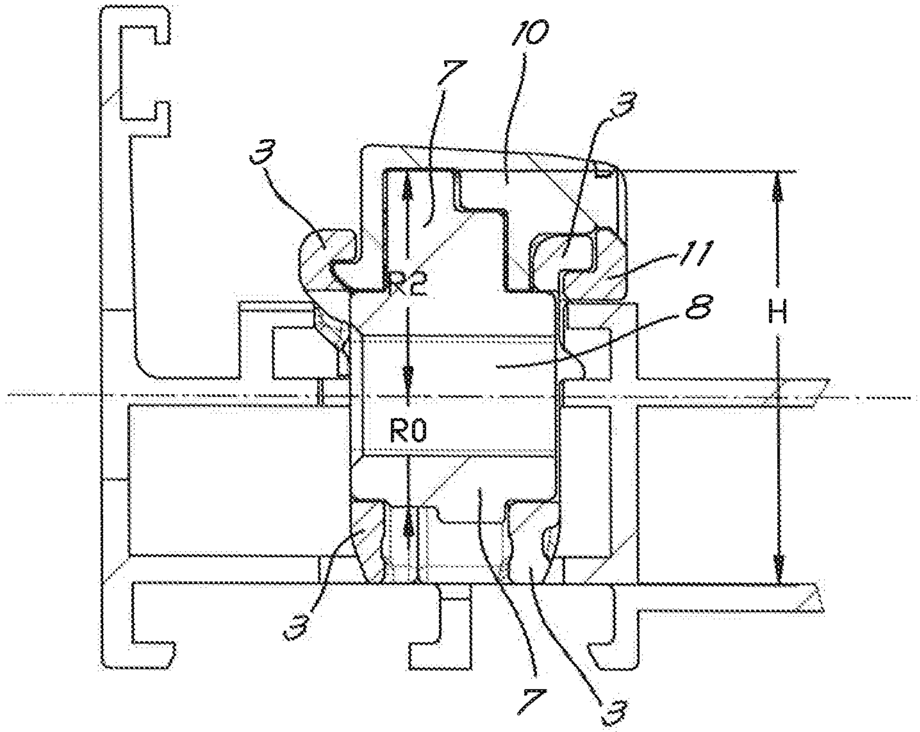


Fig.4B



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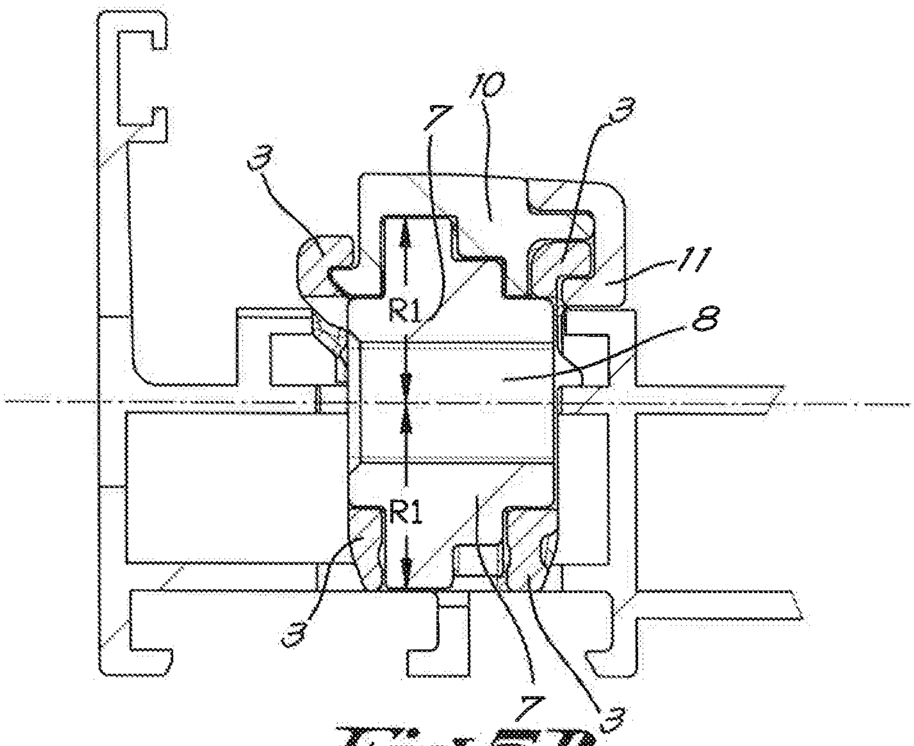

Fig.5B

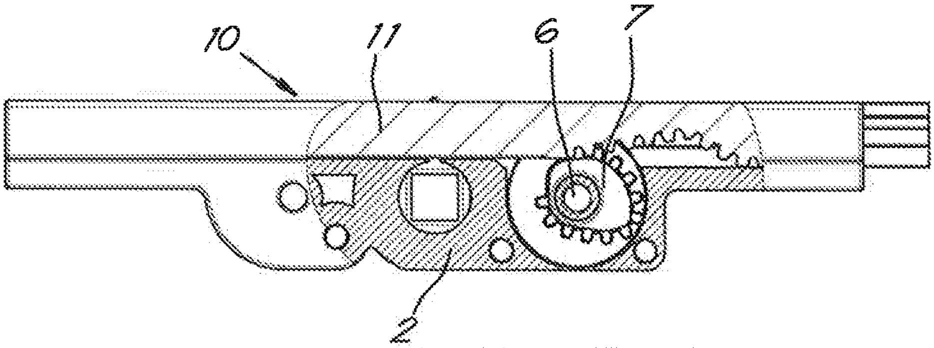

Fig.6A

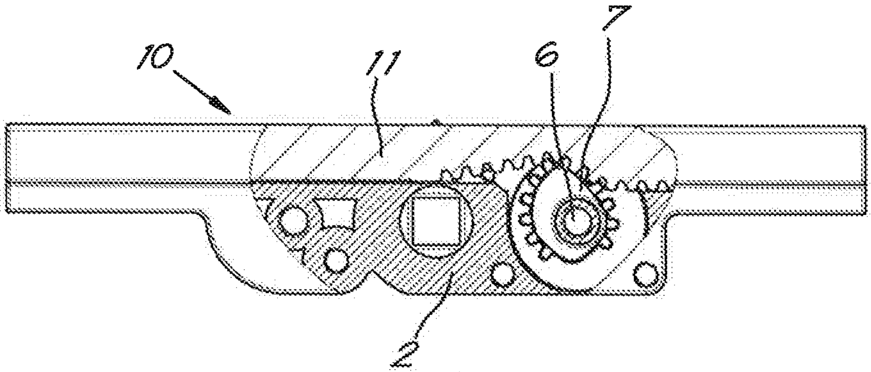

Fig.6B

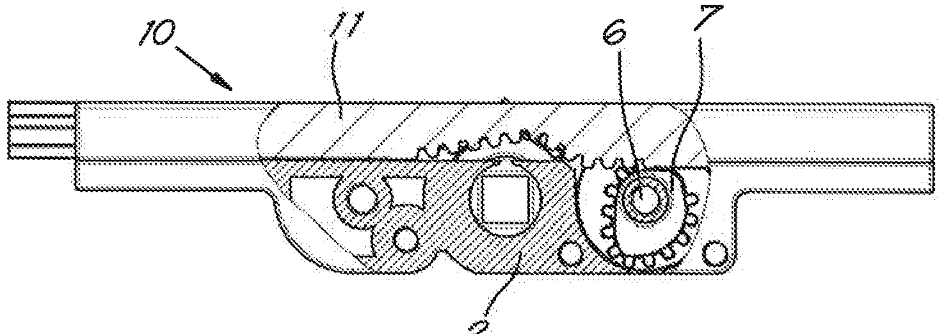

Fig.6C

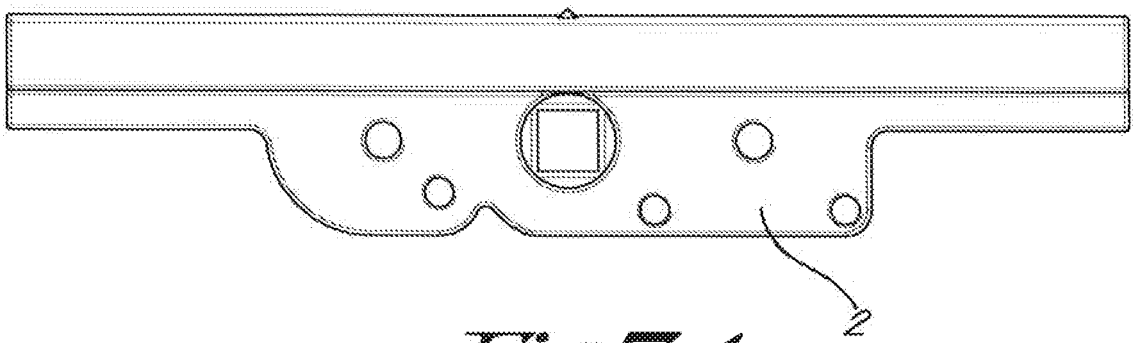

Fig.7A

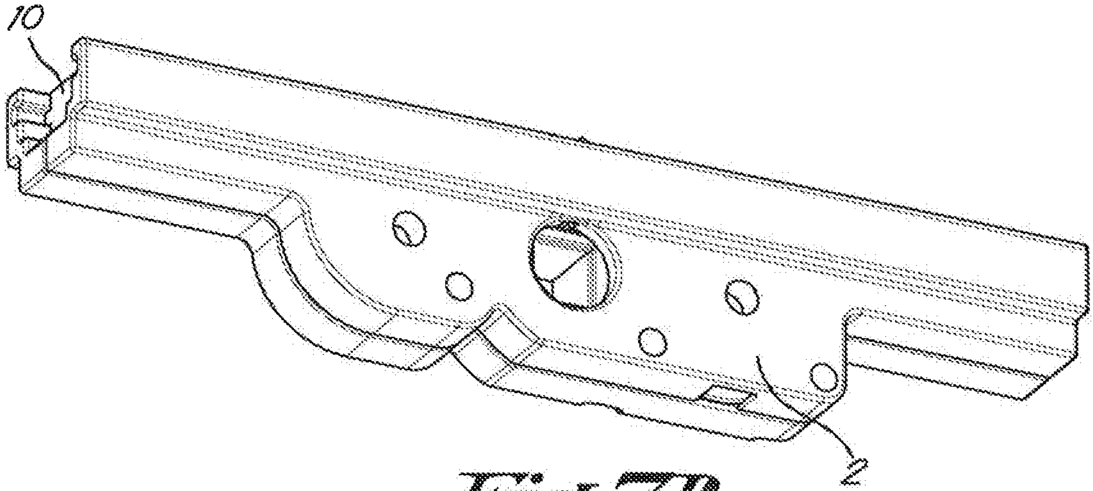

Fig.7B

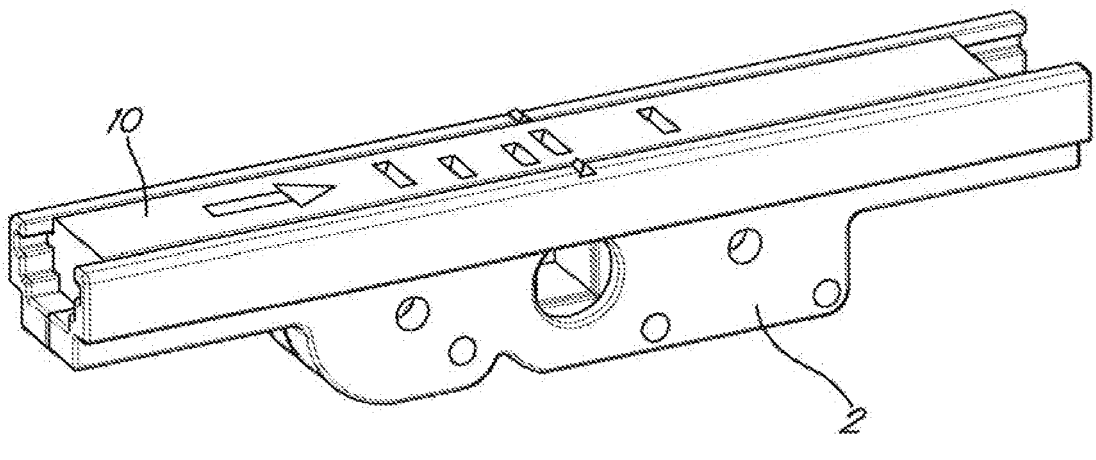

Fig.7C

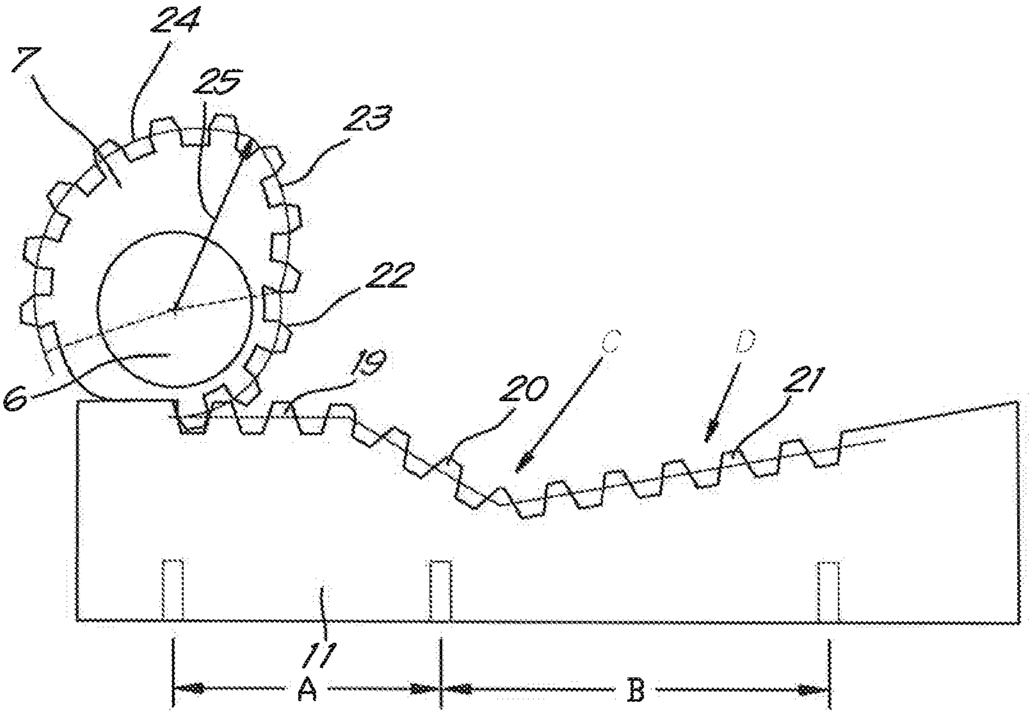

Fig.8

REFERENCES CITED IN THE DESCRIPTION

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