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(54) Lock provided with a gear device for actuating at least one bolt

(57) A lock provided with a gear device for actuating at least one bolt (8) for closing a door, window and the like, comprising a gear (31) which is operatively associated with the bolt (8) and a pinion (23) which meshes with the gear (31), the pinion (23) having a slot which lies radially between two teeth (25) and is formed by two side walls (27,28) between which the bit (16) of a cylinder (14) is arranged with play, the cylinder (14) being inserted in the lock through the pinion (23), the bit (16) forming, together with the side walls (27,28) of the slot, two interspaces which are arranged upstream and downstream of the bit (16) with respect to the direction of rotation of the bit (16), the gear (31) having at least one pair of adjacent teeth (32,33) which form a tooth space (34) which can be engaged by the bit (16) at each turn of the pinion (23) and are shaped so that the tooth (32) of the pair that engages the interspace (29) arranged downstream of the bit (16) produces, during the rotation angle in which the driven tooth (32) remains engaged in the interspace (29), the approach and abutment of the bit (16) against the side wall (28) arranged downstream of it.

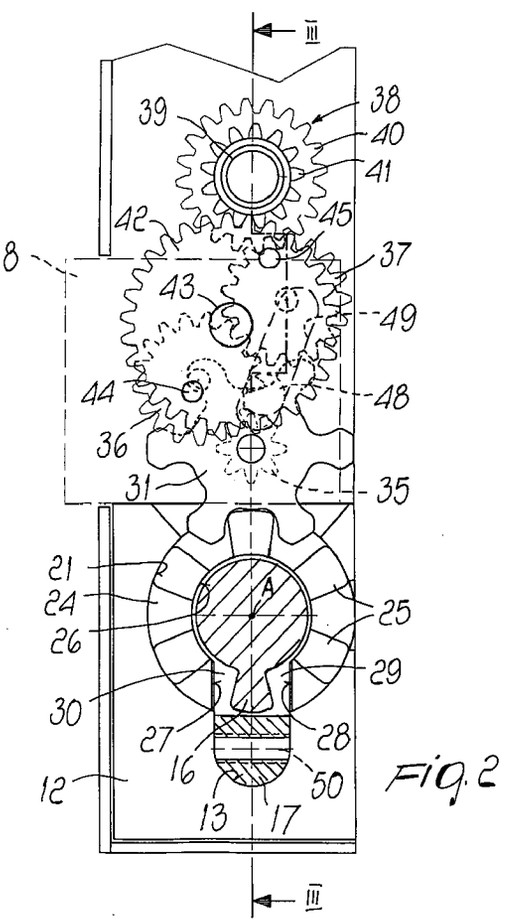

FIG. 2

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Description

[0001] The present invention relates to a lock provided with a gear device for actuating at least one bolt for closing a door, window and the like.

[0002] In gear locks, the bolt is actuated into the open and closed position by means of a gear which meshes with a pinion which is shaped like a toothed ring having a radial slot and suitable to be turned by the bit of a cylinder which is driven through said pinion.

[0003] The radial slot of the pinion is explained by the fact that the pinion is usually already provided in the lock and that it must be possible to insert the cylinder in the lock only at a later time, when the lock has already been installed in the door, so that the bit can replace the missing tooth of the pinion at the radial slot.

[0004] However, since the cylinder has standard dimensions and the bit is thinner, in a tangential direction, than the dimensions of the cylinder, it is not possible to maintain a constant space between the bit and the adjacent teeth of the pinion.

[0005] Accordingly, the drawback arises that the bit, once the cylinder has been inserted in the lock, has a certain play in the radial slot of the pinion. This play compromises the meshing of the bit with the gear to be turned.

[0006] Various solutions have been proposed to obviate this drawback and are disclosed for example in DE-28 31 896, DE-28 31 896, FR-1,190,878 and EP-270 425.

[0007] However, the proposed solutions have turned out to be rather disadvantageous, since they require the use of auxiliary elements such as gears, spacers and complex shapes of the pinion, which make the lock prone to jamming.

[0008] The aim of the present invention is to provide a lock having a device of the described type which is structurally simple and therefore economically more advantageous than conventional ones and is highly reliable in operation.

[0009] This aim is achieved by a lock provided with a gear device for actuating at least one bolt for closing a door, window and the like, comprising a gear which is operatively associated with said bolt and a pinion which meshes with said gear, said pinion having a slot which lies radially between two teeth and is formed by two side walls between which the bit of a cylinder is arranged with play, said cylinder being inserted in the lock through said pinion, said bit forming, together with said side walls of the slot, two interspaces which are arranged upstream and downstream of said bit with respect to the direction of rotation of said bit; characterized in that said gear has at least one pair of adjacent teeth which form a tooth space which can be engaged by said bit at each turn of the pinion and are shaped so that the tooth of said pair that engages the interspace arranged downstream of the bit produces, during the rotation angle in which said tooth remains engaged in said interspace, the approach and abutment of said bit against the side wall arranged downstream of it.

[0010] Further characteristics and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a side view of a lock provided with three bolts;
Figure 2 is a view of the part of the lock of Figure 1 related to the gear device for the actuation of the bolts;
Figure 3 is a sectional view, taken along the plane III-III of Figure 2;
Figures 4 to 7 are schematic views of four operating conditions of the gear device.

[0011] With reference to Figures 1 to 3, the lock comprises a case 1 which is composed of a bottom 2 from which an upper wall 3, a lower wall 4 and a front wall 5 rise. A front faceplate 6 is associated with the front wall 5 in order to fix the lock in the seat of a door.

[0012] The elements for actuating a spring latch 7 and a bolt 8, which protrude frontally from the faceplate 6, and a pair of sliders 9 and 10, which are shaped like plates and protrude from the upper wall 3 and the lower wall 4, are arranged inside the case 1. Rods for actuating other bolts, which for example engage in the upper rail of a door and in the floor, are connected to the sliders 9 and 10.

[0013] In order to actuate the bolt 8 and the sliders 9 and 10, the lock comprises a gear device, generally designated by the reference numeral 11, which is capable of making the bolt 8 and the plate sliders 9, 10 move for protruding from the case 1 and retracting into it depending on whether the lock must open or close the door.

[0014] The device 11 comprises a prism-shaped block 12, which is fixed to the bottom 2 of the case 1 proximate to the lower wall 4. A through opening 13 is formed in the prism-shaped block 12 and its cross-section is complementary to the cross-section of a lock with a lock actuation cylinder 14, termed simply "cylinder" hereinafter for the sake of convenience in description. The cylinder 14 is of a standard type with a cylindrical portion 15, in which the bit 16 is supported in a median region so that it can rotate about the axis A and from which a longitudinal ridge 17 protrudes radially.

[0015] The opening 13 is aligned with openings 18 and 19 which have the same shape and are formed in the bottom 2 and in the cover 20 which closes the case in a front region.

[0016] A seat 21 is formed in the block 12, is closed by a lamina 22 and accommodates a pinion 23 which can rotate about the rotation axis A of the bit 16 of the cylinder 14.

[0017] The pinion 23 is composed of a ring 24, in a

front region of which teeth 25 are provided which are radial with respect to the axis A; their cross-section, on the plane that lies at right angles to the axis A, is substantially rectangular.

[0018] The ring 24 surrounds an opening which is identical to the openings 13, 18 and 19, i.e., has a circular central portion 26 which is suitable to receive the cylindrical portion 15 of the cylinder 14 and a radial slot formed between two walls 27 and 28 whose distance is equal to the thickness of the ridge 17 of the cylinder 14.

[0019] When the walls 27 and 28 of the slot of the pinion 23 are aligned with the respective edges of the opening 13 of the block 12 and of the openings 18 and 19 of the bottom and of the cover, it is possible to insert and position the cylinder 14 inside the case 1 so that the bit 16 is arranged, along part of its length, between the walls 27 and 28 and, along the remaining part, in the plane of rotation of the teeth 25.

[0020] The height of the teeth 25 is less than the axial length of the bit 16 in the direction of the axis A. In this manner, the bit 16 always remains between the lamina 22 and the bottom of the seat 21 and the walls 27 and 28 of the radial slot of the pinion 23.

[0021] It should also be noted that in standard cylinders the bit 16 has a thickness, i.e., a width in the direction of its rotation, which is smaller than the thickness of the ridge 17 of the cylinder 14. Accordingly, after the cylinder 14 has been inserted in the case 1 of the lock and placed so that the bit 16 lies between the walls 27 and 28 of the pinion 23, between the walls 27 and 28 and the bit 16 a play remains which, together with the adjacent teeth arranged upstream and downstream of the pinion, helps to form two interspaces 29 and 30, whose width can vary according to the direction of rotation of the bit. In any case, through the actuation of the cylinder the interspace arranged downstream of the bit always covers a smaller angle than the interspace arranged upstream of the bit.

[0022] The pinion 23 transmits the movement to the bolt 8 and to the plates 9 and 10 by means of a gear train composed of a gear 31 which is rotatably supported in the case 1 and meshes with the pinion 23. The gear 31 has two teeth 32 and 33 provided with mutually opposite fronts which are chamfered so that the teeth assume the configuration of two diverging protrusions and the tooth space 34 formed between them is flared outward.

[0023] The gear 31 has a number of teeth such that at each turn of the pinion 23 the bit 16 engages the tooth space 34. In practice, therefore, the number of teeth of the gear 31 is equal to, or an exact multiple of, the number of teeth of the pinion 23, counting the bit as a tooth.

[0024] A sprocket 35 is rotationally rigidly coupled to the gear 31 and, by means of a pair of gears 36 and 37, it is connected to a gear set 38 which is rotatably supported on a pivot 39 locked between the bottom 2 and the cover of the case.

[0025] The gear set 38 comprises a gear 40, which has a larger diameter and meshes with the gear 37, and a gear 41, which is rotationally rigidly coupled to the gear 40 and meshes with a gear 42 arranged between the bolt 8 and the cover 20.

[0026] The gear 42 is rotatably supported in the cover 20 by means of a pivot 43 and has, on the face directed toward the cover 20, two diametrically opposite pins 44 and 45 which are suitable to engage slots 46 and 47 (see Figure 1) of the sliders 9 and 10 and, on the opposite face, a pin 48 which engages a slot 49 formed in the bolt 8 transversely to its sliding direction.

[0027] Operation of the described lock is as follows.

[0028] Assuming that the lock has already been installed in its seat in the door, the cylinder 14 is inserted through the openings 13 of the body 12, the openings 18 and 19 of the bottom 2 and of the cover 20, and the pinion 23, so that the bit 16 is interposed between the walls 27 and 28 which form the radial slot of the pinion.

[0029] The cylinder 14 is then fixed in a conventional manner by means of a screw which is driven through the faceplate 6 and engages a threaded hole 50 of the ridge 17 of the cylinder at the bit 16.

[0030] By inserting the key in the plug of the cylinder and turning it, for example in the direction B, a small free rotation of the bit 16 is produced initially until abutment against the wall 28 occurs. Said free rotation is due, as mentioned above, to the fact that the thickness of the bit 16 is lower than the width of the radial slot of the pinion, so that an interspace 29 formed between the bit 16 and the wall 28 against which it abuts covers a smaller angle than the interspace formed between the bit 16 and the opposite wall 27. Said interspace 29 is in any case smaller than the space 24 between the teeth 25.

[0031] As the rotation of the bit 16 continues, the pinion 23 turns and, by meshing with the gear 31, transmits this rotation to the gear train 35-42, causing the outward sliding, into the position for locking the door or window, of the bolt 8, of the sliders 9 and 10 and of the bolts connected thereto.

[0032] Since as mentioned the interspace 29 is smaller than the interspace between the teeth 25, when the bit 16 has turned through an angle of approximately 120° (see Figure 4) and is about to mesh with the gear 31, the teeth of said gear would no longer be able to engage the interspace 29. However, the shape of the tooth 32 allows said tooth to fit in the interspace 29 and momentarily space the bit 16 from the wall 28 (see Figure 5). The bit can thus engage the tooth space 34 that lies between the teeth 32 and 33 and turn the gear 31.

[0033] Conveniently, the sides of the teeth 32 and 33 that delimit the tooth space 34 are shaped so that in addition to facilitating the insertion of the tooth 32 in the interspace 29 the bit 16 is guided until it rests against the wall 28 (see Figure 6).

[0034] In practice, the bit 16 performs a forward angular movement which widens the interspace 30 arranged

upstream of it, allowing to insert the tooth 33 in the preceding interspace 30 and allowing the pinion 23 to mesh again with the gear 31 (see Figure 7) in order to continue its rotation and therefore also complete the rotation of the gear 31.

[0035] It should be noted that the relative movement of the bit 16 with respect to the pinion 23 causes a slight discontinuity in the actuation of the gear 31. However, this discontinuity is not significantly appreciable by the user.

[0036] It is evident that the invention constitutes a considerable structural simplification of the gear lock, since there are no auxiliary elements but the entire solution consists of a simple shaping of the teeth 32 and 33 of the driven gear 31.

[0037] Numerous modifications and variations are possible in the practical embodiment of the lock and all are within the scope of the same inventive concept. In particular, the gear 31 can have a number of teeth which is a multiple of the teeth of the pinion 23, so as to have a multiple number of pairs of shaped teeth 32 and 33 which allows the bit 16, at each turn of the pinion 23, to engage between a pair of shaped teeth.

[0038] The disclosures in Italian Patent Application No. BO97A000597 from which this application claims priority are incorporated herein by reference.

[0039] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A gear lock provided with a gear device (11) for actuating at least one bolt (8) for closing a door, window and the like, comprising a gear (31) which is operatively associated with said bolt (8) and a pinion (23) which meshes with said gear (31), said pinion (23) having a slot which lies radially between two teeth (25) and is formed by two side walls (27, 28) between which the bit (16) of a cylinder (14) is arranged with play, said cylinder being inserted in the lock through said pinion (23), said bit (16) forming, together with said side walls (27, 28) of the slot, two interspaces (29, 30) which are arranged upstream and downstream of said bit with respect to the direction of rotation of said bit; characterized in that said gear (31) has at least one pair of adjacent teeth (32, 33) which form a tooth space (34) which can be engaged by said bit (16) at each turn of the pinion (23) and are shaped so that the tooth (32) of said pair that engages the interspace (29) arranged downstream of the bit (16) produces, during the rotation angle in which said tooth (32) remains engaged in said interspace (29), the approach and abutment of said bit (16) against the side wall (28) arranged downstream of it.

2. The lock according to claim 1, characterized in that the teeth (32, 33) of said pair have chamfered opposite sides so that the teeth assume the shape of two diverging protrusions which form, between them, a tooth space (34) which flares outward.

3. The lock according to claim 2, characterized in that said gear (31) has a number of teeth which is equal to, or is an exact multiple of, the number of teeth of said pinion (23), counting the bit as one tooth, so that at each turn of the pinion the bit (16) engages the tooth space (34) formed by said pair of teeth (32, 33).

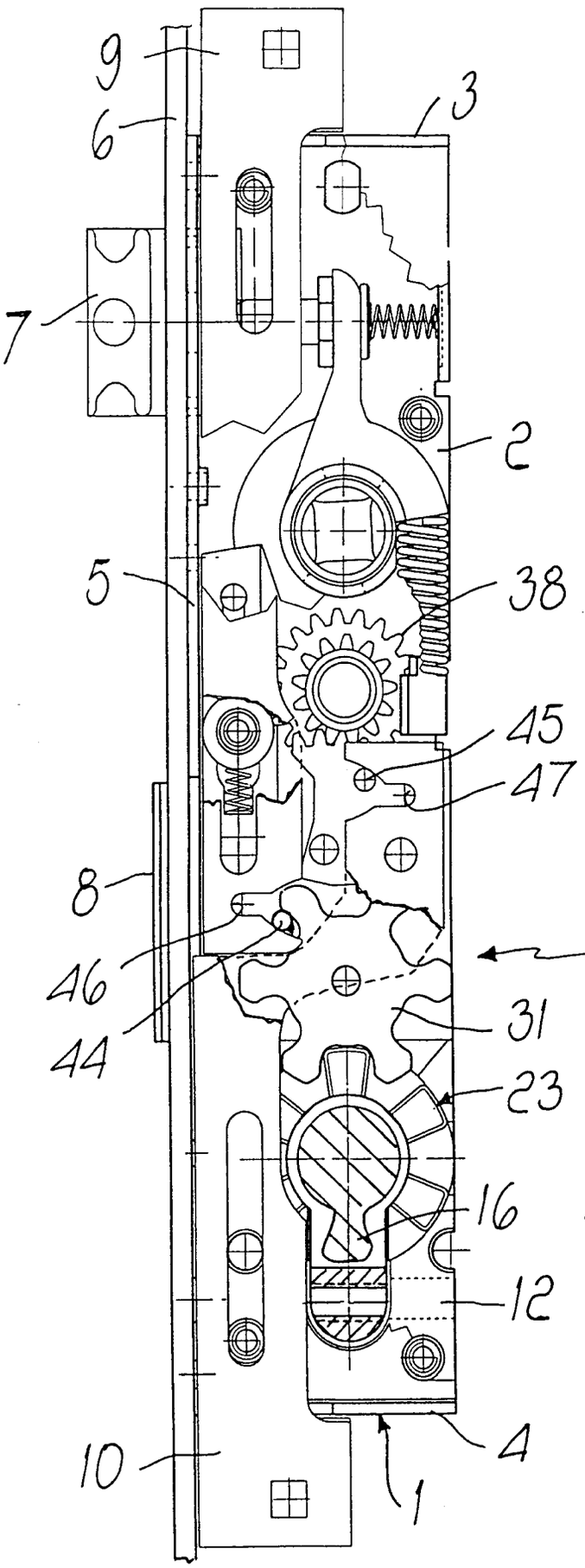

Fig.1

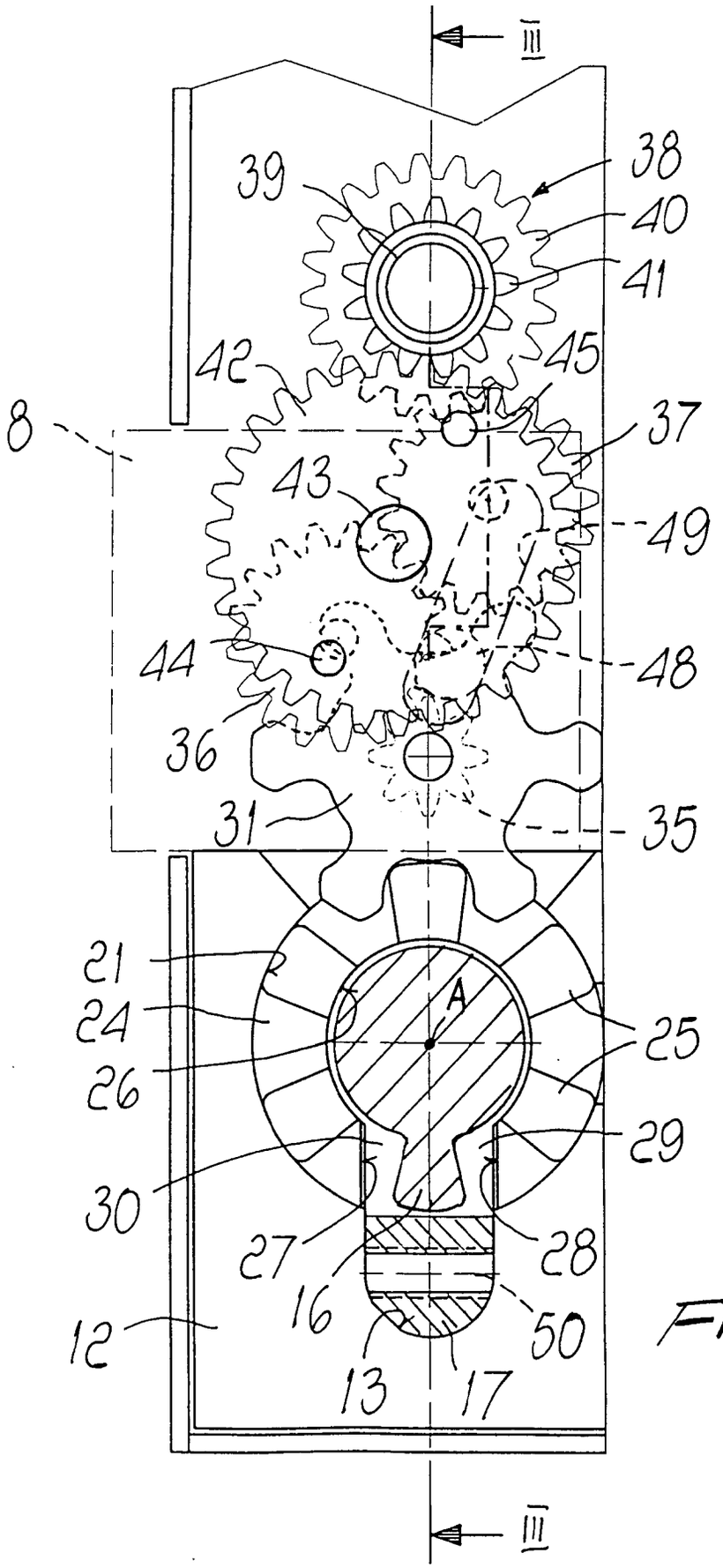
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Fig. 2

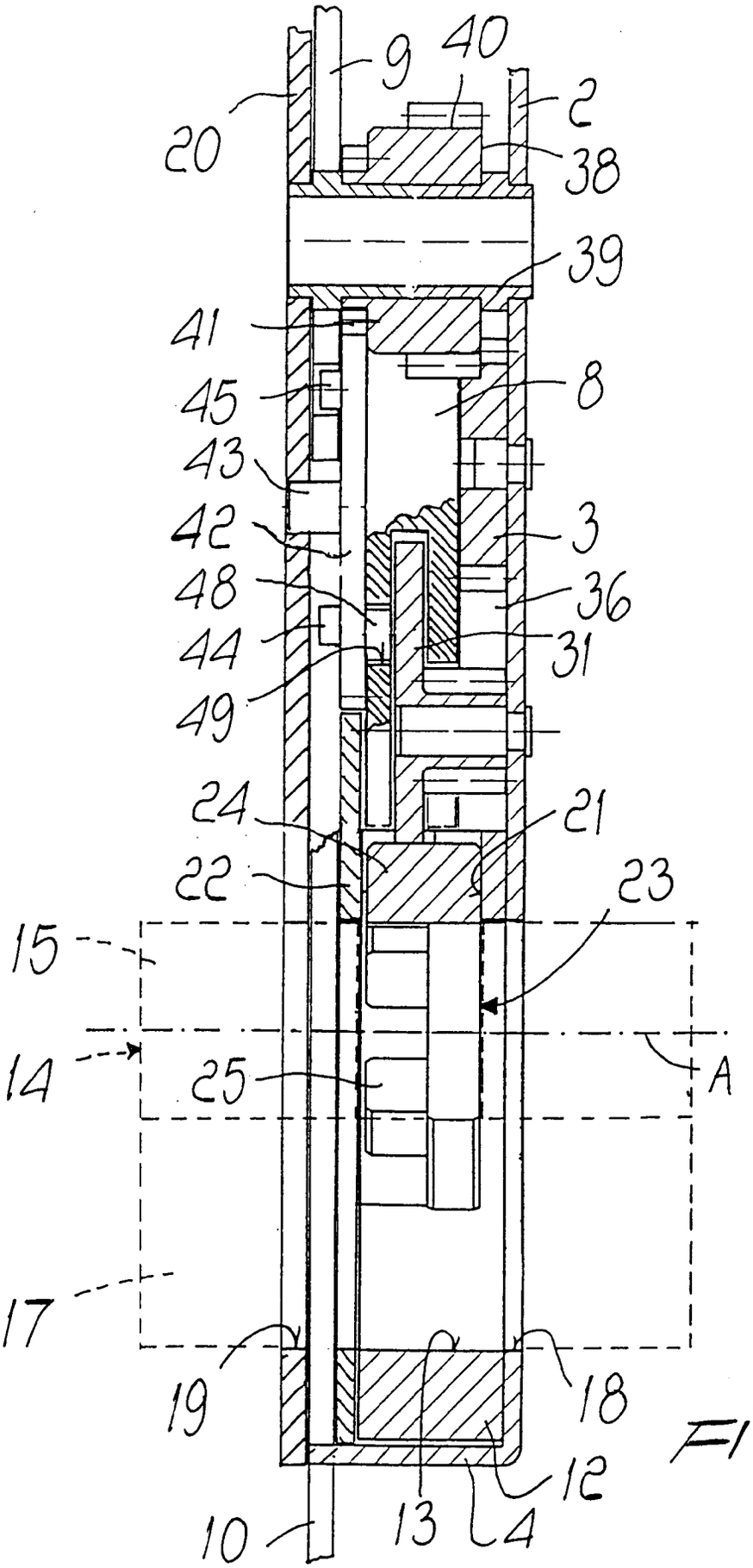
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Fig. 3

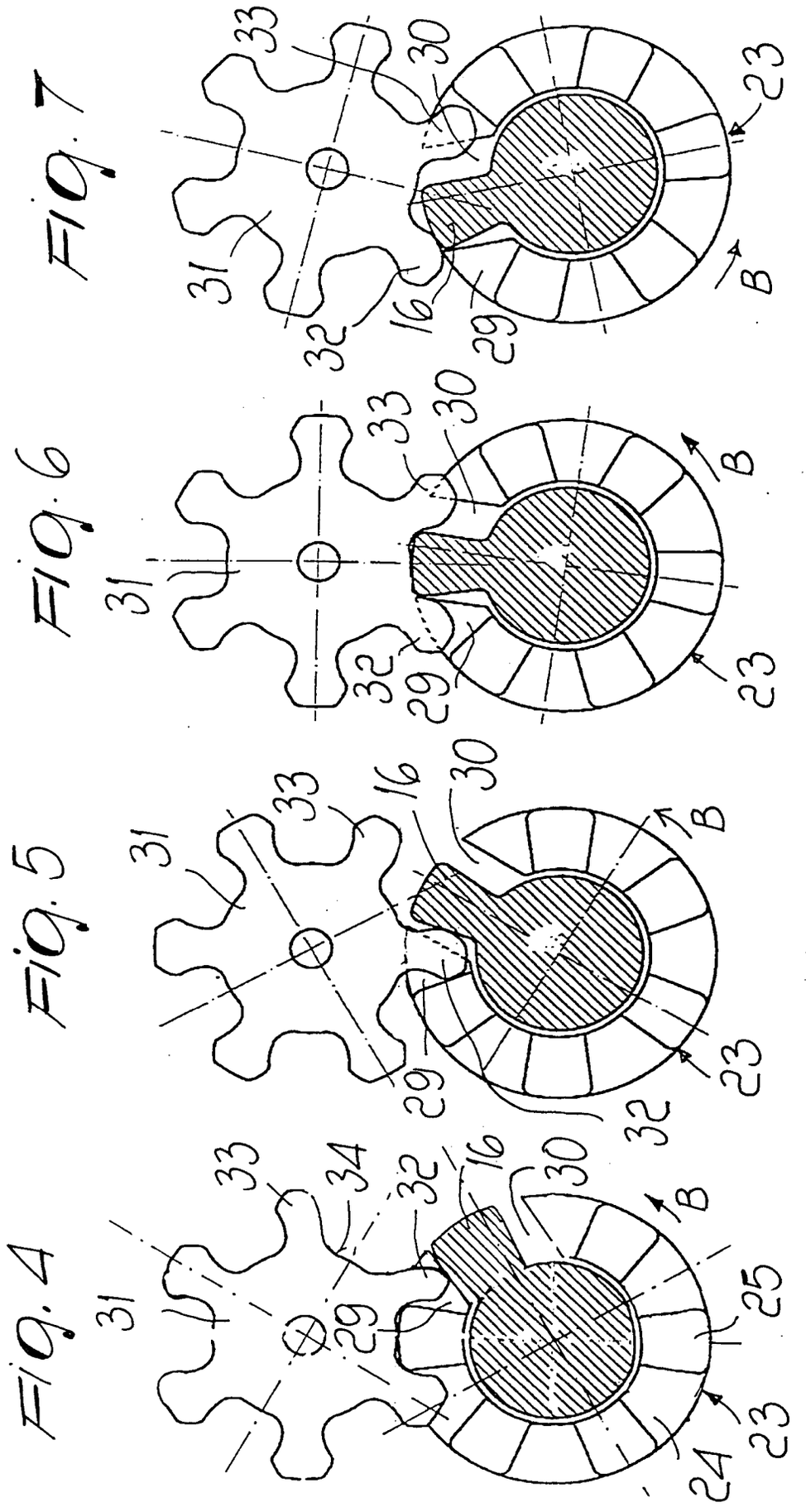
Fig. 7
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Fig. 4
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