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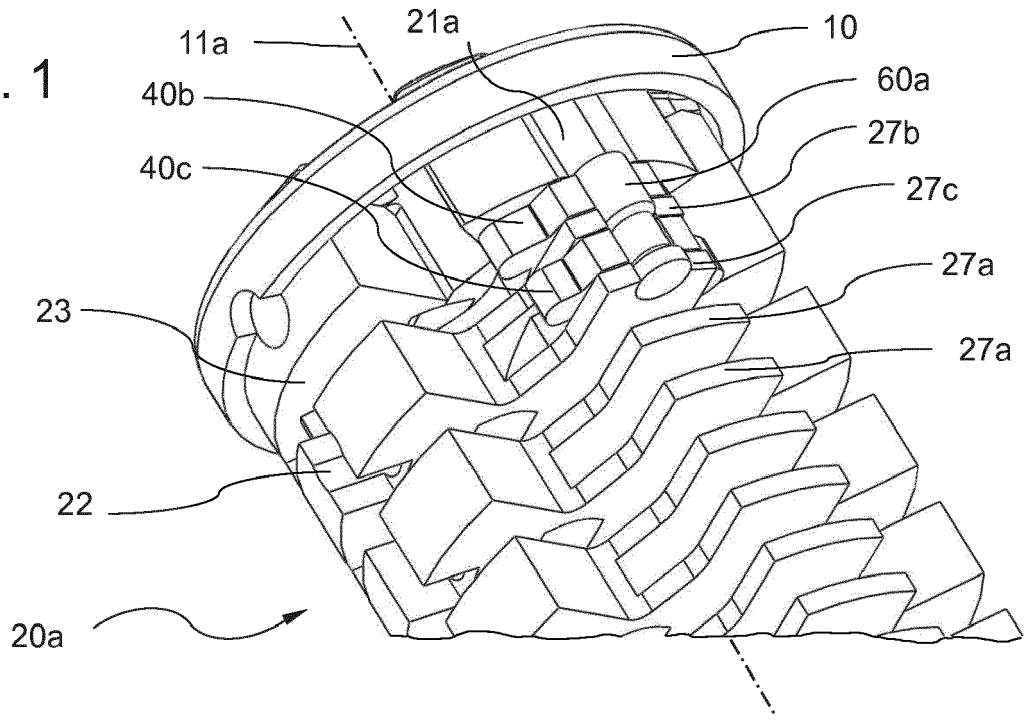
(54) **REPROGRAMMABLE LOCK**

(57) A reprogrammable lock comprises a plug (20a), which is accommodated in a housing and includes a keyway configured to receive a key, at least one validating element of a first kind configured to cooperate with a key introduced into the keyway to read a key coding, and at least one validating element of a second kind (40b, 40c), which is blockable by a pin (60a). The lock is configured to define a first state, in which the pin blocks the at least one validating element of the second kind so that it is inactive when reading the key coding and a second state, in which the at least one validating element of the second kind is released so that is active when reading the key coding.

Fig. 1



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Description

[0001] The present invention relates to a reprogrammable lock comprising a housing, a plug and at least one validating element of a first kind configured to cooperate with a key introduced into a keyway to read a key coding.

[0002] Locks with housing, plug and validating elements are e.g. known from US 9,920,548 B2, WO 2016/162363 A1 and WO 2018/041277 A1 of the same applicant.

[0003] It is desirable to configure the lock such that is reprogrammable so that a key, which with the lock could be opened before reprogramming, is not suited anymore to open the lock. When a site is provided with multiple locks, it is desirable that during a defined period, which corresponds e.g. the construction period, several locks have the same coding so that they can be opened by the very same key. Subsequently, the locks are individualized by reprogramming so that the key becomes useless as each lock has a different coding and thus needs a different kind of key to open it.

[0004] It is an object of the present invention to provide for a lock, which is reprogrammable in a mechanical and simple way.

[0005] For solving this object, a lock according to claim 1 is provided. Also, a locking set according to claim 15 is provided. The further claims specify additional embodiments of the lock and the locking set.

[0006] The lock can be mechanically reprogrammed in a simple way by providing at least one validating element of a second kind, which is blockable by a pin, wherein the lock is configured to define a first state, in which the pin blocks the at least one validating element of the second kind so that it is inactive when reading the key coding and a second state, in which the at least one validating element of the second kind is released so that is active when reading the key coding.

[0007] Preferably, the pin is arranged such that, for reprogramming the lock, it can be extracted from the lock or it can be moved to another position inside the lock. In the second case, the lock may be configured such that it holds the pin in said another position in a radial and axial secured way.

[0008] In one embodiment, the pin is held on the plug before and after reprogramming. In another embodiment the pin is held on the plug before reprogramming and in a cavity after reprogramming, the cavity being formed in a member coupled to the plug.

[0009] Following, further embodiments are described with reference to Figures. In the drawings:

Fig. 1 shows a perspective view of a part of a lock according to a first embodiment;

Fig. 2 shows the view of Fig. 1 from another direction;

Fig. 3 shows a detail of the view of Fig. 1;

Fig. 4 shows a side view of a validating element for the lock of Fig. 1;

Fig. 5 shows a side view of a blockable validating element of the lock of Fig. 1;

Fig. 6 shows a partially sectioned rearward view of the lock of Fig. 1 with a key inserted therein;

Fig. 7 shows a perspective view of the plug of Fig. 1;

Fig. 8 shows partly three different kinds of keys usable with the lock of Fig. 1;

Fig. 9 shows the lock of Fig. 1 with a key of a first kind inserted therein in a longitudinal section;

Fig. 10 shows the lock of Fig. 1 with a key of a second kind inserted therein in a transverse section;

Fig. 11 shows part of the configuration of Fig. 10 in a longitudinal section, wherein the key has been a bit extracted;

Fig. 12 shows a perspective view of a plug for a lock according to a second embodiment;

Fig. 13 shows an enlarged view of the plug of Fig. 12 together with validating elements, wherein a validating element is blocked by a release pin;

Fig. 14 shows the configuration of Fig. 13 from another direction;

Fig. 15 shows a side view of a validating element of the configuration of Fig. 13;

Fig. 16 shows a partially sectioned front view of the configuration of Fig. 13;

Fig. 17 shows a side view of another validating element of the configuration of Fig. 13;

Fig. 18 shows a partially sectioned rearward view of the lock according to the second embodiment, in which the validating element is released;

Fig. 19 shows a perspective view of the configuration of Fig. 13, in which the validating element is released;

Fig. 20 shows the configuration of Fig. 19 from another direction;

Fig. 21 shows partly two different kinds of keys usable with the lock according to the second embodiment;

Fig. 22 shows part of the lock according to the second

embodiment with a key of a first kind inserted therein in a longitudinal section;

Fig. 23 shows the configuration of Fig. 22 with a key of a second kind inserted into the lock;

Fig. 24 shows an enlarged perspective view of a variant of the lock according to the second embodiment, in which two validating elements are blocked by a release pin;

Fig. 25 shows a perspective, partially exploded view of a part of a lock according to a third embodiment;

Fig. 26 shows the configuration of Fig. 25 from another direction;

Fig. 27 shows a perspective view of the plug of the lock according to the third embodiment;

Fig. 28 shows a perspective view of a clutch member for a lock according to the third embodiment;

Fig. 29 shows a perspective view of a part of the lock according to the third embodiment, wherein two validating element are blocked by a release pin;

Fig. 30 shows a side view of a validating element for the lock of Fig. 25;

Fig. 31 shows a partially sectioned front view of the lock according to the third embodiment;

Fig. 32 shows the configuration of Fig. 29 from another direction;

Fig. 33 shows the configuration of Fig. 32 in a sectional view;

Fig. 34 shows the configuration of Fig. 34 with a key of a second kind inserted into the lock;

Fig. 35 shows a partially sectioned front view of the lock, wherein the validating elements of the second kind are blocked;

Fig. 36 shows the configuration of Fig. 35, wherein the validating elements of the second kind are released;

Fig. 37 shows partly two different kinds of keys usable with the lock according the third embodiment;

Fig. 38 shows the configuration of Fig. 32, wherein the validating elements are released; and

Fig. 39 shows the configuration of Fig. 38 in a sectional view.

[0010] In general, the embodiments of the lock described hereinafter may comprise the following components:

- a plug, which includes a keyway configured to receive a key (see e.g. the plug 20a in Fig. 7, the plug 20b in Fig. 12, and the plug 20c in Fig. 27),
- a housing with a circular cylindrical opening, in which the plug is accommodated (see e.g. the housing 50 in Fig. 35),
- one or more blocking bars for preventing a rotation of the plug with respect to the housing when the lock is in the locked state (see the blocking bar 30 in Fig. 25 and the blocking bars 30, 30' received in the longitudinal grooves 52, 52' in Fig. 36),
- one or more validating elements of a first kind configured to cooperate with a key introduced into the keyway to read a key coding (see e.g. the validating elements 40a in Fig. 25),
- one or more validating elements of a second kind which are configured to be blocked by a pin (see the validating elements 40b, 40c in Fig. 1, the validating element 40d in Fig. 13, the validating elements 40d, 40g in Fig. 24, and the validating elements 40h, 40i in Fig. 29).

[0011] A blocking bar is preloaded such that in the locked state of the lock it is pushed into a longitudinal groove which is formed in the housing (see longitudinal groove 52, 52' in Fig. 36). Said longitudinal groove extends along a longitudinal direction which is arranged parallel to the rotation axis, around which the plug is rotatable with respect to the housing in the unlocked state of the lock. The pushing force is e.g. produced by elastic means, e.g. in the form of one or more springs 34 (see Fig. 25).

[0012] In the locked state of the lock, a blocking bar is arranged between the plug and the housing, which has the effect that a rotation of the components including the plug, the blocking bar(s), and the validating elements with respect to the housing is disabled.

[0013] When a key with the correct coding is used, then the components including the plug, the blocking bar(s), and the validating elements can be rotated relative to the housing around the rotation axis, whereby a driver (see driver 85 in Fig. 31) unlocks or locks the actual locking mechanism, e.g. a bolt of a door or the like.

[0014] The individual embodiments are now described in more detail.

First embodiment

[0015] Fig. 1 and 2 show part of a lock, which comprises a cap 10, a plug 20a, and validating elements 40b, 40c of the second kind. The plug 20a has ribs 27a between which validating elements 40a of a first kind can be arranged in a manner as shown in Fig. 25. The plug 20a includes further a receiving groove 22, which extends

alongside of the plug 20a and which serves for receiving a blocking bar 30 in the unlocked state of the lock. Another receiving groove 22' is formed in the plug 20a opposite to the groove 22 for receiving a second blocking bar 30' in the unlocked state of the lock (see groove 22, 22' and blocking bars 30, 30' in Fig. 35). The lock further comprises a housing 50 (see also Fig. 35), which has a circular cylindrical opening for receiving the components 20a, 30, 30', 40a, 40b, 40c. In the assembled state of the lock, the cap 10 may be arranged fully or partly outside of the housing 50.

[0016] The plug 20a is configured to receive the key and to carry the blocking and validating components 30, 30', 40a, 40b, 40c. The plug 20a comprises a keyway 21 (see Fig. 7), which extends in the insertion direction of the key and which serves for receiving the shank of the key.

[0017] The plug 20a has slits 23, each being arranged tranversely to the rotation axis 11a and serving for receiving a portion of a validating element 40a, 40b, 40c so that the latter can cooperate with the blocking bar 30 or 30'.

[0018] The validating elements 40a, 40b, 40c are disc-shaped and arranged on an axle 11 (see Fig. 6), which is attached to the cap 10 and to the plug 20a. The latter is secured against axial movement by a clip, e.g. a circlip, which is mounted in a circumferential groove formed at the rearward end of the plug and abuts against the rearward end of the housing (see e.g. the right-hand side of the plug in Fig. 26 showing a groove arranged transversally to the rotation axis 11a and having two holes).

[0019] In Fig. 1 and 2, the lock is shown in the programmable state, in which the two validating elements 40b and 40c are blocked which - seen in the insertion direction of the key - are arranged foremost of the keyway 21. Thus, the validating elements 40a of the first kind, which are arranged between the ribs 27a, are rotatable with respect to the plug 20a to read a coding of the key, whereas the validating elements 40b, 40c are blocked in the plug 20a and are thus not active when reading the key coding. In the present embodiment, the validating elements 40b, 40c are secured to the plug 20a by means of a release pin 60a, see the detailed illustration in Fig. 3.

[0020] The plug 20a includes ribs 27a, 27b, 27c which are arranged between a validating element 40a, 40b, 40c. The foremost ribs 27b and 27c serve for holding the release pin 60a and have each a recess 28 to receive a portion of the release pin 60a. The validating elements 40b, 40c have also a recess 48b, 48c to receive a portion of the release pin 60a.

[0021] Holding means are provided to hold the release pin 60a securely in the recesses 28, 48b, 48c. In the present embodiment, holding means are provided in that the recesses 28 and 48b have an open end with a maximum distance d (see Fig. 3 and 5) that is smaller than the maximum diameter of the portion 61a, 65a of the release pin 60a received in said recess. Thus, there are at least two elements out of the validating elements 40b, 40c and the ribs 27b, 27c which extend around a portion of the pin 60a to that extent that the latter cannot be moved radially out of a recess. For instance, the recess 28, when seen in a front view, may be defined by a circular arc, which extends over an angle of more than 180 degrees. The validating elements 40b, 40c are prestressed by means of an elastic mean (see spring 49 in Fig. 6). Thereby, the validating elements 40b, 40c exert a side pressure on the pin 60a, which impedes a movement in the axial direction. Securement in the axial direction is also achieved in that the pin 60a has an intermediate part 63a, which has a smaller diameter than the two end parts 61a, 65a of the pin 60a such that tapered parts 62a, 64a are formed. Due to the elastic mean 49 the validating element 40c extending around the intermediate part 63a is a bit rotated to a position in which it contacts the intermediate part 63a (see Fig. 6). Thus, the latter butts against a tapered part 62a or 64a when the pin 60a is moved in the axial direction.

[0022] Fig. 4 shows a validating element 40a of the first kind. It comprises a first arm 41a, which is configured to contact a coding part of the key, a second arm 42a, which is configured to cooperate with a blocking bar 30 or 30', and a hole 45, which is arranged between the arms 41a and 42a and which serves for receiving the axle 11 for a rotational arrangement around the axis 11a.

[0023] The validating element 40a includes a protrusion 43, which cooperates with the elastic mean 49, e.g. a spring such as a coil spring, see Fig. 6. The plug 20a includes blind holes 24, which are arranged transversally to the axis 11a and radially offset thereto (see Fig. 6). Said elastic mean 49 is arranged in a blind hole 24 and acts via the protrusion 43 on the validating element 40a so that the latter is pushed in a specific direction. When inserting the key into the keyway 21, the first arm 41a of the validating element 40a senses the inner side of a key portion, which is provided with the key coding.

[0024] The second arm 42a of the validating element 40a has a recess 44, which serves for receiving a portion of the blocking bar 30 or 30'. The recess 44 is defined by side walls 44a, 44b and is arranged with respect to the rotation axis 11a such that its shape is mirror symmetrical around an axis 44c which goes through the middle of the recess 44 and the rotation axis 11a.

[0025] Optionally, the second arm 42 may have one or more additional recesses 46, which are "false" recesses having no mechanical function, but making it more difficult for someone who tries to pick the lock by finding the correct position of the validating element 40a. The at least one false recess 46 is formed such that the blocking bar 30, 30' cannot be received therein. In the embodiment of Fig. 4, the depth of the recess 46 is smaller than the depth of the recess 44.

[0026] A side portion 47 of a validating element 40a is configured to contact a support face 25 formed on the plug 20a such that the validating element 40a can be rotated only within a predetermined angle range (see Fig. 6).

[0027] Fig. 5 shows a validating element 40b of the second kind, wherein elements corresponding to those of a validating element 40a of the first kind have the same reference numbers. It comprises a first arm 41b, which is configured to contact a coding part of the key, and a second arm 42b, which is configured to cooperate with the blocking bar 30 or 30'. The first arm 41b of the validating element 40b of the second kind is enlarged with regard to the first arm 41a of the validating element 40a of the first kind, so that the recess 48b can be formed therein. When seen in a front view, the recess 48b may be defined by a circular arc, which extends over an angle of more than 180 degrees. The recess 44' is enlarged with regard to the recess 44 of the validating element 40a of the first kind. This allows the blocking bar 30 or 30' to be received in the recess 44' in the state when the validating element 40b is inactive as well as in the state when it is active and has the correct position to unlock the lock.

[0028] The validating element 40c is also a validating element of the second kind and may be shaped in the same way as the validating element 40b. Thus, it may have a first arm 41c with a recess 48c and a second arm with a recess 44' (see Fig. 6). The recess 48c has the same shape as the recess 48b allowing a transfer of the pin 60a as explained below.

[0029] In the present embodiment, the validating elements 40a, 40b, 40c are arranged in an alternating inverted manner so that the first arms 41a, 41b, 41c point alternatingly to the left and right side. Another blocking bar 30' is provided, which e.g. is arranged opposite to the blocking bar 30 and which, in the locked state of the lock, engages into another groove 52' formed in the housing 50.

[0030] In the unlocked state of the lock, the blocking bar 30 is movable between the groove 52 and a receiving space formed by recesses 44, 44' of the validating elements 40a, 40b and the groove 22 in the plug 20a, and the blocking bar 30' is movable between the groove 52' and a receiving space formed by recesses 44, 44' of the validating elements 40a, 40c and by another groove in the plug 20a formed similar to the groove 22.

[0031] The release pin 60a is arranged such it can be extracted from the lock by a specific key. To this end, an extraction groove 21a is provided which is in alignment to the recesses 28, 48b, 48c and which extends to the outside of the lock. Fig. 7 shows the extraction groove 21a which in the present embodiment is formed in the cap 10. It is conceivable that a first part of the groove 21 is formed in the cap 10 and a subsequent part in the plug 20a.

[0032] Fig. 8 shows three different kinds of keys usable with a lock according to the first embodiment:

- a key 70a of a first kind, which is usable in the state in which the validating elements 40b, 40c are inactive and the lock is not yet reprogrammed,
- a key 70b of a second kind, which is usable to reprogram the lock by extracting the release pin 60a, and
- a key 70c of a third kind, which is usable in the state in which the validating elements 40b, 40c are active and the lock has been reprogrammed.

[0033] Each key 70a, 70b, 70c has a handling part, e. g. a bow, to which the key shank 71a, 71b, 71c is attached.

[0034] The key 70a has a longitudinal groove 76a, which is preferably arranged along the middle of the key shank 71a. The shape of the groove 76a is adapted to the shape of the release pin 60a so that when the key shank 71a is inserted in the keyway 21 the release pin 60a is received in the groove 76a. The length of the groove 76a is chosen such that the end of the key shank 71a reaches at least up to the rearward end of the plug 20a, see Fig. 9. The key coding of the key 70a is such that there is no coding at the positions, which would be sensed when the validating elements 40b, 40c were active.

[0035] In the present embodiment, the key shank 71a has a semi-closed profile enclosing at least partially the coding part. The key shank 71a has side portions 73, 74 which are U-shaped and which are connected via an arcuate middle portion 72 (see also Fig. 6). Thus, a side portion 73, 74 encloses a coding cavity 73a, 74a, in which the key coding is formed, e.g. in form of one or more coding tracks. A coding track extends along the key shank 71a and may have e.g. a wavelike course. The coding track may be formed e.g. by a line of successive channel portions and/or ridge portions.

[0036] When looking at the key 70a itself, the side portions 73, 74 prevent that the coding part of the key 70a is visible from outside. This impedes an unauthorized duplication of the key 70a e.g. by producing a copy based on pictures taken from the key 70a.

[0037] By inserting the key 70a into the lock, the first arm 41a of a validating element 40a protrudes into the coding cavity 73a or 74b and follows the coding track of the key 70a, whereby it is rotated accordingly around the axle 11. Once the key shank 71a is fully inserted, each validating element 40a and with it its recess 44 have a specific angular position. The validating elements 40b, 40c are blocked by the pin 60a and thus are not active.

[0038] If a key 70a having the correct coding with regard to the validating elements 40a is inserted, then their recesses 44 form together with the recesses 44' of the validating elements 40b, 40c and grooves 22, 22' in the plug 20a a first and a second receiving space, in which the blocking bars 30 and 30', respectively can be received. Subsequent rotation of the correct key 70a exerts a torque on the plug 20a which counteracts the force of the elastic means 34 so that the blocking bar 30, 30' is released out of the groove 52, 52' and pushed into the receiving space mentioned above. This allows the components 10, 20a, 30, 30', 40a, 40b, 40c, 60a together with the key 70a to be rotated with respect to the housing 50, which is the static part of the lock.

[0039] The lock is locked again by rotating the key 70a and with it the components 10, 20a, 30, 30', 40a, 40b, 40c, 60a into the other direction, so that the blocking bar 30, 30' can slide back into the groove 52, 52'. Withdrawal of the key 70a causes the validating elements 40a by means of the elastic means 49 in the blind holes 24 to be returned back to the initial position, in which at least one of the recesses 44 is not in the correct position anymore.

[0040] The key of the second kind 70b has a key shank 71b constituted substantially by the middle portion 72 of the key 70a, in which the groove 76a is formed. At the inner end of the groove 76a a pocket 77 is provided for receiving the release pin 60a. In order to activate the validating elements 40b, 40c, the key 70b is fully inserted into the keyway 21, turned into the direction, where the pocket 77 is located, so that the pin 60a is received therein (see Fig. 10), and pulled out (see Fig. 11). The pin 60a is now withdrawn and all validating elements 40a, 40b, 40c are active when reading the coding of a key.

[0041] The key of the third kind 70c has a key shank 71c which is shaped in a similar way as the key of the first kind 70a. However, the groove 76a may be left away and in order to open a lock, the coding of the key 70c has to be such that also the recesses 44' of the validating elements 40b, 40c have the correct position allowing the coding bar 30 or 30' to enter therein.

[0042] When providing a plurality of locks, which have not yet been reprogrammed, a key 70a can be configured such that it can open more than one lock. After reprogramming, the key 70c can be configured such that it can open only one lock.

Second embodiment

[0043] Fig. 12-20 show a second embodiment of a lock, in which corresponding elements have the same reference numbers as those of the first embodiment, in particular the blocking bars 30, 30', the validating elements 40a and the housing 50. With regard to the first embodiment, the plug 20b is designed differently, the release pin 60b has another position and another kind of validating elements 40d, 40e, 40f are provided. As will become apparent from the description below, the release pin 60b provided remains in the lock also after reprogramming so that the extraction groove 21a as shown in Fig. 7 is not needed.

[0044] Fig. 12 shows the plug 20b, which comprises ribs 27a, between which validating elements 40a of the first kind according to Fig. 4 may be arranged, and ribs 27d-27h each provided with a recess 28d-28h, which may configured like the recess 28 in the first embodiment. However, in the embodiment shown in Fig. 13, according to which a short release pin 60b is provided to block only one validating element 40d of the second kind, the recesses 28d and 28h are not needed. The recess 28e-28g is configured such that it may extend around a release pin 60b to that extent that the latter cannot be moved radially out of the recess. The recesses 28e-28g may have an open end with a maximum distance d (see Fig. 13) that is smaller than the maximum diameter of the portion 61b, 65b of the release pin 60b received in said recess (see Fig. 14). For instance, the recess 28e-28g, when seen in a front view, may be defined by a circular arc, which extends over an angle of more than 180 degrees.

[0045] Fig. 13 and 14 show a release pin 60b, which is held in the recesses 28e and 28f of ribs 27e and 27f. Therebetween a validating element 40d of Fig. 15 is arranged, which is blocked due to the presence of the pin 60b. The latter has an intermediate part 63b, which is arranged between the two end parts 61b and 65b. Tapered parts 62b, 64b are formed between parts 63b and 61b and between parts 63b and 65b.

[0046] The validating element 40d of the second kind shown in Fig. 15 differs from the validating element 40b of the second kind of Fig. 5 in that the first arm 41d has a recess 48d, which is adapted to the size of the pin 60b. The recess 48d may be larger than the size of the intermediate part 63b. When seen in a front view, the recess 48d may be defined by a circular arc, which extends over an angle of more than 180 degrees.

[0047] As the validating element 40d is prestressed (see Fig. 16), it exerts a side pressure on the pin 60b, which impedes a movement in the axial direction. Securement in the axial direction is also achieved by the tapered parts 62b, 64b of the pin 60b, against which the validating element 40d butts when the pin 60b is moved in the axial direction.

[0048] Another validating element 40e of a third kind shown in Fig. 17 is arranged between the ribs 27f and 27g of the plug 20b. The validating element 40e of the third kind differs from a validating element 40a of the first kind of Fig. 4 in that the first arm 41e has a contour 48e, which is adapted to secure the pin 60b, when it is arranged between the ribs 27f and 27g, see Fig. 18. The contour 48e has end portions and an intermediate portion arranged therebetween. An end portion of the contour 48e is concavely curved and merges into the intermediate portion, which is convexly curved and is defined by a circular arc. This arc is arranged such that it corresponds to the lower edge of the recess 28e - 28h enabling the release pin 60b to be axially transferred.

[0049] In order to activate the validating element 40d the pin 60b is moved from the position, in which it is held on the ribs 27e and 27f to the position, in which it is held on the ribs 27f and 27g.

[0050] The latter position is shown in Fig. 19 and 20. The pin 60b is radially secured in the recesses 28f and 28g of the ribs 27f and 27g. Axial securement is achieved by means of the first arm 41e of the validating element 40e. As is shown in Fig. 20, the first arm 41e contacts the pin 60b. During a rotation of the validating element 40e, e.g. when it senses the coding of a key, the validating element 40e moves via the contour 48e along the pin 60b, whereby the contact between validating element

40e and pin 60b and with it a friction force therebetween persists so that the pin 60b is secured in the axial direction irrespective of the rotational position of the validating element 40e. When the lock is not in use, the validating elements 40d and 40f prevent axial movement of the pin 60b in the standby state as shown on the Fig. 22.

[0051] Fig. 21 shows two different kinds of keys usable with a lock according to the second embodiment:

- a key 70d of a first kind, which is usable in the state in which the validating element 40d is inactive and the lock is not yet reprogrammed,
- a key 70e of a second kind, which is usable in the state in which the lock has been reprogrammed, so that the validating element 40d is active.

[0052] Each key 70d, 70e has a handling part, to which the key shank 71d, 71e is attached.

[0053] The key 70d has a longitudinal groove 76d, which is preferably arranged along the middle of the key shank 71d. The shape of the groove 76d is adapted to the shape of the release pin 60b so that when the key shank 71d is inserted in the keyway 21 the release pin 60b is received in the groove 76d. The length of the groove 76d is chosen such that the pin 60b when held on the ribs 27e, 27f is located at the end of the groove 76d when the key shank 71d is fully inserted into the keyway 21, see Fig. 22. The key coding of the key 70d is such that there is no coding at the position, which would be sensed when the validating element 40d was active.

[0054] The key 70e has a longitudinal groove 76e, which is preferably arranged along the middle of the key shank 71e. The shape of the groove 76e is adapted to the shape of the release pin 60b so that when the key shank 71e is inserted in the keyway 21 the release pin 60b is received in the groove 76e. The length of the groove 76d is chosen such that the pin 60b when hold on the ribs 27f, 27g is located at the end of the groove 76d when the key shank 71e is fully inserted into the keyway 21, see Fig. 23.

[0055] For reprogramming the lock, the key 70e with the shorter groove 76e may be used to move the pin 60b from the position shown in Fig. 22 to the position shown in Fig 23.

[0056] As with the keys 70a, 70c, the key shank 71d, 71e may include portions 72, 73, 74 to define a semi-closed profile enclosing at least partially the coding part.

[0057] In the embodiment shown in Fig. 13, the recesses 28d, 28h in ribs 27d and 27h are not needed and the validating element 40f, which is shaped here the same way as the validating element 40e, may be designed in the same way as the validating element 40a of Fig. 4, i. e. as a validating element without the specific contour 48e.

[0058] Fig. 13 shows an embodiment, in which only one validating element 40d is blocked before reprogramming the lock. It is conceivable to block more than one validating element and to liberate them after reprogramming. Fig. 24 shows a variant in which a release pin 60c is held on ribs 27d and 27f. The pin 60c corresponds substantially to the pin 60b, but has a longer intermediate part 63c so that it is enclosed by the recesses 48d, 48g of the validating elements 40d, 40g of the second kind, whereby the latter are inactivated. When reprogramming the lock, the pin 60c is moved to the position, in which it is held on ribs 27f and 27h to liberate the validating elements 40d, 40g. In this position, the validating elements 40e and 40f of the third kind contact the pin 60c and exert via their contour 48e, 48f a friction force thereon, so that it is axially secured.

Third embodiment

[0059] Fig. 25-36 show a third embodiment of a lock, in which corresponding elements have the same reference numbers as those of the first and second embodiments, in particular the blocking bars 30, 30', the validating elements 40a and the housing 50. With regard to the first embodiment, the plug 20c is designed differently, the release pin 60d has another position and another kind of validating elements 40h, 40i are provided. As will become apparent from the description below, the release pin 60d provided remains in the lock also after reprogramming so that the extraction groove 21a as shown in Fig. 17 is not needed.

[0060] The plug 20c shown in Fig. 25-27 has ribs 27a, between which validating elements 40a as shown in Fig. 4 are arranged, and ribs 27g' and 27h' each provided with a recess 28g' and 28h', respectively, which is configured similar to the recess 28 in the first embodiment. Thus, the recess 28g', 28h' is configured such that it may extend around the release pin 60d to that extent that the latter cannot be moved radially out of the recess 28g', 28h'. The recesses 28g', 28h' may have an open end with a maximum distance d that is smaller than the maximum diameter of the portion of the release pin 60c received in said recess. For instance, the recess 28g', 28h', when seen in a front view, may be defined by a circular arc, which extends over an angle of more than 180 degrees.

[0061] The rearward end of the plug 20c is provided with an accommodation space 29, in which a clutch member 80 as shown in Fig. 28 can be accommodated. The accommodation space 29 includes a slit 29a for receiving a protrusion 80a of the clutch member 80 to connect it in a rotationally secured manner with the plug 20c.

[0062] As shown in Fig. 28, the clutch member 80 includes a protruding portion 80b with a cavity 80c and a bore 80d, which is arranged transversally to the cavity 80c. The cavity 80c is configured to receive the release pin 60d (see Fig. 34) such that the latter cannot be moved radially out of the cavity 80c. This is achieved e.g. in that seen in a front view the cavity 80c is defined by a circular arc, which extends over more than 180 degrees. The bore 80d is configured to receive a magnet 81 (see Fig. 33) for securing the pin 60d when received in the cavity

80c.

[0063] As a variant for securement in the cavity 80c it is conceivable that the release pin 60d is permanently magnetic, e.g. by forming it as a cylindrical magnet polarized transversally. The clutch member 80 is made of a magnetizable material e.g. magnetic steel such that the magnetic forces of the release pin 60d cause it to be attracted to the clutch member 80. In this case, there is no need for use of the magnet 81. Furthermore, by providing validating elements 40h and 40i which are made of a magnetizable material e.g. magnetic steel, the magnetic forces of the release pin 60d assist to hold it in the standby position as depicted in Fig. 29.

[0064] Fig. 29 shows the release pin 60d hold on the ribs 27g' and 27h'. The pin 60d has a circular cylindrical shape and engages into the recesses 28g' and 28h' of ribs 27g', 27h' and the recesses 48h and 48i formed in the validating elements 40h and 40i of the second kind.

[0065] The validating elements 40h and 40i are designed in the same way, but are arranged rotated by 180 degrees with respect to each other on the axle 11.

[0066] Fig. 30 shows the validating element 40i of the second kind in more detail. The first arm 41i of the validating element 40i includes a recess 48i which is adapted to the shape of the pin 60d, so that the latter cannot be moved radially out of the recess 48i. Seen in a front view, the recess 48i may e.g. be defined by a circular arc, which extends over more than 180 degrees. The other elements 42b, 43, 44', 45-47 of the validating element 40i may be designed in the same way as the corresponding elements 42b, 43, 44', 45-47 of the validating element 40b of the second kind shown in Fig. 5.

[0067] As seen in Fig. 29, the last rib 27a acts as a stopper for the pin 60d, so that it cannot be moved in the axial direction towards the entry of the keyway 21. A validating element 40h, 40i is also prestressed by means of an elastic mean 49, e.g. a spring received in the blind hole 24 formed in the plug 20c, see Fig. 31. Thereby, a validating element 40h, 40i exerts a side pressure on the release pin 60d to secure it in the axial direction.

[0068] Fig. 31 shows also a driver 85 with a cam 85a, which is rotatable in the unlocked state of the lock to act on the actual locking mechanism. The driver 85 includes a seat for receiving the clutch member 80 so that it is connected with the driver 85 in a rotational secured manner.

[0069] Fig. 32 and 33 show further views of the lock in the state, in which the release pin 60d blocks the validating elements 40h and 40i such that they are in the inactive position.

[0070] Fig. 35 shows also the lock in the state, in which the validating elements 40h, 40i are blocked by the release pin 60d. The recess 44' of the validating elements 40h, 40i is positioned such that the blocking bar 30, 30' can be received therein when the validating elements of the first kind 40a have the correct position. This is shown in Fig. 35: The lock is in the unlocked state and the components 10, 20c, 30, 30', 40a, 40h, 40i, 49, 60d are rotated in the clockwise direction with respect to the housing 50.

[0071] Fig. 36 shows the lock in the state, in which the validating elements 40h, 40i are released and thus are active when the key coding is read. In the situation shown in Fig. 36, the validating elements 40h, 40i do not have the correct position for opening the lock, as the blocking bar 30, 30' abuts against the end of the second arm 42b.

[0072] To liberate the validating elements 40h and 40i the pin 60d is moved in the axial direction towards the clutch member 80, so that the pin 60d is received in the cavity 80c and secured therein by means of the magnet 81, see Fig. 34. This transfer of the pin 60d may be done e.g. with a key 70g of a second kind as shown in Fig. 37. The key 70g of a second kind has a longitudinal groove 76g, which is preferably arranged along the middle of the key shank 71g. The shape of the groove 76g is adapted to the shape of the release pin 60d so that when the key shank 71g is inserted in the keyway 21 the release pin 60d is received in the groove 76g. The end of the groove 76g is chosen such that it defines the position of the pin 60d in the cavity 80c, when the key 70g is fully inserted into the keyway 21, see Fig. 34.

[0073] The further key 70f shown in Fig. 37 is a key of a first kind, which is usable in the state in which the validating elements 40h, 40i are inactive and the lock is not yet reprogrammed. The key 70f has a longitudinal groove 76f, which is preferably arranged along the middle of the key shank 71f. The shape of the groove 76f is adapted to the shape of the release pin 60d so that when the key shank 71f is inserted in the keyway 21 the release pin 60d is received in the groove 76f. The groove 76f is longer than the groove 76g. Thus, when the key 70g is fully inserted into the keyway 21, the groove 76g ends at the front face of the pin 60d when arranged on the ribs 27g' and 27h'. The key coding of the key 70f is such that there is no coding at the position which would be sensed when the validating elements 40h, 40i were active.

[0074] As with the keys 70a, 70c, 70d, 70e the key shank 71f, 71g may include portions 72, 73, 74 to define a semi-closed profile enclosing at least partially the coding part.

[0075] After reprogramming the lock, a key of a third kind is usable, which may free of the groove 76f or 76g and which may be e.g. configured similar to the key 70c of the third kind of the first embodiment.

[0076] Fig. 38 and 39 show further views of the lock in the state in which the release pin 60d is arranged in the cavity 80c of the clutch member 80, so that the validating elements 40h and 40i are in the active position for reading the key coding of a key of a third kind.

Claims

1. A reprogrammable lock, comprising
   a housing (50),
   a plug (20a, 20b, 20c), which is accommodated in

the housing and includes a keyway (21) configured to receive a key (70a-70g),
at least one validating element of a first kind (40a) configured to cooperate with a key introduced into the keyway to read a key coding, and
at least one validating element of a second kind (40b, 40c, 40d, 40g, 40h, 40i), which is blockable by a pin (60a-60d), wherein
the lock is configured to define a first state, in which the pin blocks the at least one validating element of the second kind so that it is inactive when reading the key coding and a second state, in which the at least one validating element of the second kind is released so that is active when reading the key coding.

2. The lock according to claim 1, wherein the plug (20a, 20b, 20c) comprises at least two ribs (27b, 27c-27f, 27g', 27h'), each rib including a recess (28, 28d-28f, 28g', 28h') extending around a portion (61a, 65a, 61b, 65b) of the pin (60a-60d) when blocking the at least one validating element of the second kind (40b, 40c, 40d, 40g, 40h, 40i), preferably the recess having an open end with a maximum distance (d) that is smaller than the maximum diameter of said portion of the pin received in the recess.

3. The lock according to any one of the preceding claims, wherein the at least one validating element of the second kind (40b, 40c, 40d, 40g, 40h, 40i) comprises a recess (48b, 48c, 48d, 48g, 48h, 48i) extending around a portion (62a, 65a, 63b, 63c) of the pin (60a-60d) when blocking the at least one validating element of the second kind.

4. The lock according to any one of the preceding claims, wherein the at least one validating element of the first kind (40a) is movably arranged in a plane transversally to the rotation axis (11a) around which the plug (20a, 20b, 20c) is rotatable when the lock is in the unlocked state, preferably the at least one validating element of the first kind (40a) is rotatable around the rotation axis.

5. The lock according to any one of the preceding claims, wherein the at least one validating element of the second kind (40b, 40c, 40d, 40g, 40h, 40i) in the second state, in which it is active, is movable in a plane transversally to the rotation axis (11a), preferably the at least one validating element of the second kind is rotatable around the rotation axis.

6. The lock according to any one of the preceding claims, wherein the pin (60a-60d) is arranged in the keyway (21) at least in the first state, in which it blocks the at least one validating element of the second kind (40b, 40c, 40d, 40g, 40h, 40i), and/or the keyway (21) includes an extraction groove (21a) for extracting the pin (60a) out of the lock.

7. The lock according to any one of the preceding claims, wherein the pin (60b-60d) is movable from a first position, in which it is held on the plug (20b, 20c) to block the at least one validating element of the second kind (40d, 40g, 40h, 40i), to a second position, in which it is held on the part of the lock being rotatable in the unlocked state of the lock such that the at least one validating element of the second kind is active.

8. The lock according to claim 7, wherein the plug (20b, 20c) includes ribs (27f, 27g, 27h), each having a recess extending (28f, 28g, 28h) around a portion (61b, 65b) of the pin (60b, 60c) when it is in the second position.

9. The lock according to any one of the preceding claims, wherein the plug (20c) is coupled to a member (80) having a cavity (80c) for receiving the pin (60d) in the second state of the lock, preferably the member having a magnet (81) for holding the pin in the cavity and/or the pin (60d) being configured as a magnet.

10. The lock according to any one of the preceding claims, wherein the at least one validating element of the second kind (40b, 40c, 40d, 40g, 40h, 40i) is prestressed to act on the pin (60a-60d) when blocking the at least one validating element of the second kind.

11. The lock according to any one of the preceding claims, further comprising at least one validating element of a third kind (40e, 40f), which, when the at least one validating element of the second kind (40d, 40g) is active, is configured to act on the pin (60b, 60c) to secure it in the axial direction, preferably the at least one validating element of the third kind includes an arm (41e) which has a curved contour (48e, 48f) to permanently contact the pin when the at least one validating element of the second kind is active and the validating element of the third kind is rotated.

12. The lock according to any one of the preceding claims, wherein the housing (50) includes at least one longitudinal groove (52, 52'), and at least one blocking bar (30, 30'), which, in the locked state of the lock, engages into the at least one longitudinal groove and which, in the unlocked state of the lock, is receivable in a receiving space in the plug (20a, 20b, 20c), preferably the lock further comprises a second blocking bar (30'), which, in the locked state of the lock, engages in a second longitudinal groove (52') formed in the housing and which, in the unlocked state of the lock, is receivable in a second

receiving space in the plug.

13. The lock according to any one of the preceding claims, which comprises at least two validating elements of the second kind (40b, 40c, 40d, 40g, 40h, 40i) and/or a multiple of validating elements of the first kind (40a), preferably the validating elements of the first kind (40a) being arranged one after another along the rotation axis (11a), most preferably neighboring validating elements of the first kind (40a) are arranged rotated by 180 degrees with respect to each other.

14. The lock according to any one of the preceding claims, wherein, seen in a plan view, the keyway (21) has a shape which includes a middle portion, which is arranged between two end portions, the middle portion having an arcuate shape to receive an arcuate wall portion (72) of the key (70a, 70c-70g) and/or at least one of the end portions having a U-shape to receive a U-shaped wall portion (73, 74) of the key.

15. A locking set, comprising
at least one lock according to any one of the preceding claims,
at least one key of a first kind (70a, 70d, 70f) configured to open the lock when the lock is in the first state, and
at least one key of a second kind (70c, 70e, 70g) configured to open the lock when the lock is in the second state.

16. The locking set according to claim 15, wherein the at least one key of the first kind (70a, 70d, 70f) includes a longitudinal groove (76a, 76d, 76f) for receiving the pin (60a-60d), when it blocks the at least one validating element of the second kind (40b, 40c, 40d, 40g, 40h, 40i), preferably the at least one key of the second kind (70e, 70g) includes a longitudinal groove (76e, 76g) for receiving the pin (60b-60d), when the at least one validating element of the second kind is active.

Fig. 1

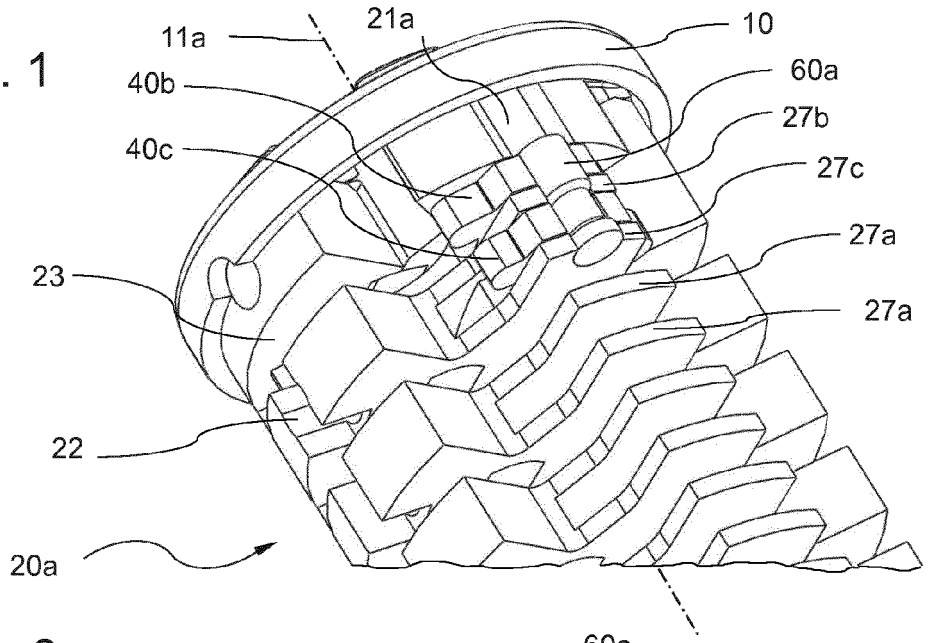


Fig. 2

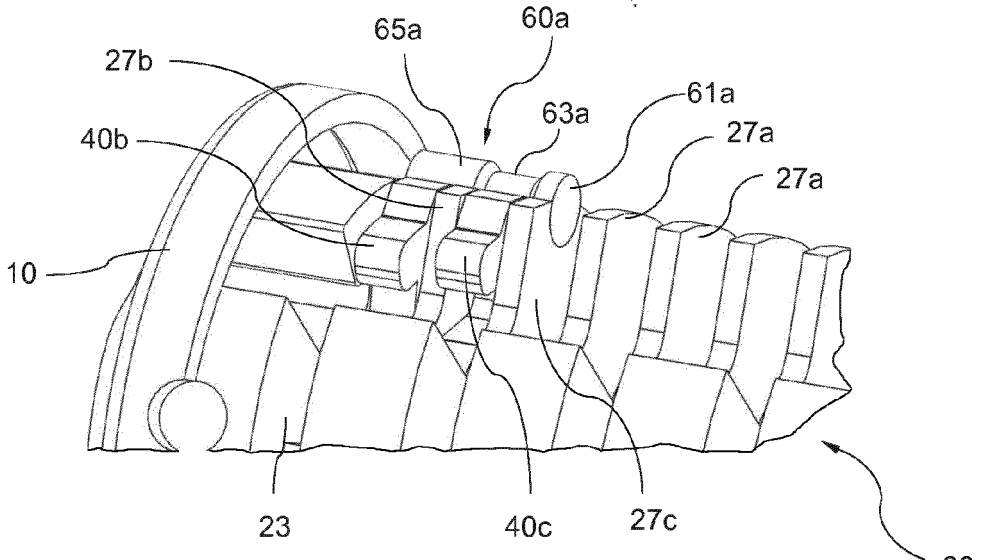


Fig. 3

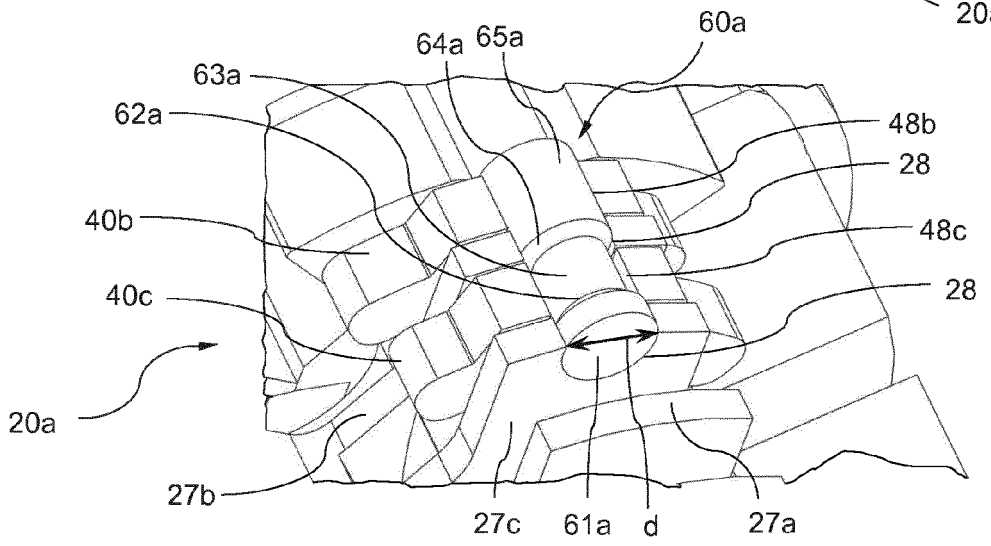


Fig. 4

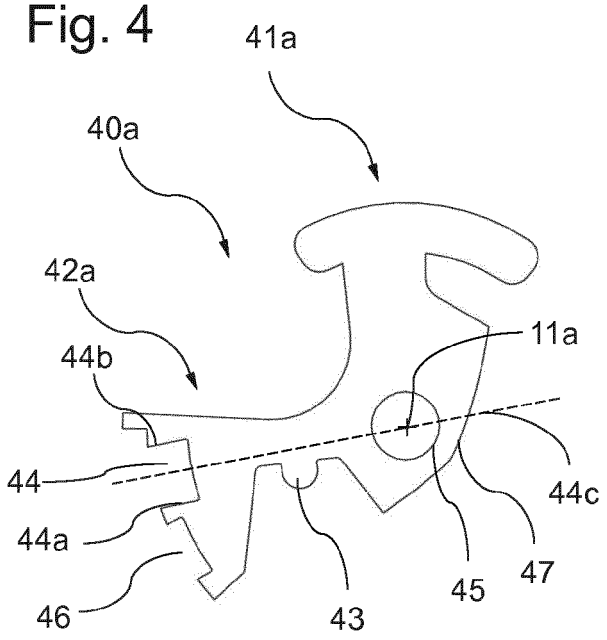


Fig. 5

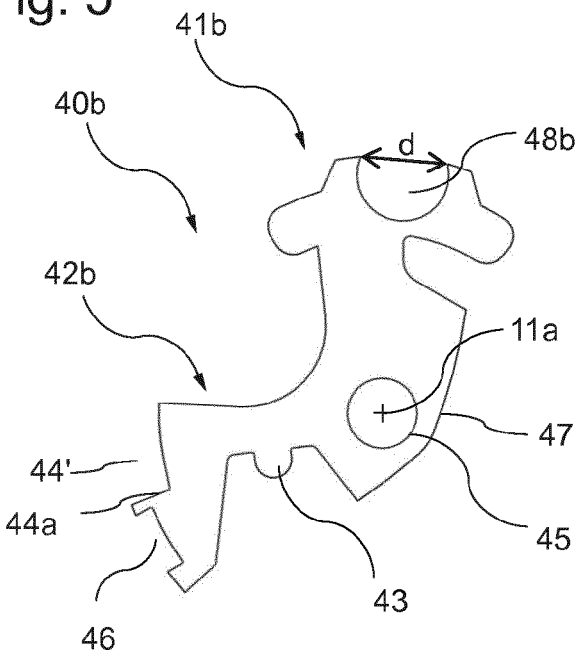


Fig. 6

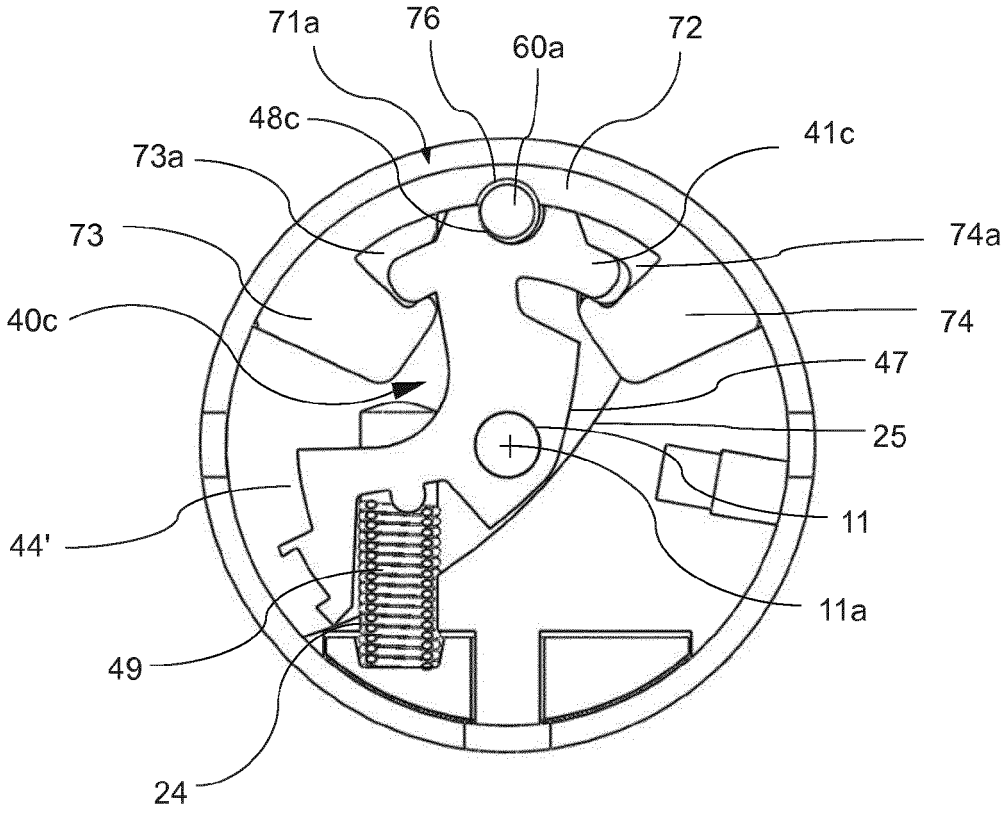


Fig. 7

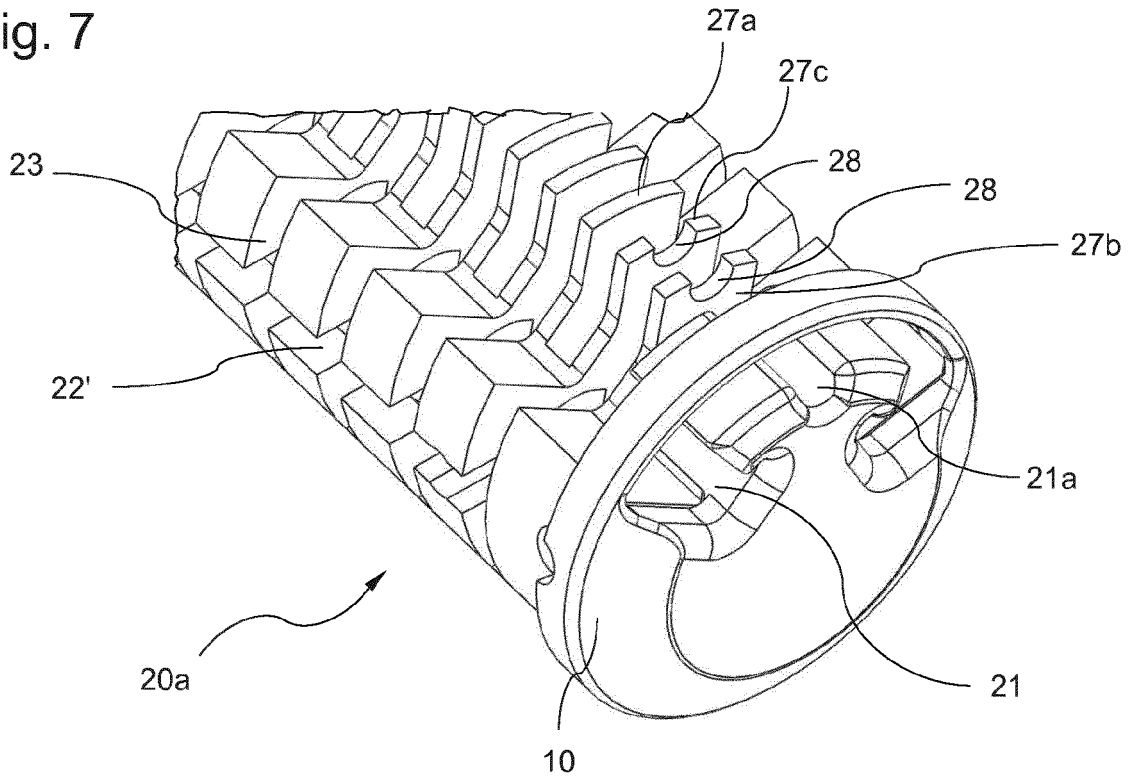

27a
27c
23
28
28
27b
22'
21a
20a
21
10

Fig. 8

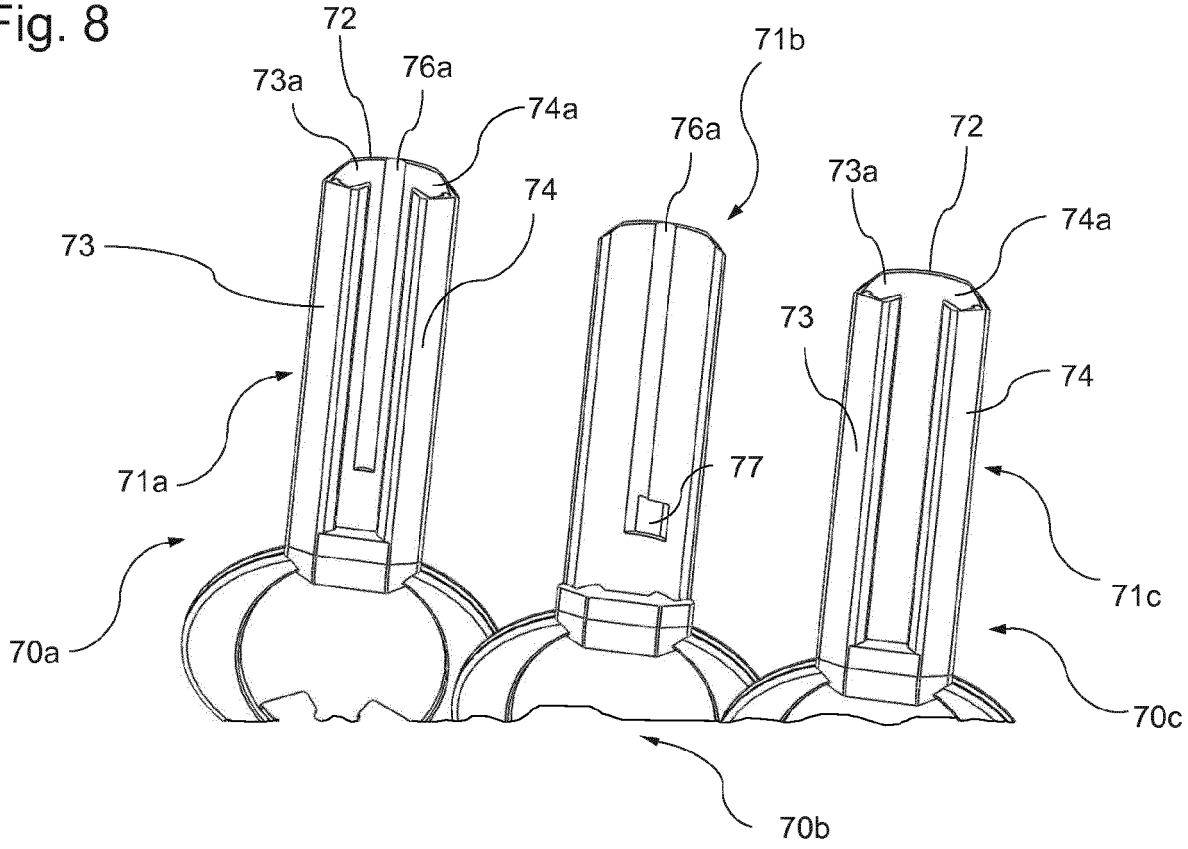

72
73a
76a
74a
71b
76a
72
73a
74a
74
73
73
74
71a
77
71c
70a
70c
70b

Fig. 9

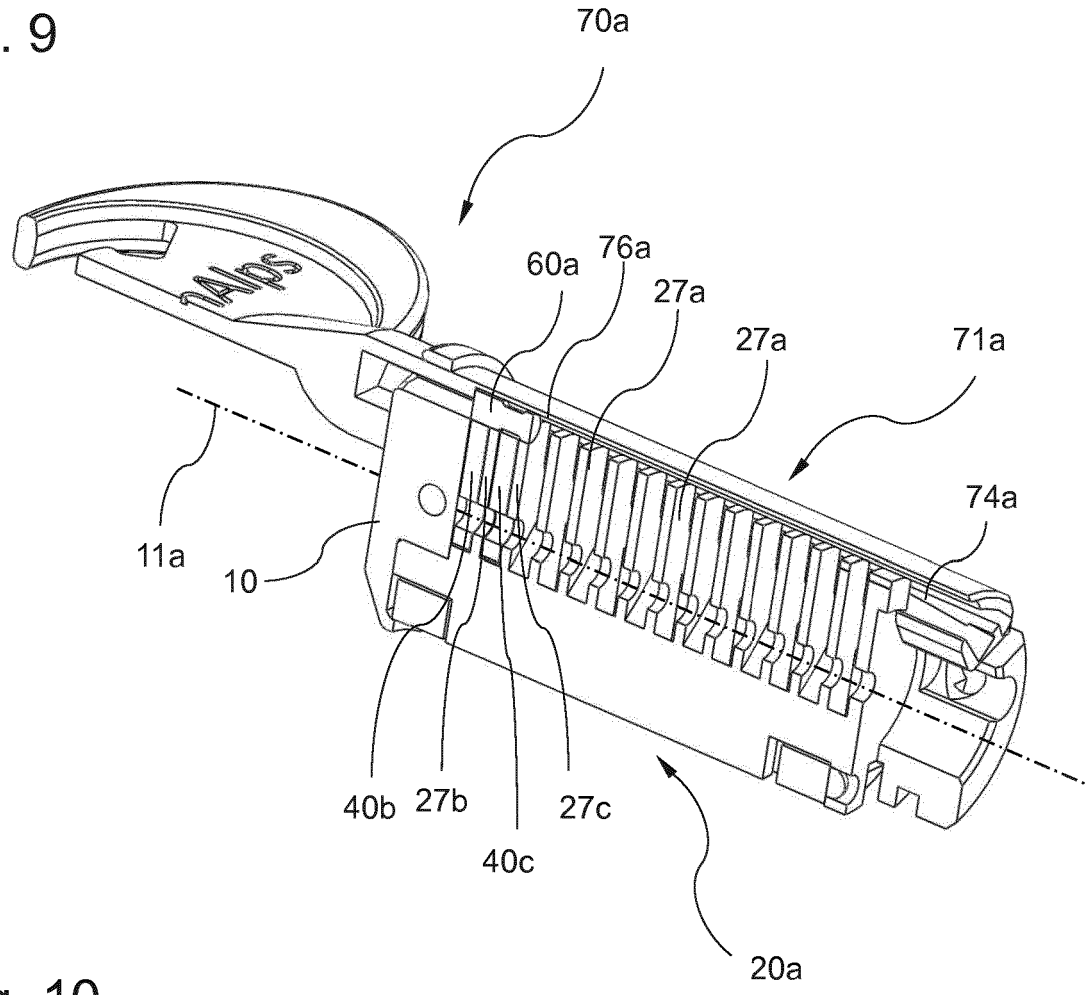

70a
60a
76a
27a
27a
71a
74a
11a
10
40b
27b
40c
27c
20a

Fig. 10

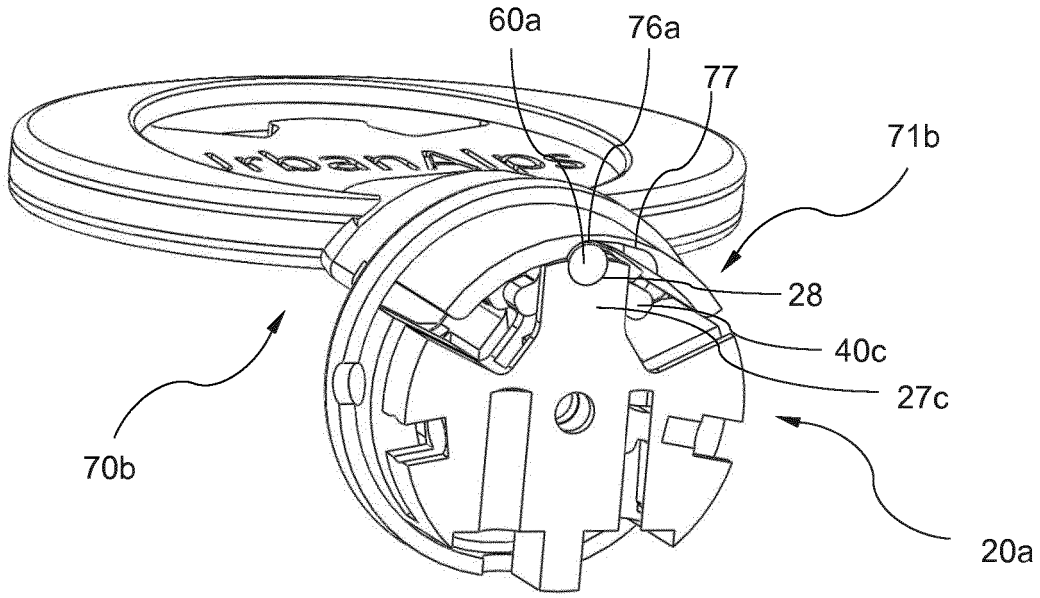

60a
76a
77
71b
28
40c
27c
70b
20a

Fig. 11

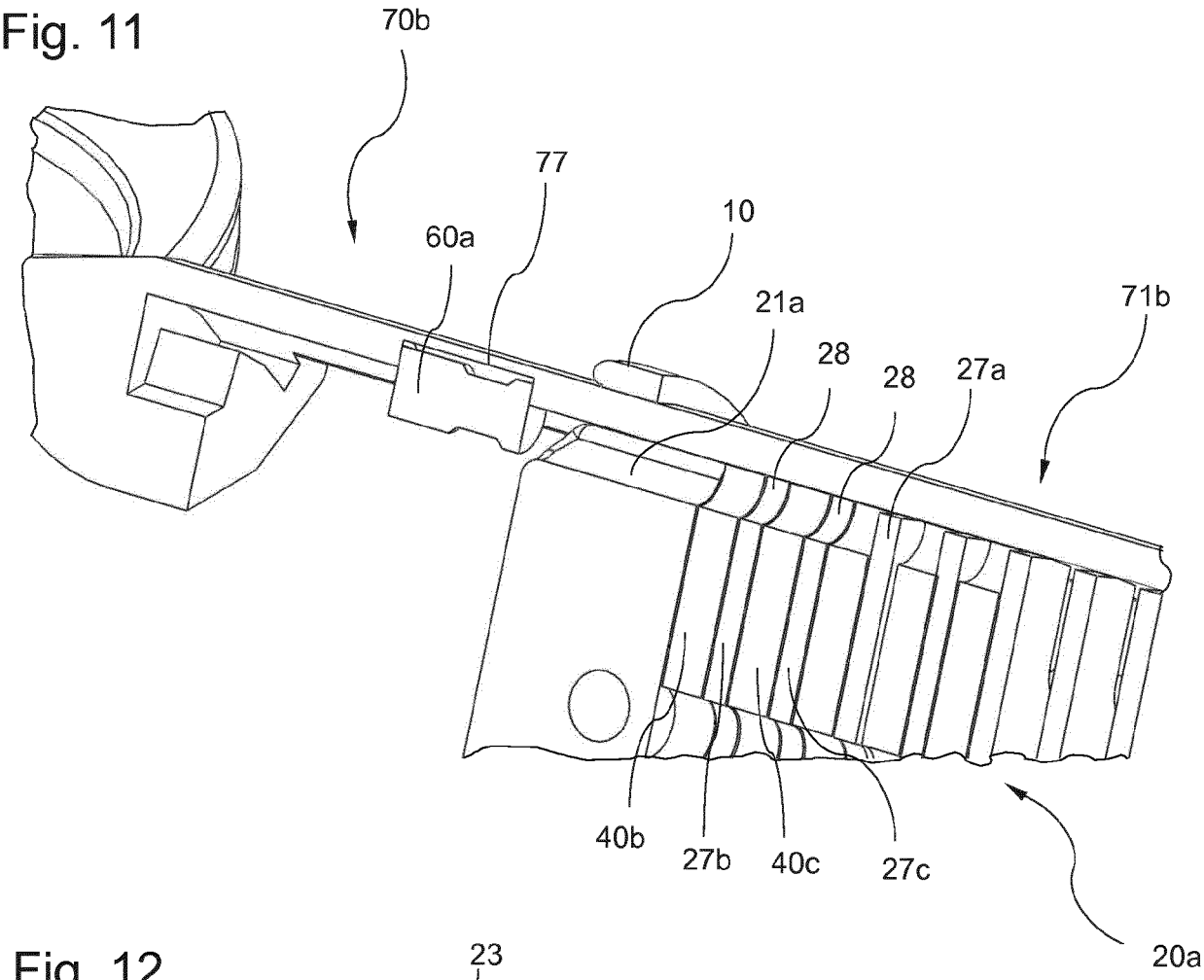

70b
77
60a
10
21a
71b
28
28
27a
40b
27b
40c
27c
20a

Fig. 12

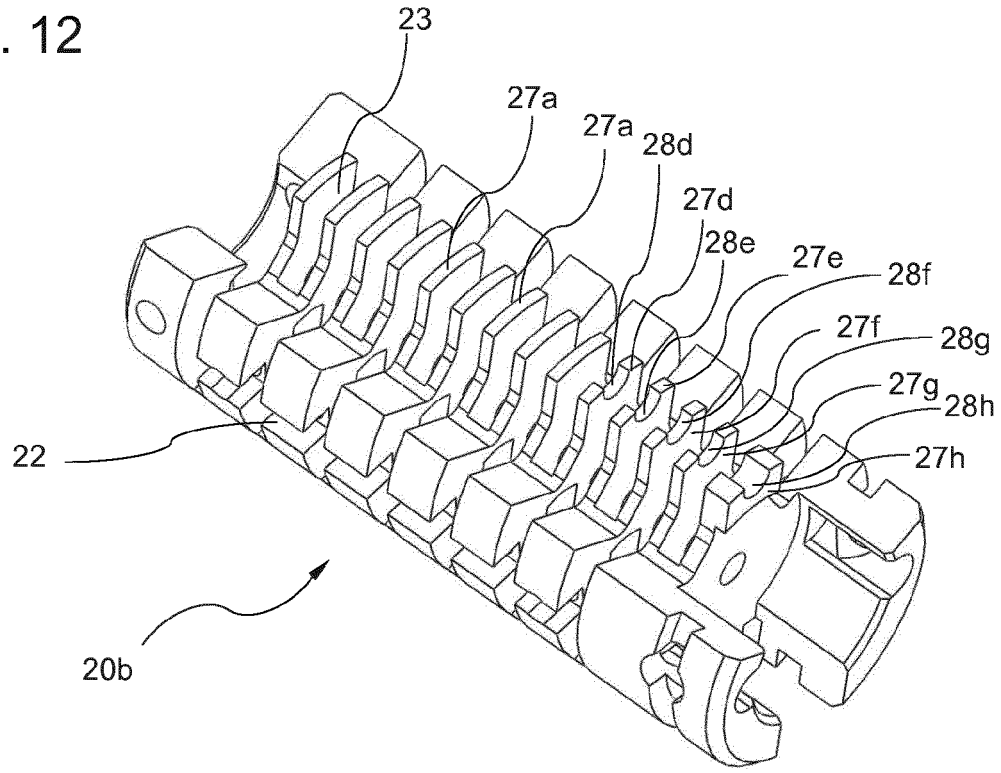

23
27a
27a
28d
27d
28e
27e
28f
27f
28g
27g
28h
27h
22
20b

Fig. 13

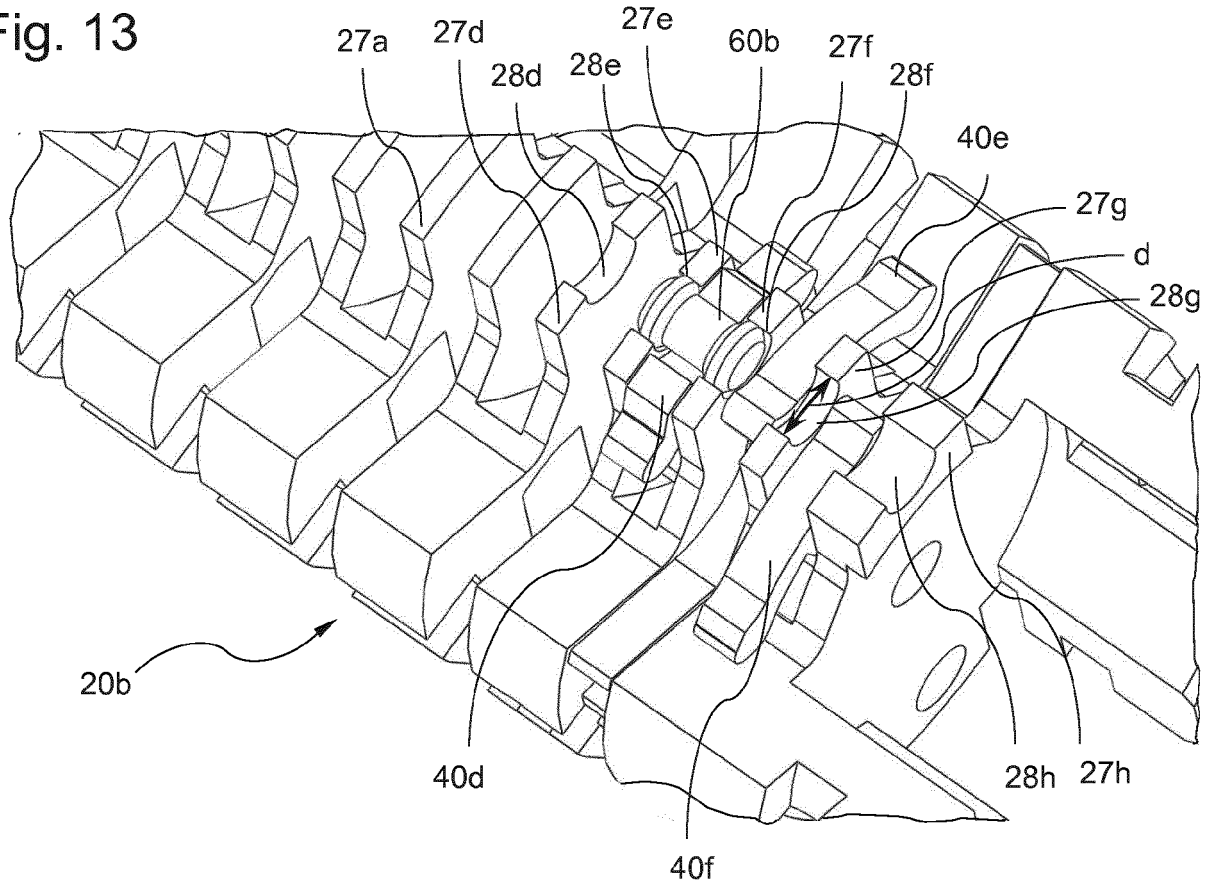

27a
27d
28d
28e
27e
60b
27f
28f
40e
27g
d
28g
20b
40d
40f
28h
27h

Fig. 14

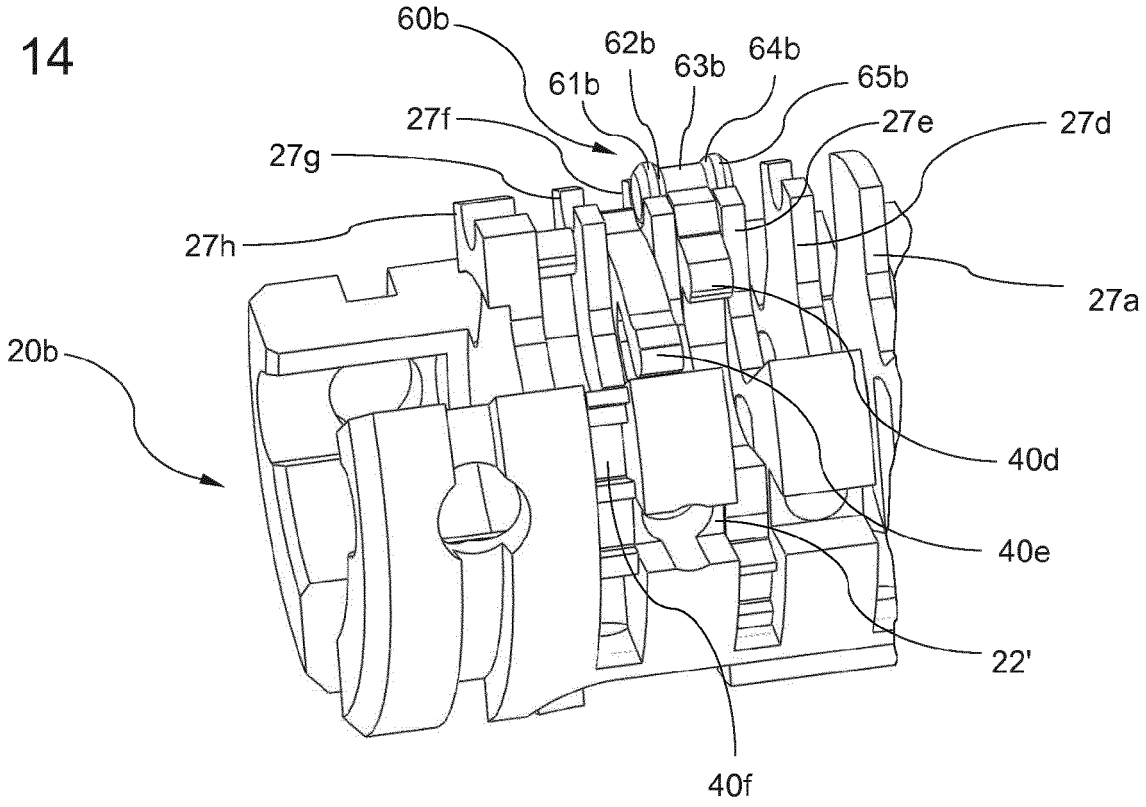

60b
62b
63b
64b
61b
65b
27f
27e
27d
27g
27h
27a
20b
40d
40e
22'
40f

Fig. 15

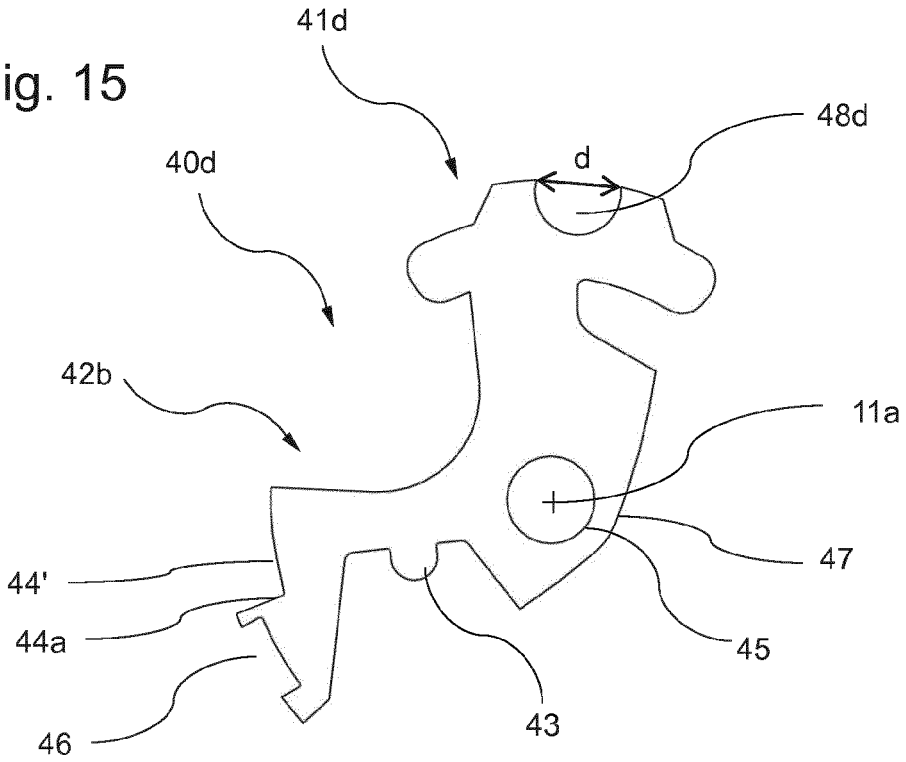

41d
48d
40d
d
42b
11a
47
44'
44a
45
46
43

Fig. 16

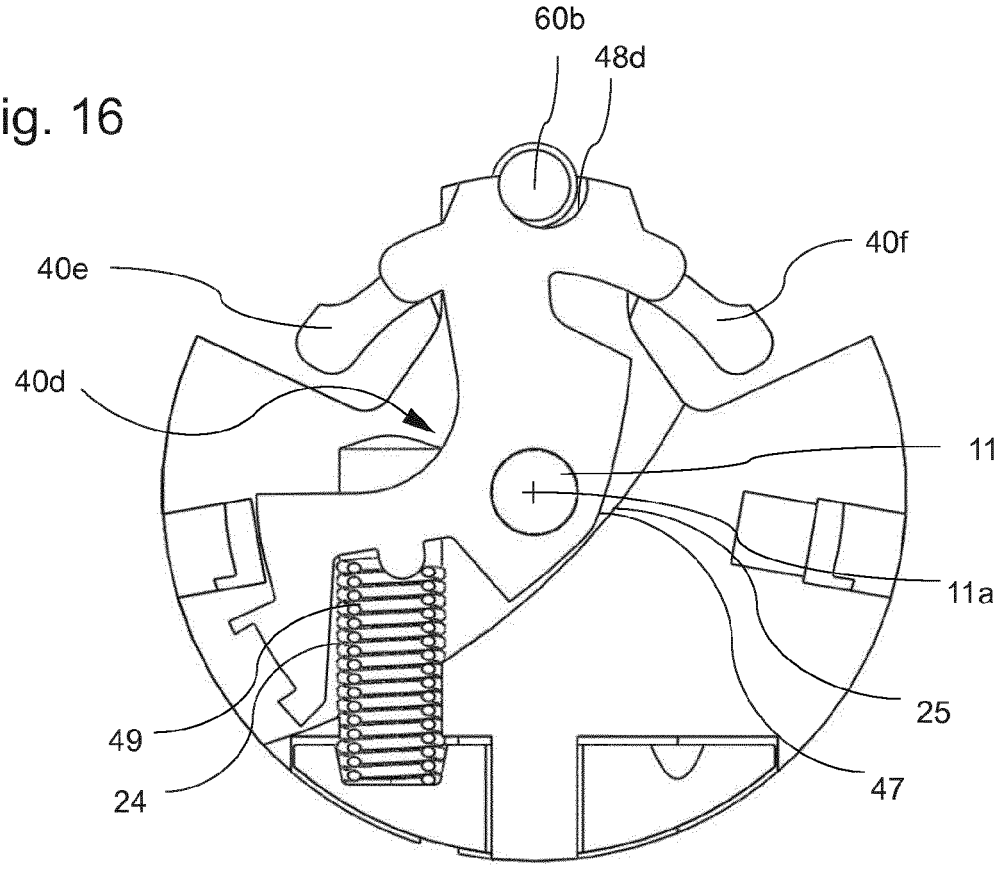

60b
48d
40f
40e
40d
11
11a
25
49
24
47

Fig. 17

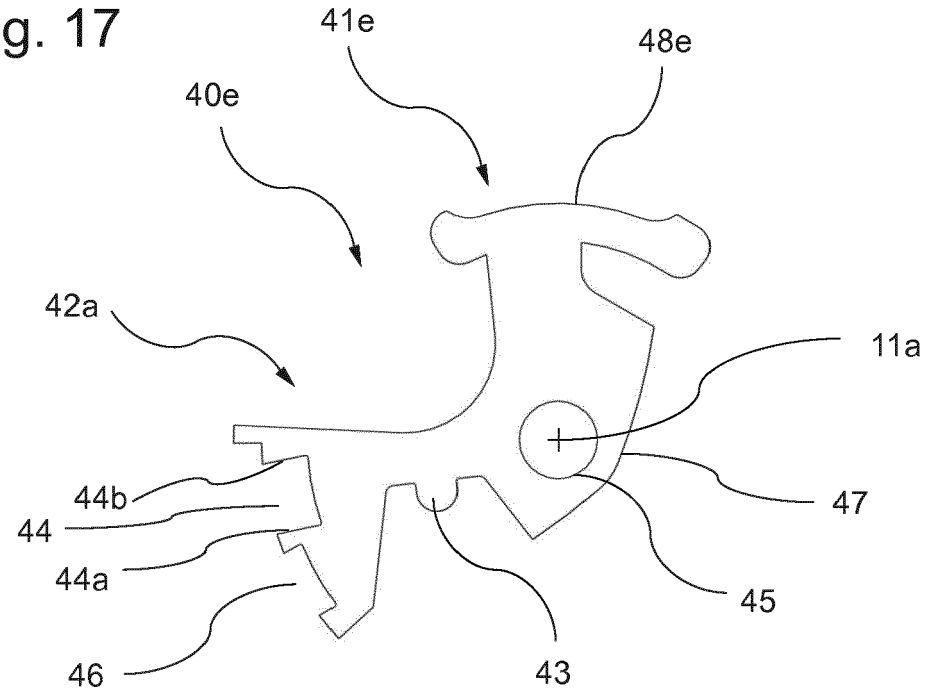

41e
48e
40e
42a
11a
47
44b
44
44a
45
46
43

Fig. 18

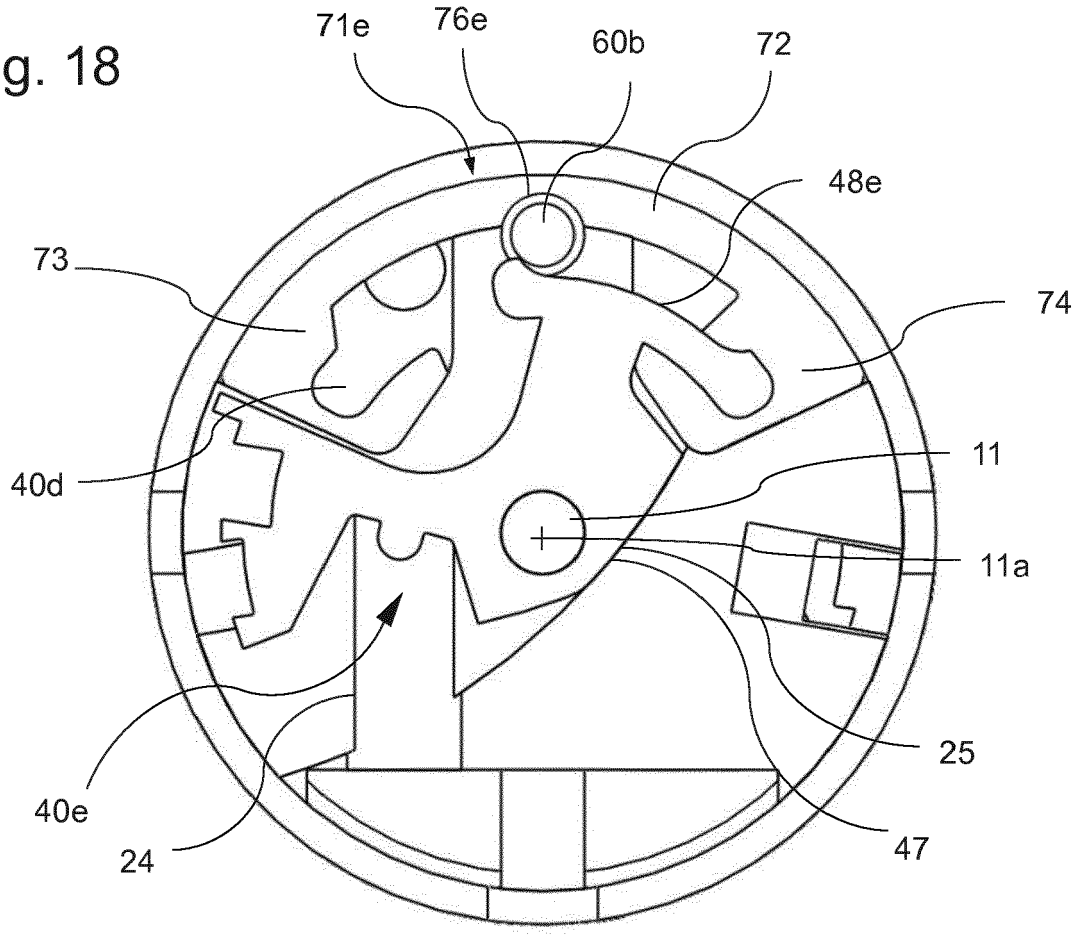

71e
76e
60b
72
48e
73
74
11
40d
11a
25
40e
24
47

Fig. 19

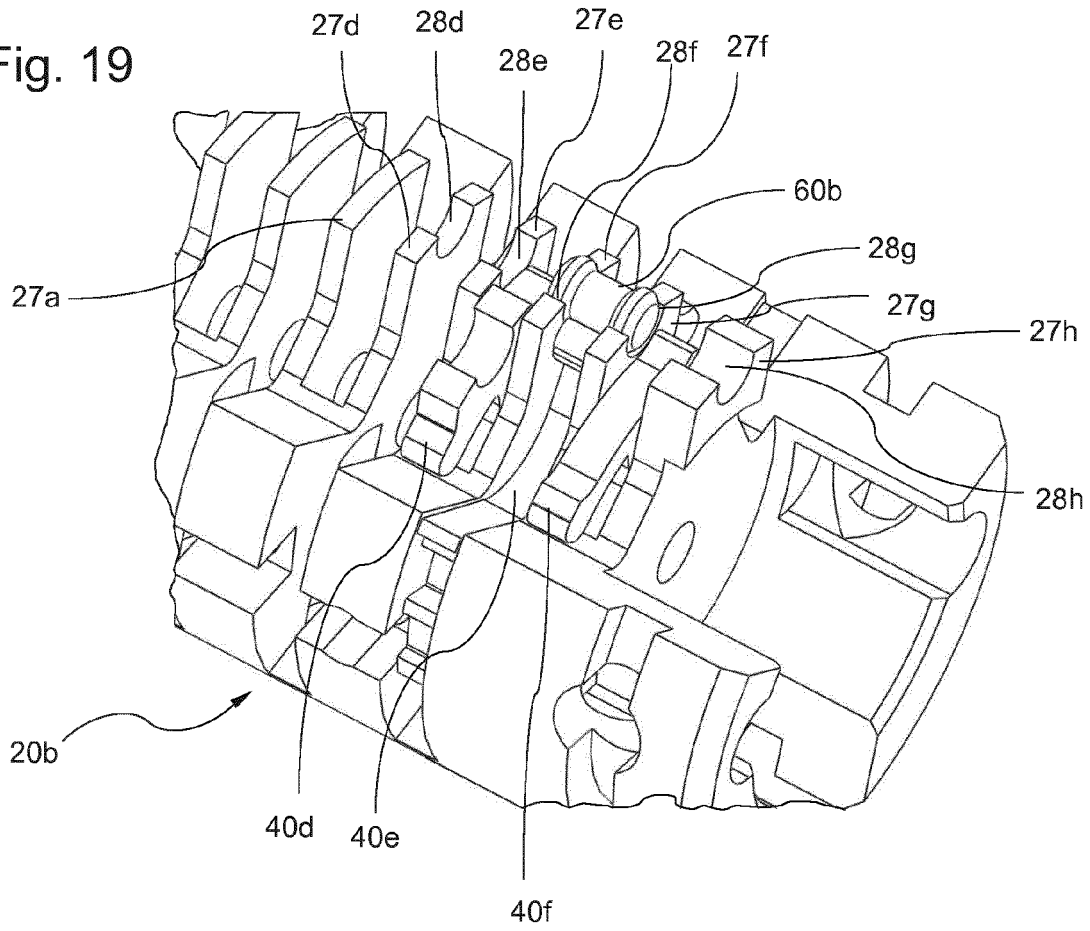

27d
28d
28e
27e
28f
27f
60b
28g
27g
27h
28h
27a
20b
40d
40e
40f

Fig. 20

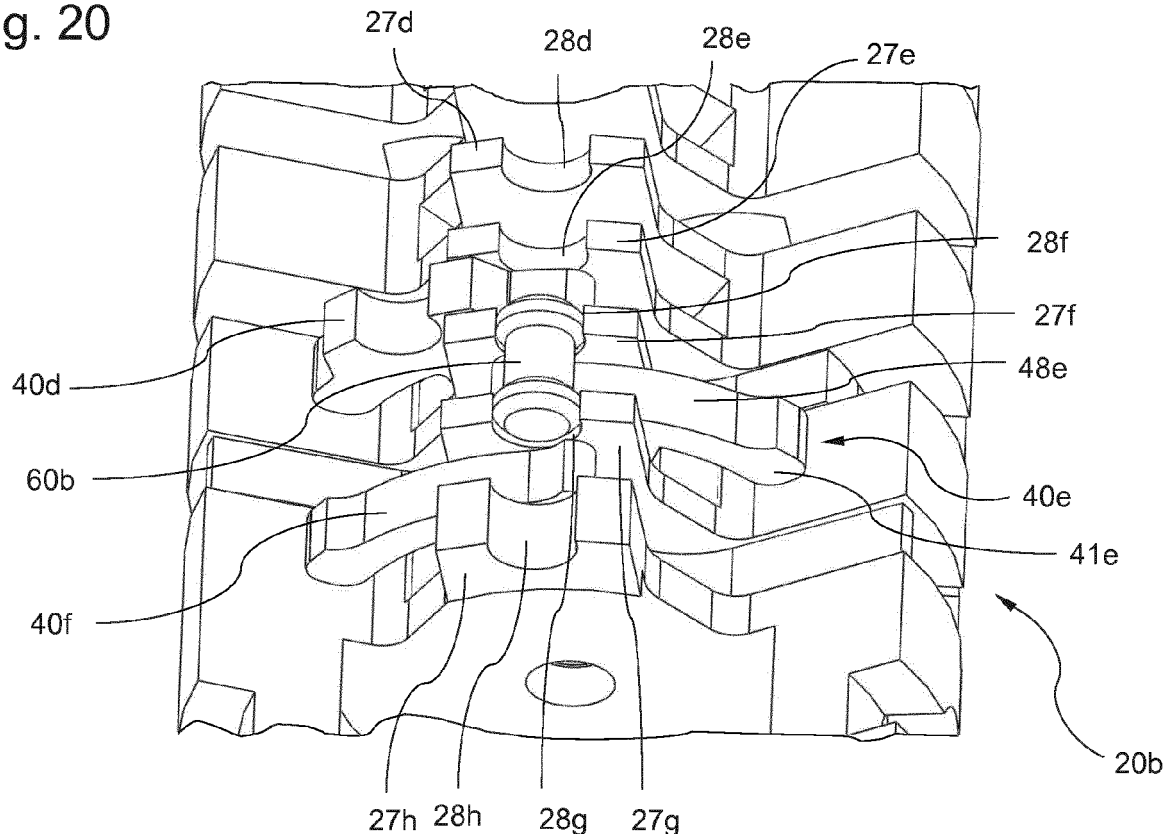
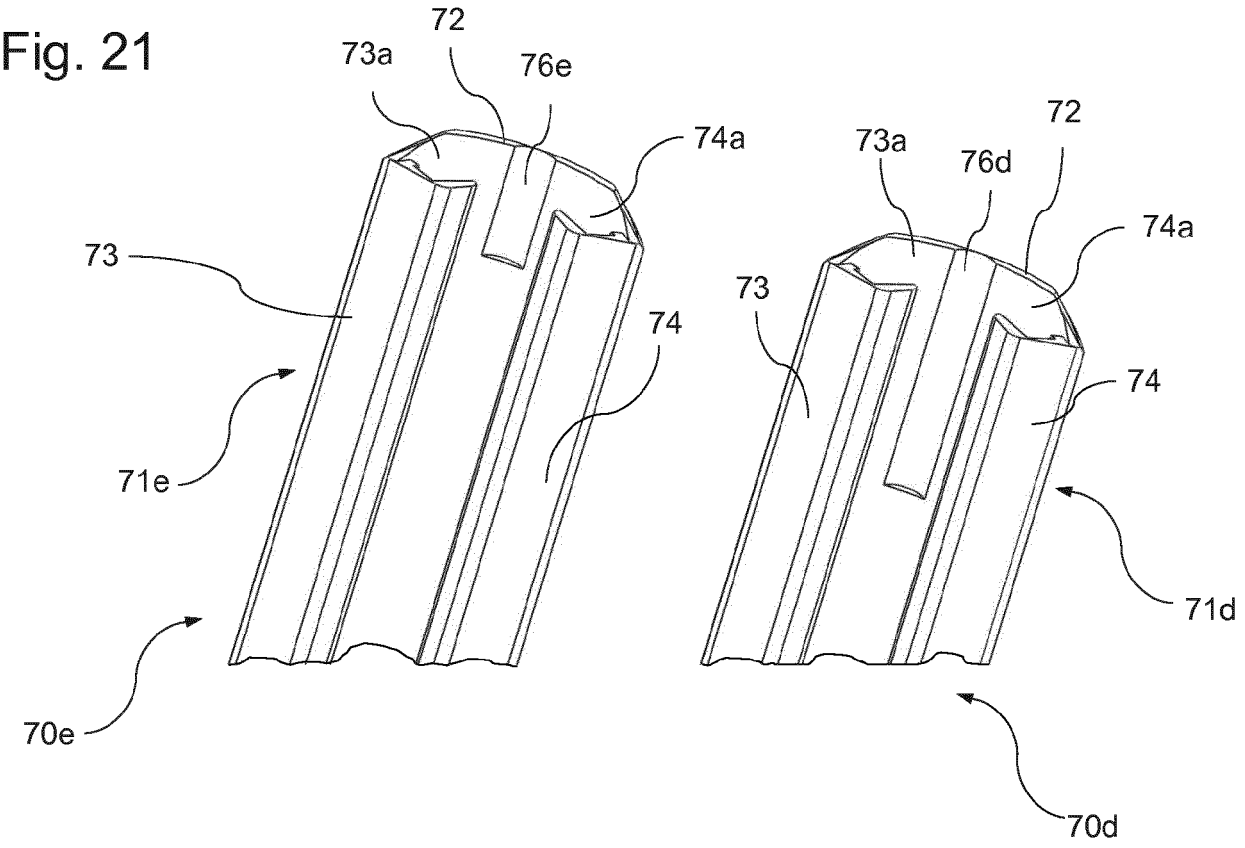

27d
28d
28e
27e
28f
27f
48e
40d
60b
40e
41e
40f
20b
27h
28h
28g
27g

Fig. 21


72
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74
71e
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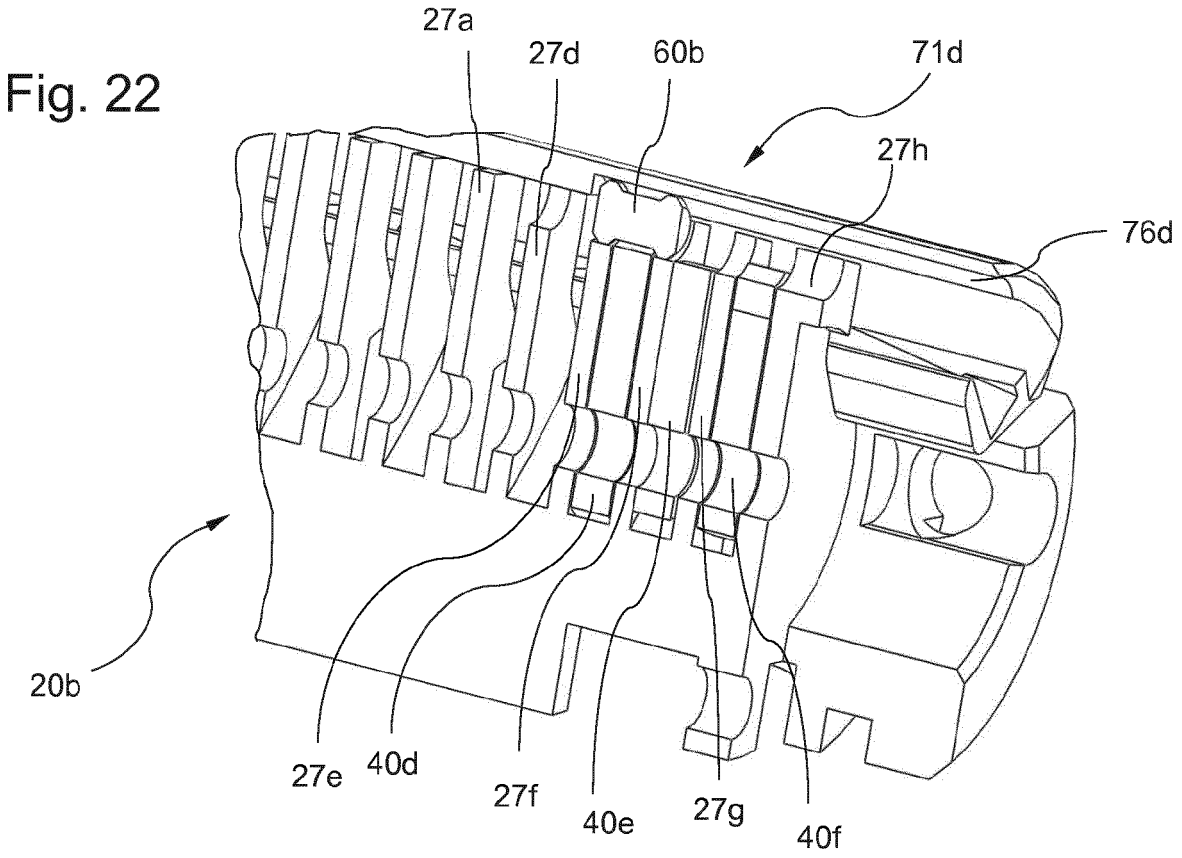
73a
76d
72
74a
73
74
71d
70d

Fig. 22


27a
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60b
71d
27h
76d
20b
27e
40d
27f
40e
27g
40f

Fig. 23

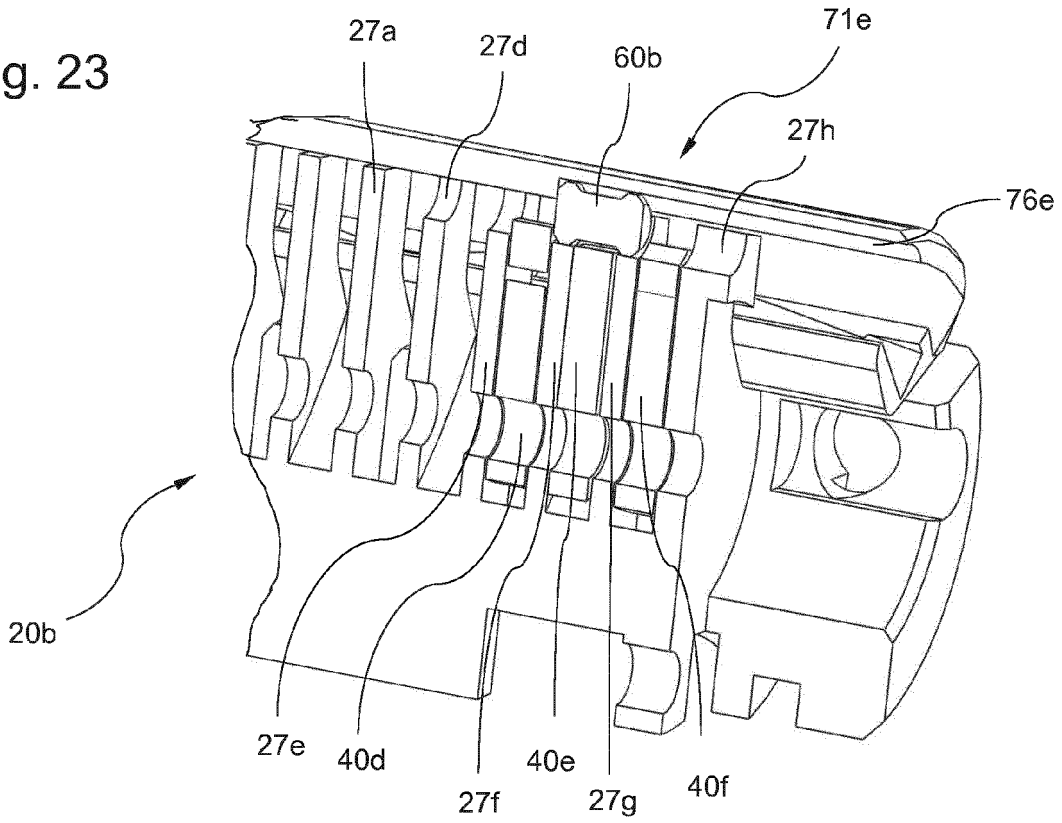

27a
27d
60b
71e
27h
76e
20b
27e
40d
27f
40e
27g
40f

Fig. 24

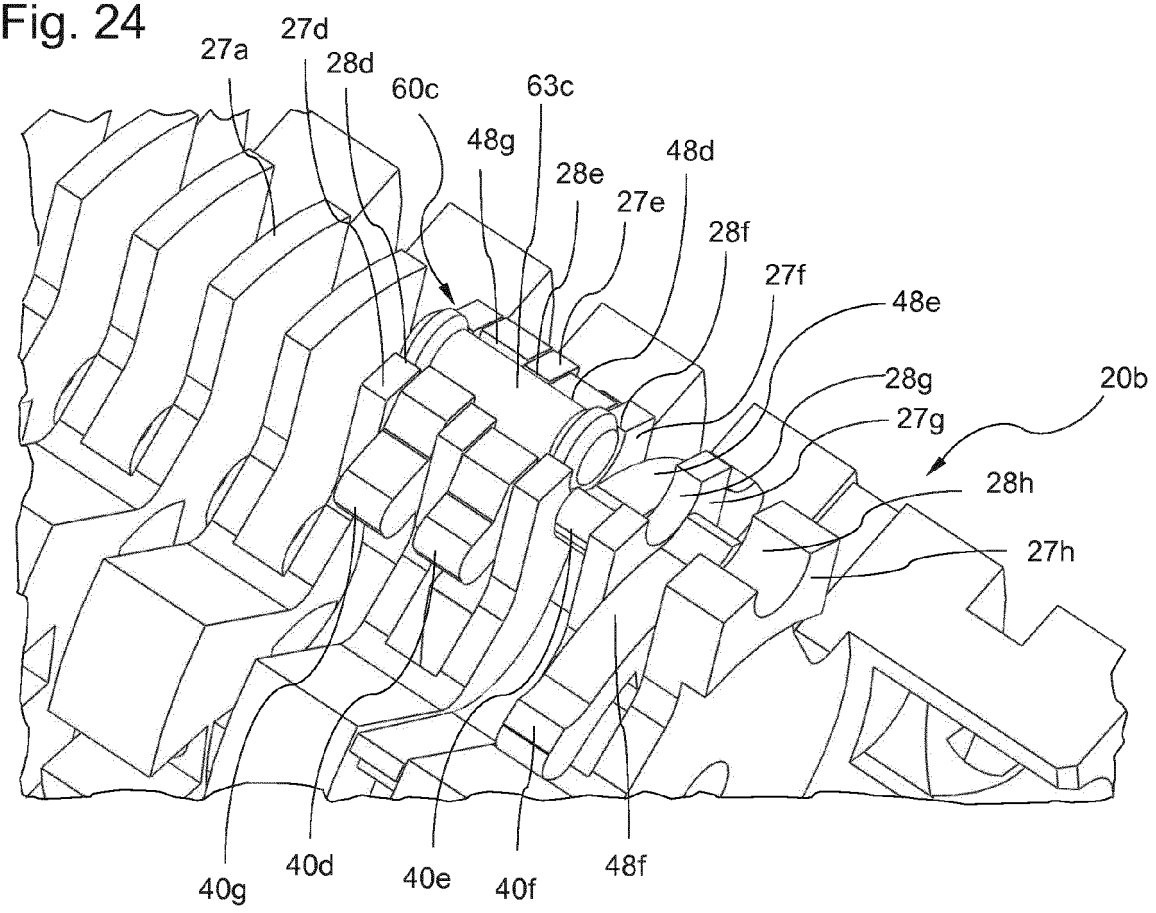

27a
27d
28d
60c
63c
48g
28e
27e
48d
28f
27f
48e
28g
27g
20b
28h
27h
40g
40d
40e
40f
48f

Fig. 25

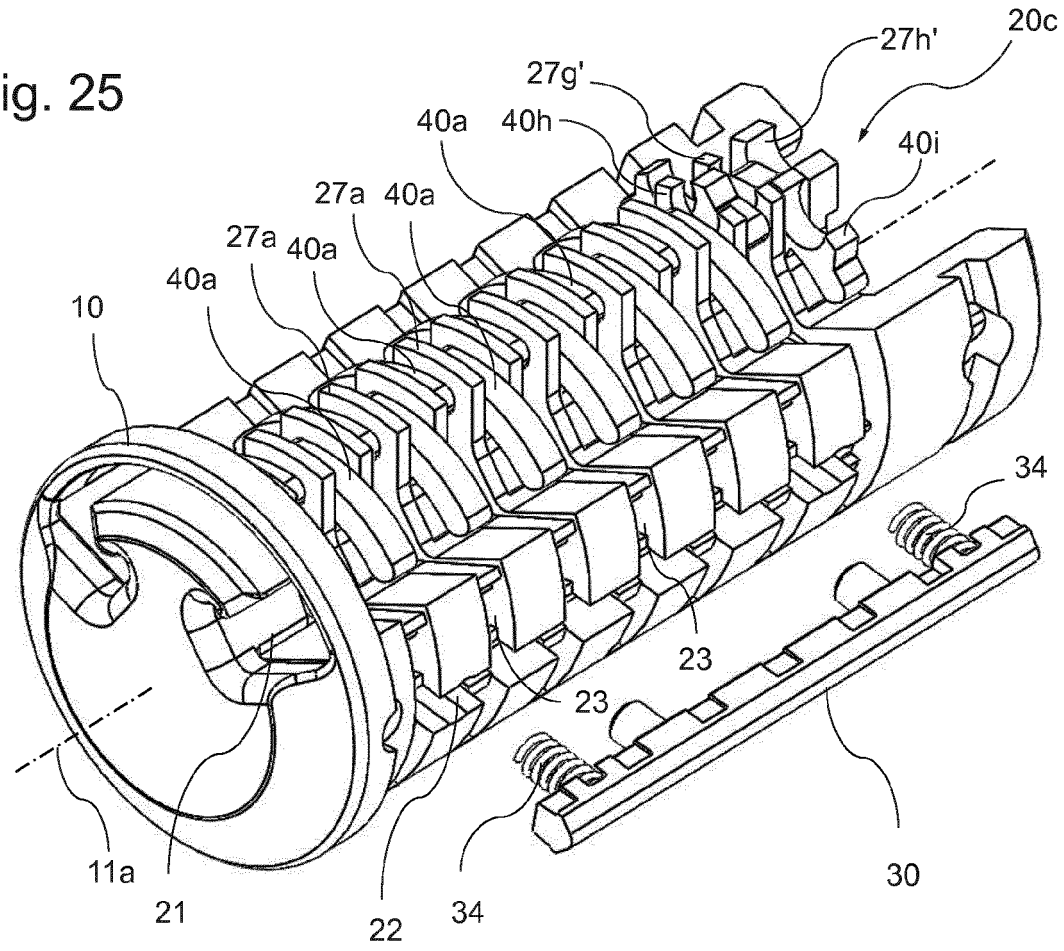

27h'
20c
27g'
40a
40h
40i
27a
40a
27a
40a
40a
10
34
23
23
11a
21
22
34
30

Fig. 26

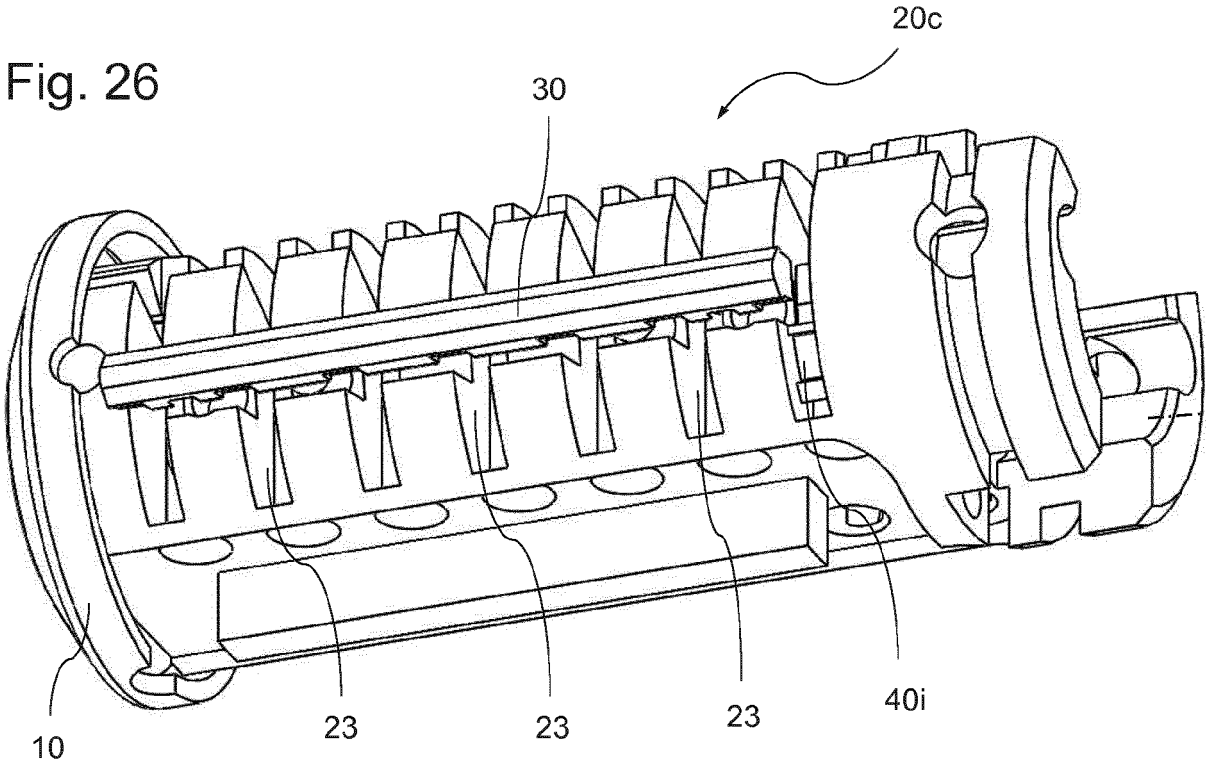

20c
30
10
23
23
23
40i

Fig. 27

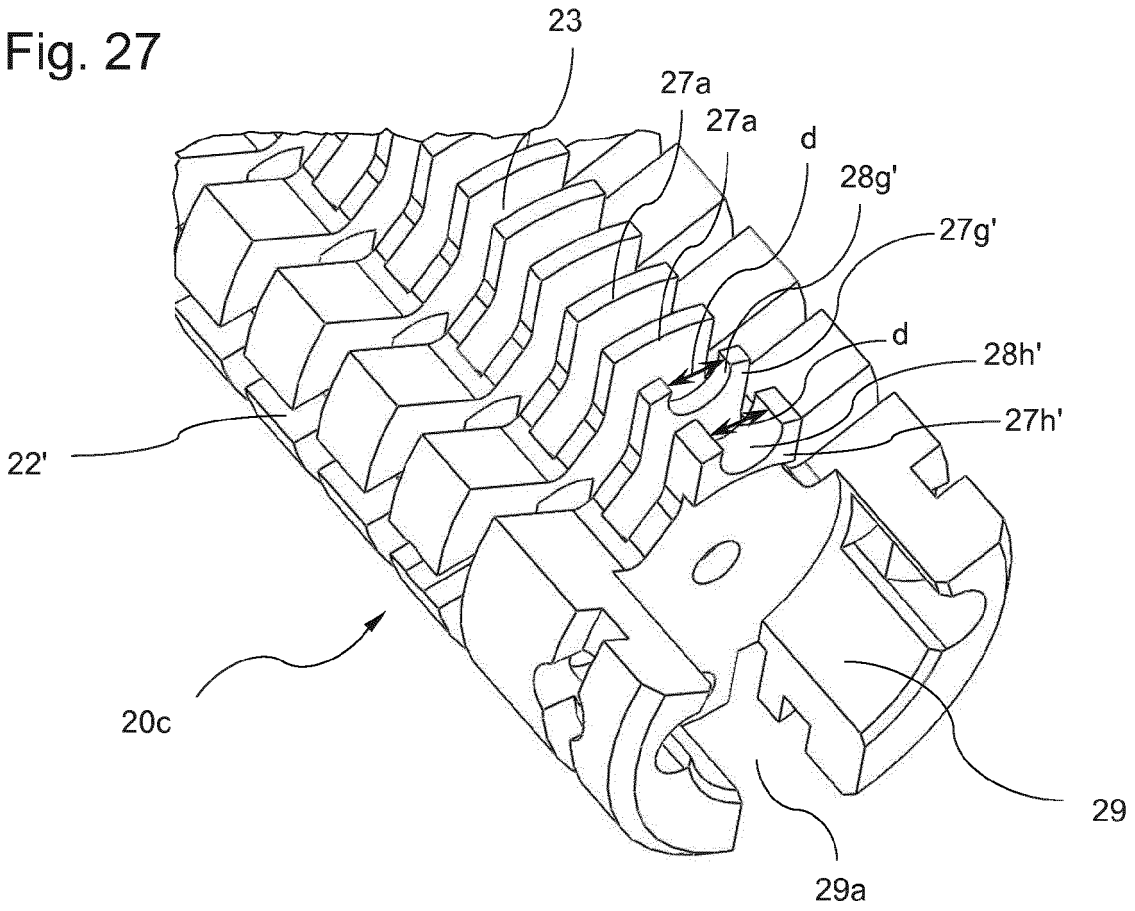


Fig. 28

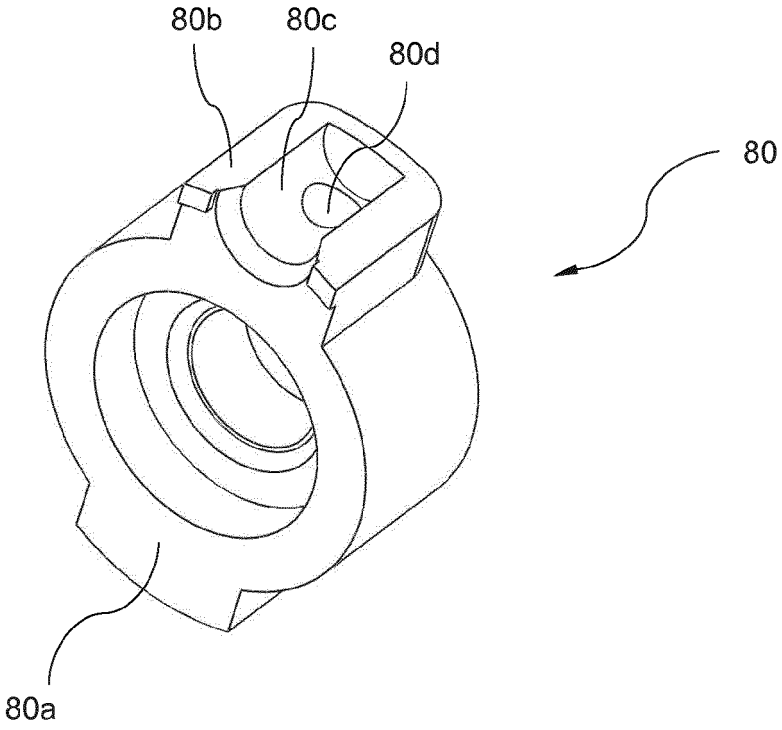


Fig. 29

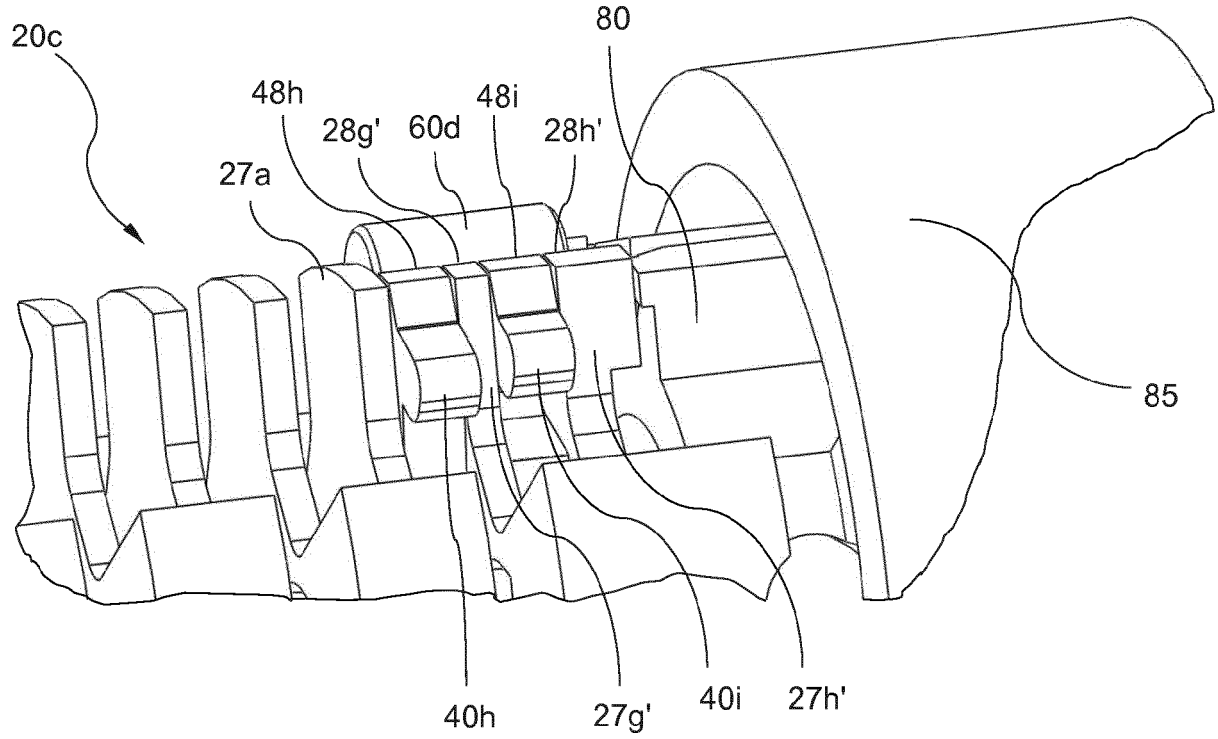

20c
80
48h
48i
28g'
60d
28h'
27a
85
40h
27g'
40i
27h'

Fig. 30

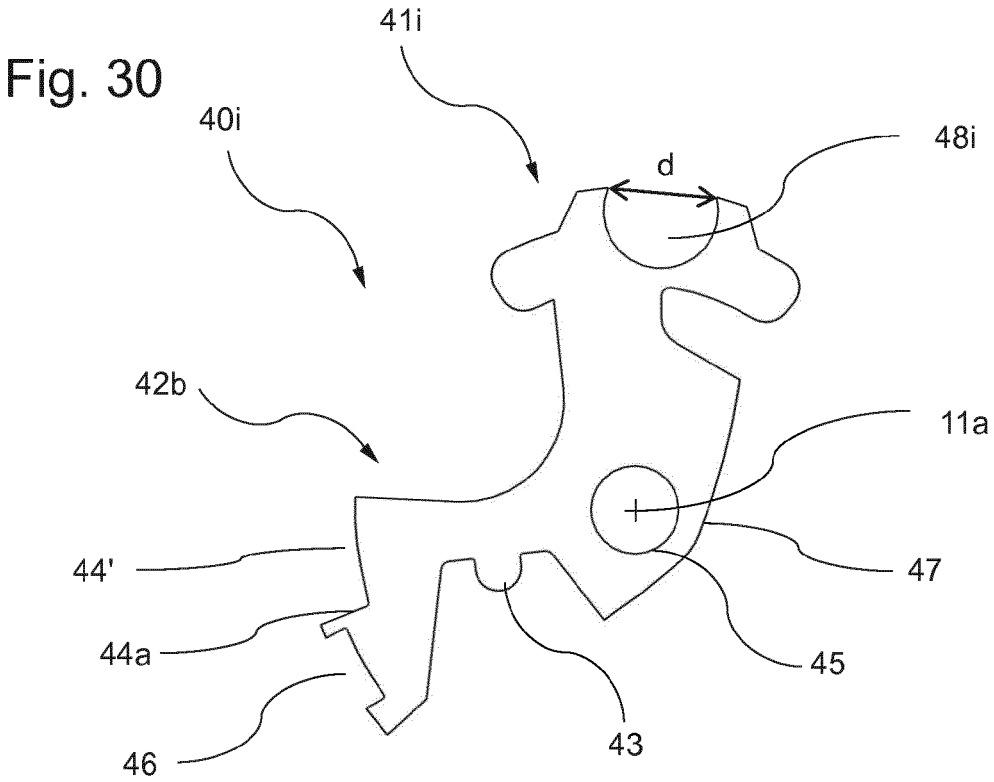

41i
40i
48i
d
42b
11a
44'
47
44a
45
46
43

Fig. 31

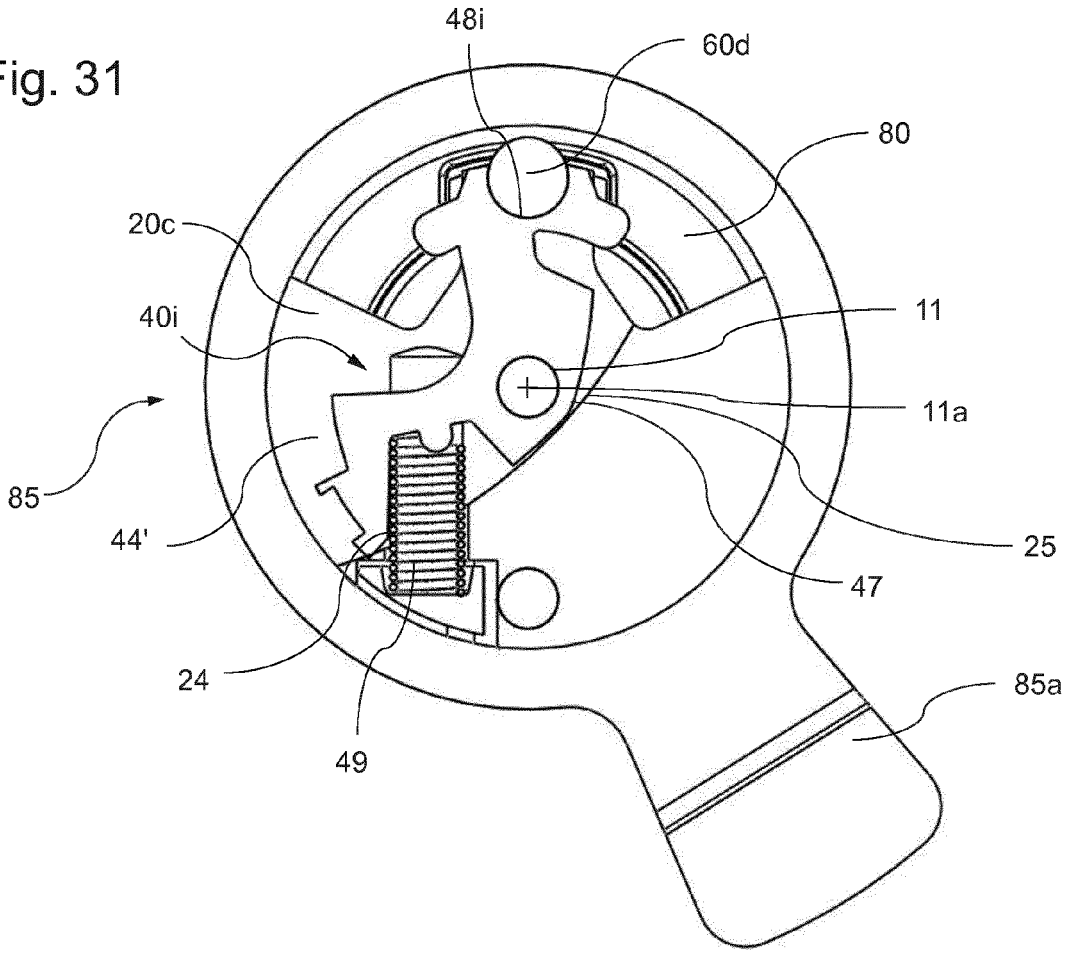

48i
60d
80
20c
40i
11
11a
85
44'
25
47
24
85a
49

Fig. 32

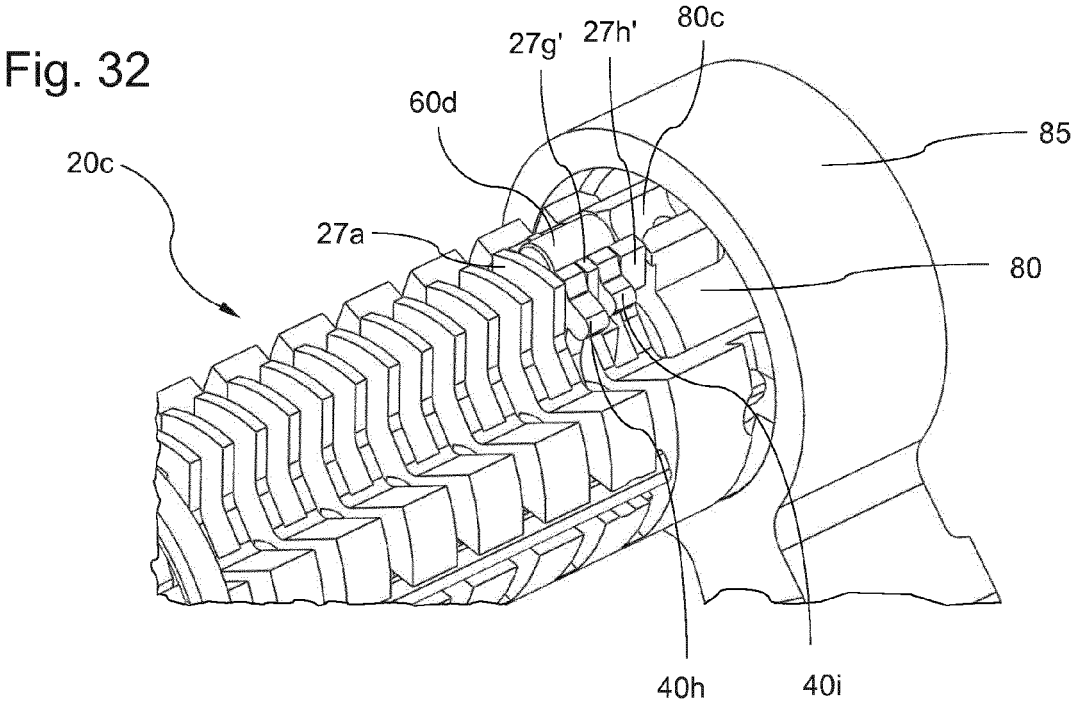

27g'
27h'
80c
60d
85
20c
27a
80
40h
40i

Fig. 33

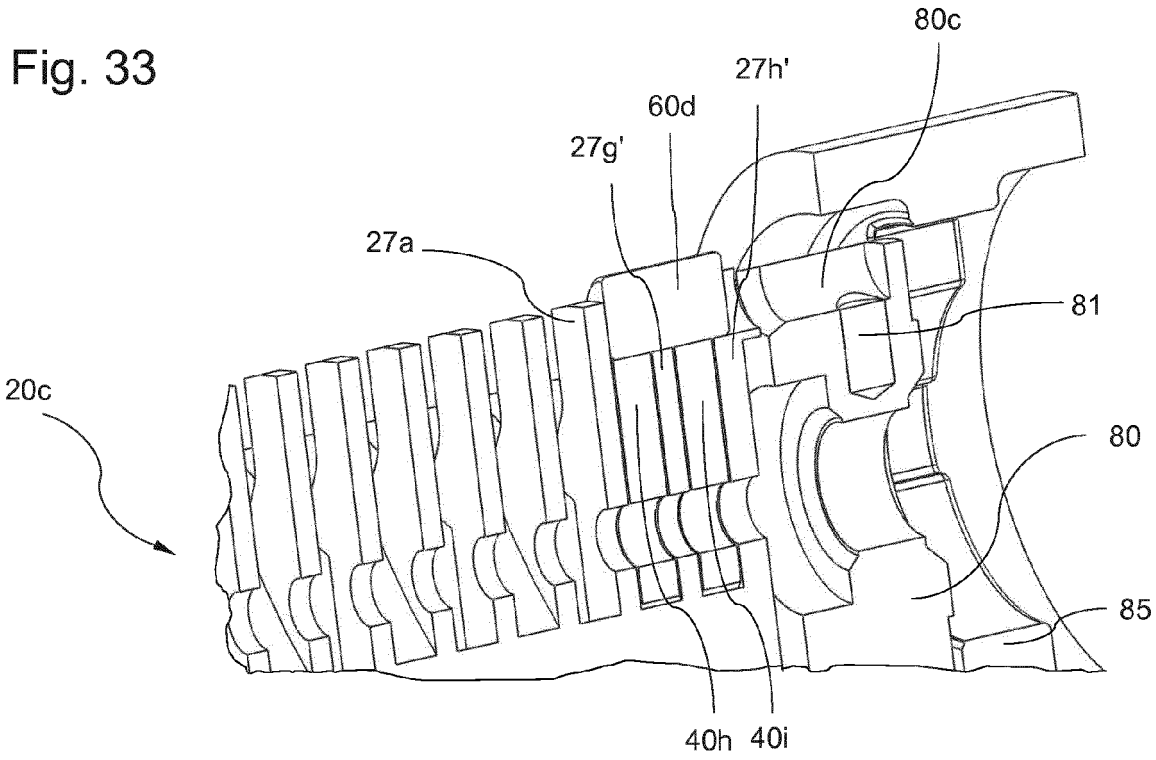

80c
27h'
60d
27g'
27a
81
20c
80
85
40h
40i

Fig. 34

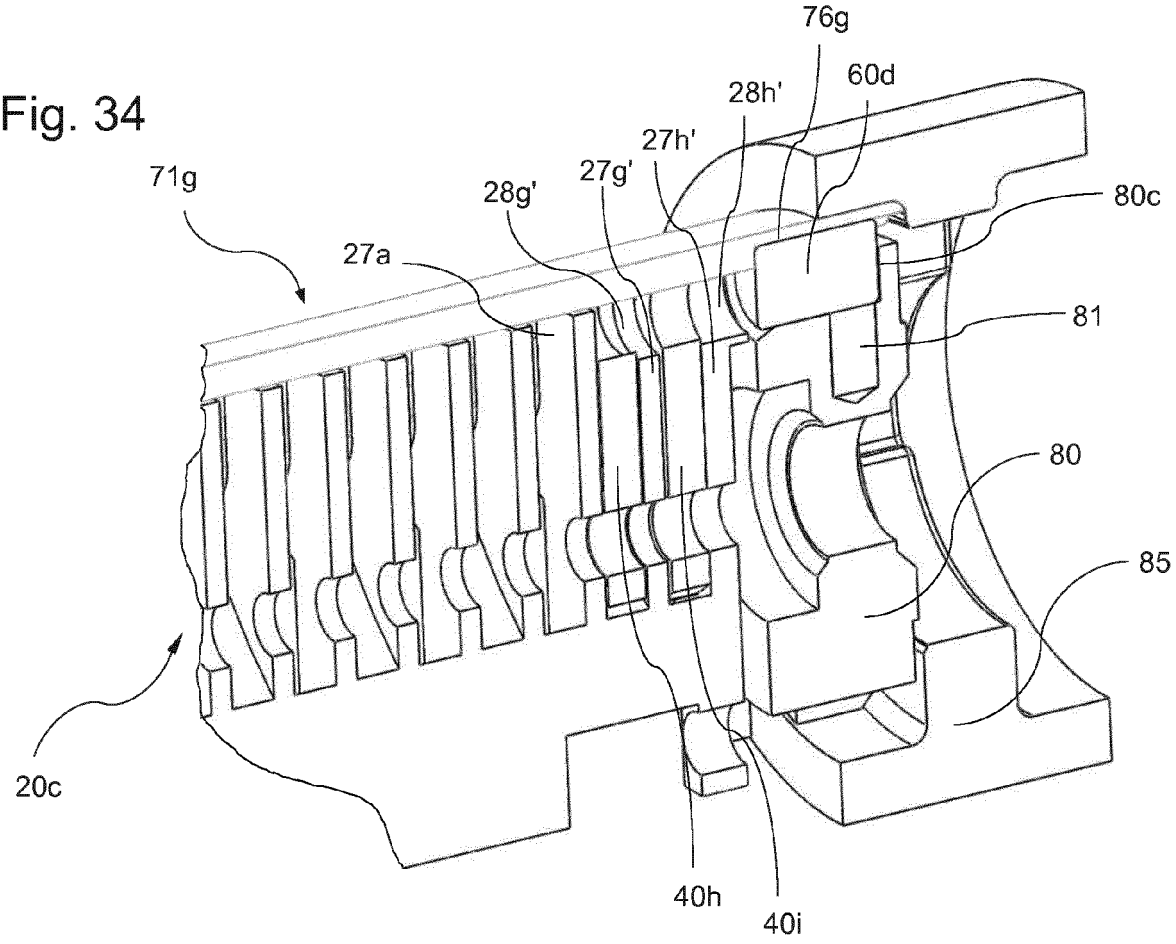

76g
60d
28h'
27h'
27g'
71g
28g'
80c
27a
81
80
85
20c
40h
40i

Fig. 35

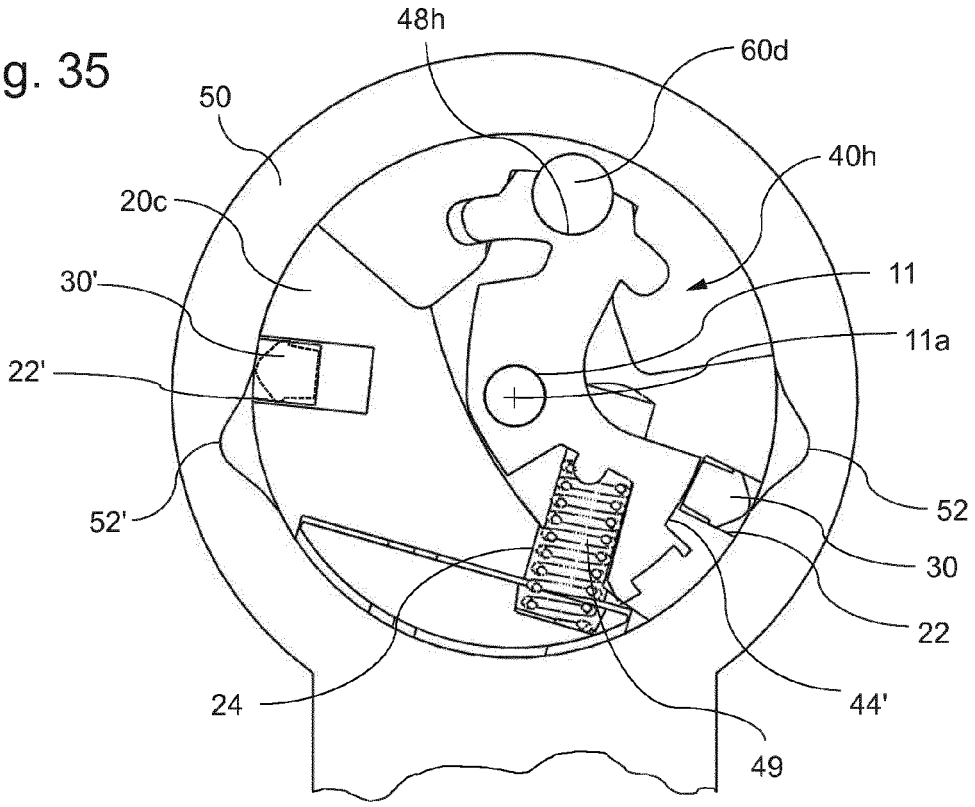

48h
60d
50
40h
20c
11
30'
11a
22'
52
52'
30
22
44'
24
49

Fig. 36

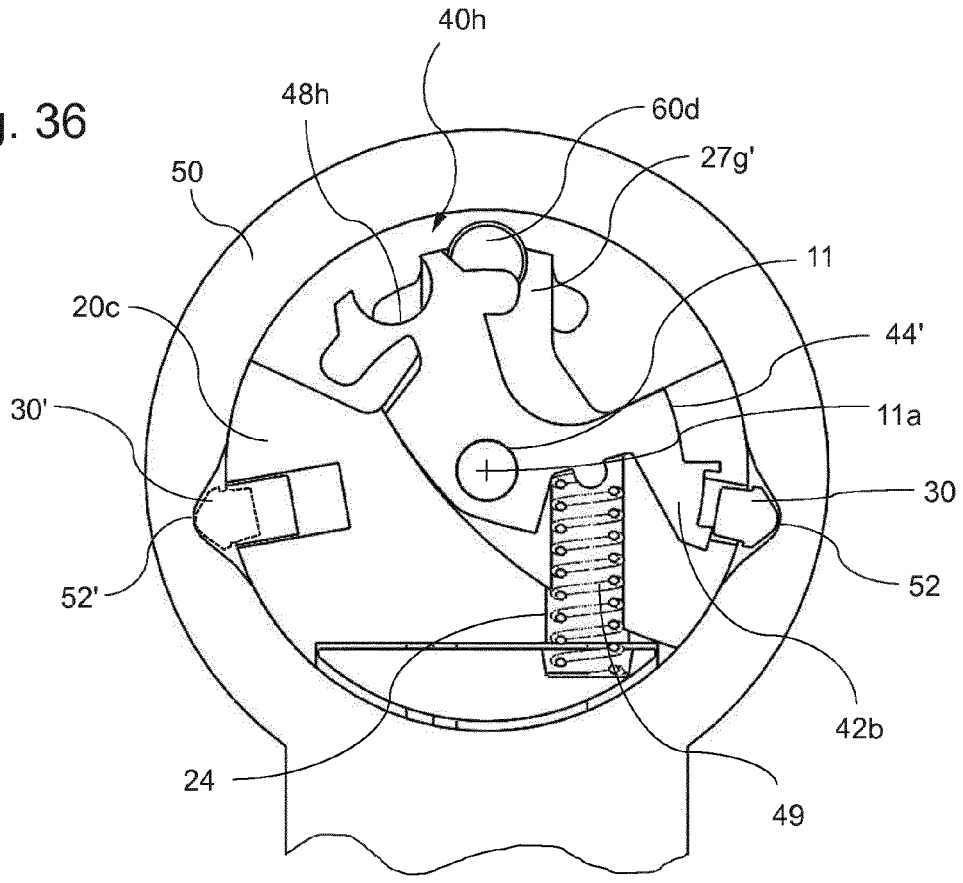

40h
48h
60d
27g'
50
11
20c
44'
30'
11a
30
52
52'
42b
24
49

Fig. 37

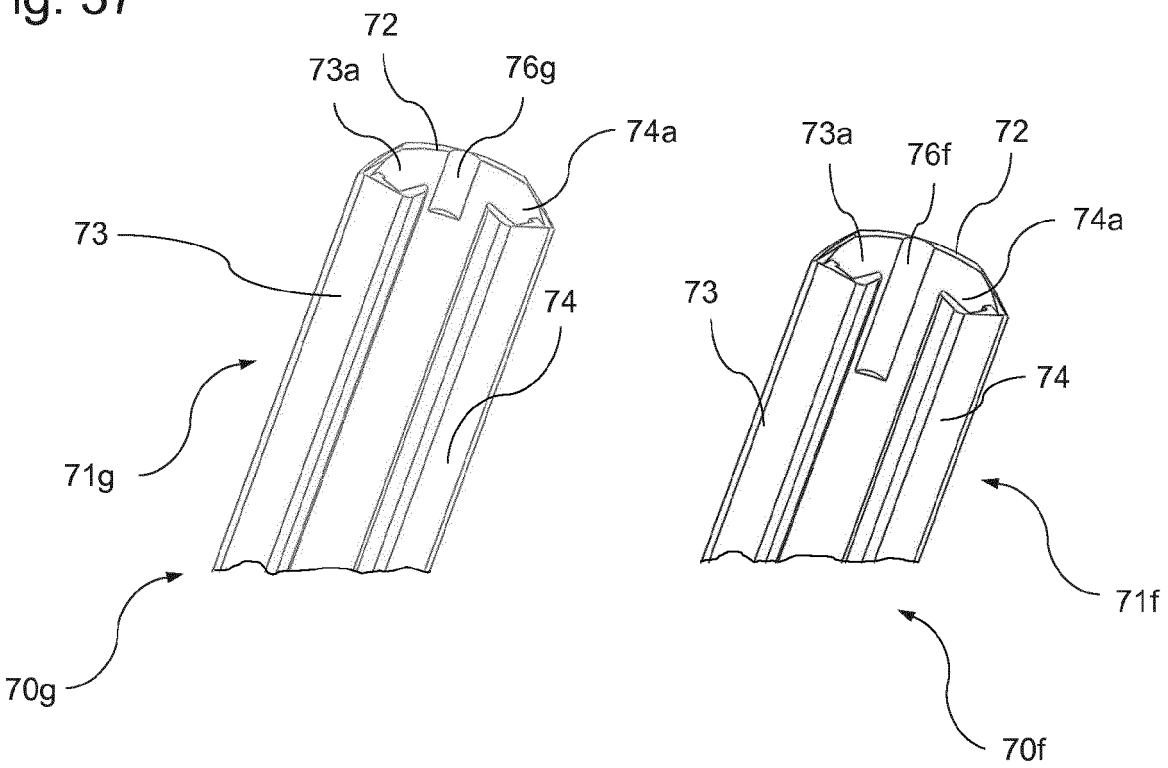

72
73a
76g
74a
73
74
71g
70g
73a
76f
72
74a
73
74
71f
70f

Fig. 38

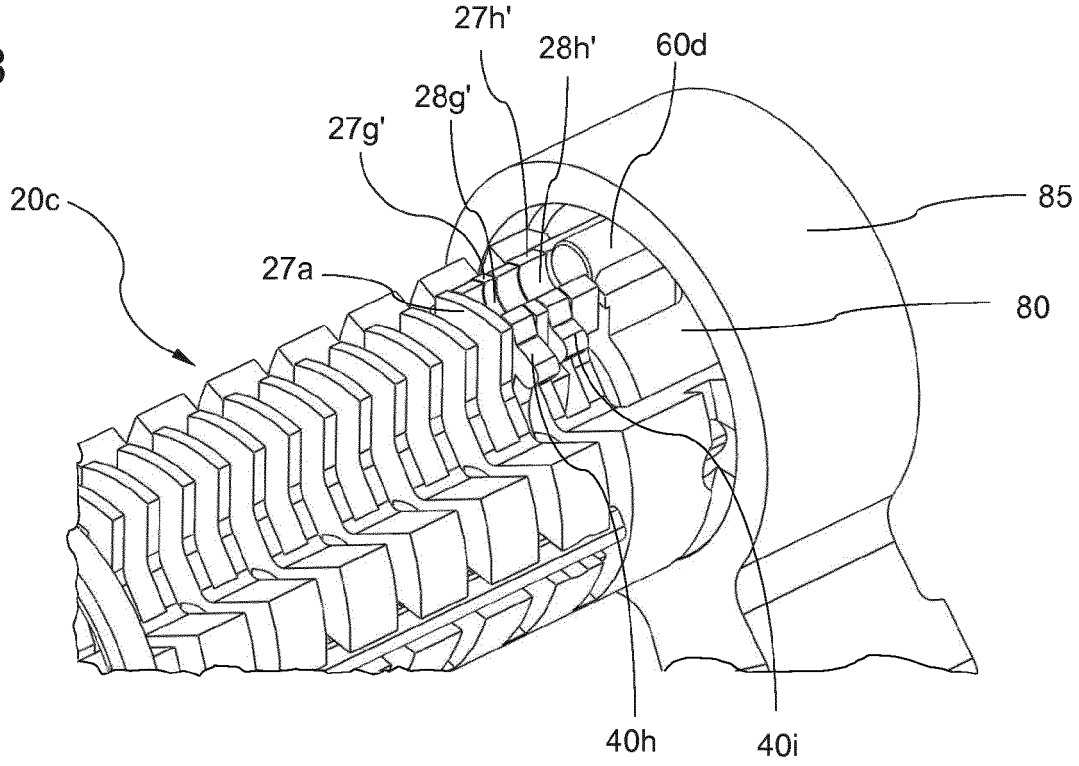
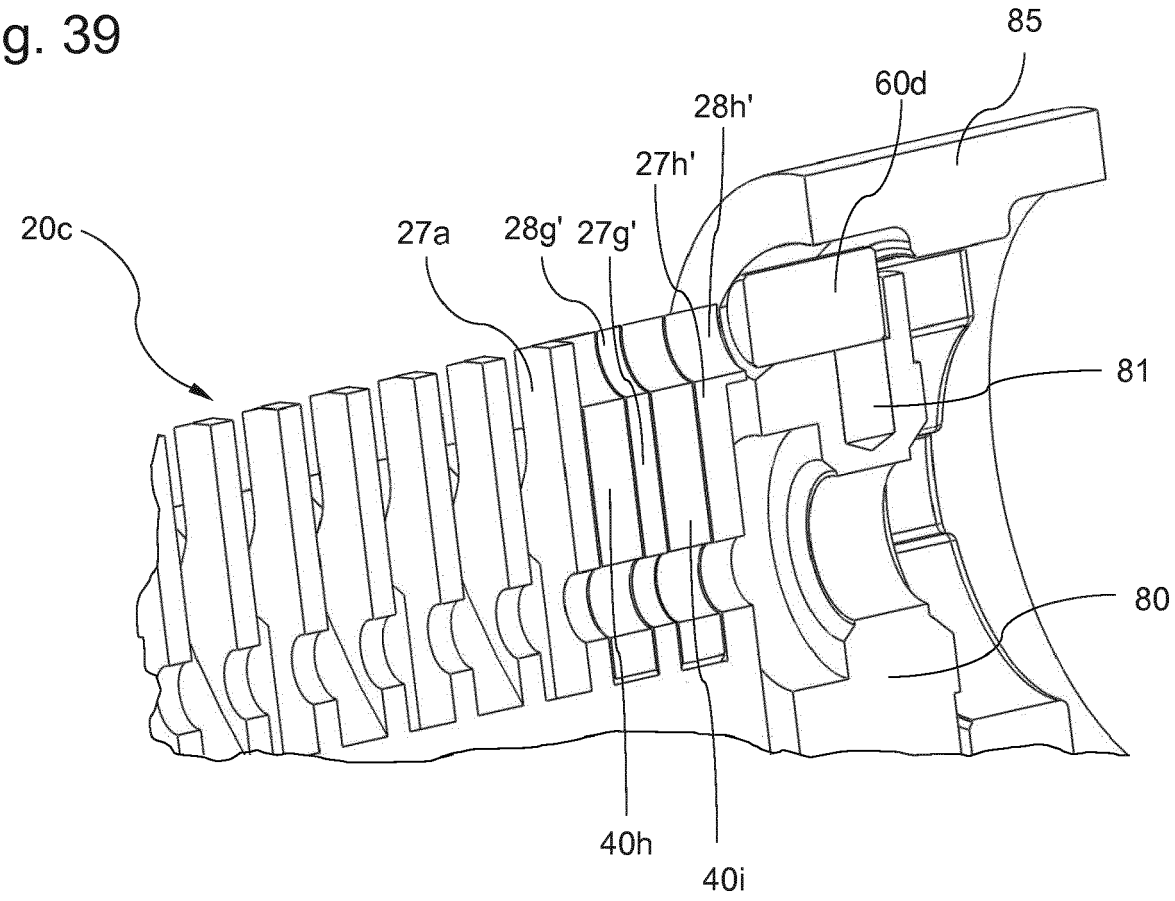

27h'
28h'
60d
28g'
27g'
20c
85
27a
80
40h
40i

Fig. 39



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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 3845

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 3 099 151 A (SCHLAGE ERNEST L) 30 July 1963 (1963-07-30) * column 2, line 12 - column 3, line 17 * * figures 1-8 * -----	1,4-7,9, 10,12-15 2,3,8, 11,16	INV. E05B19/00 E05B29/00
X A	US 3 059 462 A (CHECK MATHIAS M) 23 October 1962 (1962-10-23) * column 2, line 43 - column 4, line 11 * * figures 1-9 * -----	1,4-7,9, 10,12-15 2,3,8, 11,16	
X A	US 8 056 379 B2 (DICKHANS WILLIAM J [US]; GARDNER PAUL O [US] ET AL.) 15 November 2011 (2011-11-15) * column 3, line 58 - column 6, line 43 * * column 13, line 16 - line 37 * * column 15, line 32 - line 58 * * figures 1-24 * -----	1,2,4-7, 10,12-15 3,8,9, 11,16	
A,D	WO 2018/041277 A1 (URBANALPS CZECH S R O [CZ]) 8 March 2018 (2018-03-08) * the whole document * -----	1-16	

TECHNICAL FIELDS SEARCHED (IPC)

E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 November 2019	Antonov, Ventseslav

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3099151 A	30-07-1963	NONE	
US 3059462 A	23-10-1962	NONE	
US 8056379 B2	15-11-2011	TW 200831763 A	01-08-2008
		US 2008163657 A1	10-07-2008
		US 2012055215 A1	08-03-2012
		WO 2008082797 A1	10-07-2008
WO 2018041277 A1	08-03-2018	AU 2017318104 A1	28-02-2019
		CA 3033153 A1	08-03-2018
		CN 109642437 A	16-04-2019
		EP 3507435 A1	10-07-2019
		JP 2019526725 A	19-09-2019
		WO 2018041277 A1	08-03-2018

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Patent documents cited in the description

- US 9920548 B2 **[0002]**
- WO 2016162363 A1 **[0002]**
- WO 2018041277 A1 **[0002]**