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(54) **ANGLE ADJUSTMENT TOOL AND FURNITURE EMPLOYING IT**

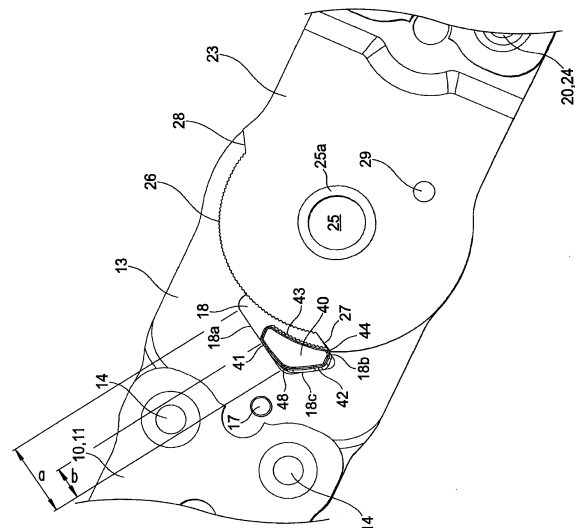
(57) **PURPOSE**

The provision of an angle adjustment tool having stable operational characteristics and whose design and manufacture is facilitated.

SOLUTION

An angle adjustment tool having a first arm (10) providing a wedge-shaped window means (18) having a linear wedge surface (18a), and a second arm (20) providing support enabling swinging about the axial center with respect to the first arm (10), in addition to a circular arc-shaped gear means (26), and a floating wedge member (40) regulating the swinging motion of the second arm (20) to the deployed direction with respect to the first arm (10), by means of the toothed surface (43) meshing with the gear means (26), by slidable displacement of the linear first contact surface (41) along the linear wedge surface (18a), which is displaceably stored in a wedge-shaped space which is not covered by the gear means (26) of said wedge-shaped window means (18), having a linear first contact surface (41) on one surface side contacting the linear wedge surface (18a) positioned outside of said wedge-shaped window means (18), and having a toothed surface (43) on the other surface side meshing with said gear means (26) and of said wedge-shaped window means (18).

Fig. 12



Description

TECHNICAL FIELD:

[0001] 0001 The present invention relates to an angle adjustment tool, in particular to angle adjustment tools employed in furniture such as sofas.

Prior art technology

[0002] 0002 Conventionally, angle adjustment tools for the purposes of adjustment of, for example, the desired angle of the headrest, armrest, footrest and the like of sofas have been widely used (Refer to patent reference 1).

[0003] For example, there are angle adjustment tools equipped with a first arm 1 providing a case means 3, and a second arm 2 not only provided pivotally connected in a swingable manner about a first axial center C_1 and the first arm 1 on said case means 3, but also provides gear means 4, a wedge-shaped window means 5 formed on the case means 3 of the first arm 1, and the floating wedge member 6 having the toothed surface 7 meshing with said gear means 4, disposed in a displaceable manner in the wedge-shaped window means 5.

[0004] In particular, with said angle adjustment tool, the disposition of a floating wedge member 6 in the wedge-shaped space formed by the circular arc-shaped gear means 4 and the circular arc-shaped wedge surface 8 provided in said wedge-shaped window means 5 are enabled.

Prior Art references

Patent references

[0005] 0003 Patent reference 1: Japanese laid open unexamined patent publication 2005-76735

Outline of the Patent

Problems to be Solved by the Invention

[0006] 0004 However, with said angle adjustment tool, the gear means 4 (reference numbers from patent reference) is formed in a circular arc shape centered on the first axis C_1 . On the other hand, the wedge surface 8 is formed in a circular arc shape centered on the second axis C_2 which is off-center to the first axis C_1 . Furthermore, the contact surface 9 of the floating wedge member 6 contacting the contact surface of said wedge surface 8 is also formed in a circular arc shape. For this reason, there are many design elements which need to respect the curvature and off-center amount of each circular arc shape on the occasion of the design thereof, and the design is not easy. In particular, when designing the angle adjustment tool in correspondence with orders from clients, the design is troublesome.

[0007] Furthermore, a high degree of dimensional accuracy is required in respect of the dimensions of the parts, for example, the curvature and the off-centered amount of each circular arc shape, the operations of the floating wedge member 6 performing complicated operations in order to smoothly and stably operate the floating wedge member 6 which performs complicated operations. For this reason, there was the problem that the manufacture of the parts was troublesome in order to secure stable operating characteristics with the conventional angle adjustment tool.

[0008] The present invention is conceived of in consideration of these problems, and has as its object the provision of an angle adjustment tool which can be designed and manufactured with ease, and has remarkably more stable operational characteristics.

Summary of the invention

[0009] 0005 The angle adjustment tool of the present invention should resolve the earlier described issues, and configures a first arm providing a wedge-shaped window means having a wedge surface of a linear shape, and a second arm supported in a swingable manner about the axial center with respect to the first arm, in addition to providing a circular arc-shaped gear means, and a floating wedge member having a linear shaped contact surface on one side surface contacting the linear shaped wedge surface positioned outside of said wedge-shaped window means, and having a toothed surface meshing with said gear means on the other surface thereof, which is displaceable he stored in the wedge-shaped space not covering the gear means, of the earlier described wedge-shaped window means, and a linear shaped contact surface slidably displaced along the linear shaped wedge surface, and by the toothed surface meshing with the gear means, the swinging of the second arm to the deployed direction with respect to the first arm is regulated.

[0010] The linear wedge surface does preferably enclose an angle with a middle axis of the respective arm, the first arm, in the assembled state, between 80° and 30° , more preferably between 65° and 50° and even more preferably about 57° . The longitudinal extension a of the linear wedge surface can be in relation of the respective extension of the respective linear extension b at the floating wedge member be between 1.4 to 2.2 times this extension, more precisely between 1.6 and 2.0 times and even more precisely preferably about 1.83 times.

Effects of the invention

[0011] 0006 By means of the present invention, the linear shaped contact surface of the floating wedge member is slidably displaced along the linear shaped wedge surface. With this, the wedge surface of the wedge shaped window means provided on the first arm may be

designed and manufactured according to a linear standard. As a result, the requirement for the design and manufacture of a circular arc-shaped wedge surface eccentric from the circular arc-shaped gear means as in the conventional embodiments is no longer required, and the design and manufacture thereof are facilitated.

[0012] Moreover, the linear shaped contact surface of the floating wedge member is slidably displaced along the linear shaped wedge surface of the wedge-shaped window means. With this, the operation of the floating wedge member is simplified, enabling the derivation of an angle adjustment tool having remarkably smooth and stable operational characteristics.

[0013] 0007 As an embodiment of the present invention, the formation of a parallel linear guide surface with respect to said wedge surface, positioned opposite to the wedge surface of said wedge-shaped window means is also possible.

[0014] By means of this embodiment, the floating wedge member may be slidably displaced along the parallel two surfaces of the wedge surface and the guide surface. With this, the operational characteristics of the floating wedge member are remarkably stabilized.

[0015] 0008 As an embodiment of the present invention, the contact surface may be formed in parallel with said contact surface, on the edge means of the toothed surface of said floating wedge member.

[0016] By means of this embodiment, the slidable displacement of the floating wedge member in the wedge-shaped window means is enabled, via the two parallel contact surfaces of the floating wedge member. With this, the operational characteristics of the floating wedge member are remarkably improved.

[0017] 0009 As a different embodiment of the present invention, the floating wedge member may form a pair of linear shaped contact surfaces with mirrored surface shapes.

[0018] By means of this embodiment, the directionality of the floating wedge member on the occasion of assembly is improved, and assembly errors are eliminated, improving the efficiency of assembly.

[0019] 0010 Yet another embodiment of the present invention may form a circular arc surface between a pair of linear shaped contact surfaces.

[0020] By means of this embodiment, the operation of the floating wedge member becomes remarkably smoother.

[0021] 0011 Another embodiment of the present invention may provide, on the occasion of the swinging of the second arm, a non-contacted free-floating holding means holding the toothed surface of said floating wedge member and the gear means of the second arm freely in non-contact.

[0022] By means of this embodiment, on the occasion of the swinging of the second arm, there is no impact of the toothed surface of the floating wedge member with the gear means of the second arm. With this, the derivation of an angle adjustment tool which does not generate

a harsh metallic crunching noise is enabled.

[0023] 0012 As yet another embodiment of the present invention, said non-contacted free-floating holding means provides a wedge operational plate revolved in a small angle by means of the entrained friction force with said second arm,

and by the swinging of said second arm in one direction with respect to said first arm, said wedge operating plate causes said toothed surface of said floating wedge member to be free and non-contacting with said gear means in a non-contacted free floating state,

furthermore, by swinging to the other direction of said small angle, pressing said floating wedge member between the linear wedge surface formed on said first arm side and said gear means, with said toothed surface of said floating wedge member and said gear means in a meshed state, a configuration regulating the relative swinging to said other direction of said second arm with respect to said first arm is enabled by means of the wedge effect of said floating wedge member.

[0024] By means of this embodiment, on the occasion of the swinging of the second arm, said toothed surface of said floating wedge member adopts a non-contacted free-floating state maintaining freedom thereof from said gear means. With this, the prevention of the generation of the harsh metallic crunching noise generated on the occasion of the swinging of the second arm is enabled.

[0025] 0013 As an embodiment of the present invention, by biasing said floating wedge member attached to said first arm to the axial center side, a biasing spring may be provided generating an impact noise on the occasion of the locked state of the meshing together of the gear means with the toothed surface of the floating wedge member.

[0026] By means of this embodiment, by the provision of the wedge operating plate, when the second arm is swung, there is no generation of a harsh metallic crunching during the swinging.

[0027] Furthermore, the floating wedge member biased by the spring force of the biasing spring generates an impact noise only on the occasion of the locked state on meshing together of the gear means with the toothed surface of the floating wedge member. With this, the user can become aware of the achievement of the locked state of the second arm on hearing the impact noise, and will be relieved from anxiety because the notification that the operational state is enabled.

[0028] 0014 As a new embodiment of the present invention, one terminal means may be locked on the pivot disposed in the axial center, and the other terminal means may be locked to the second arm, providing an anti-clockwise revolution suppression spring suppressing swinging to the upright direction of the second arm by means of the spring force of a spiral shaped spring member.

[0029] By means of this embodiment, for example, when a user sits on a sofa assembling the angle adjustment tool of this patent application, a tensile force acts on the cover material of the sofa, and there are times

when the second arm of the angle adjustment tool is pulled to the upright direction. In this type of situation, the spring force of the anti-clockwise revolution suppression spring suppresses the swinging of the second arm. With this, there is no swinging to the upright direction of the second arm counter to the wishes of the user, enabling the sustenance of the desired angle of inclination.

[0030] 0015 The furniture of the present invention configure the assembly of the earlier described angle adjustment tool in order to resolve the earlier described issues.

[0031] 0016 By means of the furniture of the present invention, the design and manufacture of the constituent of parts are facilitated, and there is the benefit of the enablement of the derivation of furniture wherein the operational characteristics of the swinging constituent of parts is smooth and stable.

Brief description of the drawings

[0032] 0017

Figure 1: A perspective view representing the first embodiment of the angle adjustment tool of the present invention.

Figure 2: A perspective view of the angle adjustment tool of Fig. 1 when viewed from a different angle.

Figure 3: An exploded perspective view of the angle adjustment tool of Fig. 1.

Figure 4: An exploded perspective view of the angle adjustment tool of Fig. 2.

Figure 5: An elevated view of the opposed wall means which is a constitutive part represented in Fig. 3

Figure 6: A perspective view of the wedge operation plate of Fig. 3.

Figure 7: A perspective view of the floating wedge member of Fig. 1.

Figure 8: A perspective view of the floating wedge member of Fig. 7 when viewed from a different angle.

Figure 9: A partial exploded perspective view representing the state wherein the first and second cover are removed from the perspective view of Fig. 1.

Figure 10: A partial exploded perspective view representing the state wherein the opposing wall means of the anterior side is removed from Fig. 9.

Figure 11: A partial exploded perspective view representing the state wherein the gear plate means of the anterior side is removed from Fig. 10.

Figure 12: A partial exploded perspective view representing the state wherein the wedge operating plate is removed from Fig. 11.

Figure 13: A partial exploded perspective view representing the state wherein the floating wedge member is removed from Fig. 12.

Figure 14: A partial exploded elevated view representing the locked state of the second arm resulting from the wedge effect of the floating wedge member in Fig. 12.

Figure 15: A drawing of the operational processes representing the operating procedures of the angle adjustment tool of the first embodiment.

Figure 16: A drawing of the operational processes following on from Fig. 15.

Figure 17: A drawing of the operational processes following on from Fig. 16.

Figure 18: A drawing of the operational processes following on from Fig. 17.

Figure 19: A drawing of the operational processes following on from Fig. 18.

Figure 20: A drawing of the operational processes following on from Fig. 19.

Figure 21: A perspective view representing the second embodiment of the angle adjustment tool of the present invention.

Figure 22: A perspective view of the angle adjustment tool of Fig. 21 when viewed from a different angle.

Figure 23: An exploded perspective view of the angle adjustment tool of Fig. 21.

Figure 24: An exploded perspective view of the angle adjustment tool of Fig. 22.

Figure 25: An elevated view of the opposed wall means which is a constitutive part represented in Fig. 23.

Figure 26: An elevated view of the wedge operating plate represented in Fig. 23

Figure 27: A partial exploded perspective view representing the state wherein the first and second cover are removed from Fig. 21.

Figure 28: A partial exploded perspective view representing the state wherein the anterior opposing wall means is removed from Fig. 27.

Figure 29: A partial exploded perspective view representing the state wherein the anterior gear plate means is removed from Fig. 28.

Figure 30: A partial exploded perspective view representing the state wherein the wedge operating plate and the biasing spring are removed from Fig. 29.

Figure 31: A partial exploded perspective view representing the state wherein the floating wedge member is removed from the perspective view of Fig. 30.

Figure 32: A drawing of the operational processes representing the operating procedures of the angle adjustment tool of the second embodiment.

Figure 33: A drawing of the operational processes following on from Fig. 32.

Figure 34: A drawing of the operational processes following on from Fig. 33.

Figure 35: A drawing of the operational processes following on from Fig. 34.

Figure 36: A drawing of the operational processes following on from Fig. 35.

Figure 37: A drawing of the operational processes following on from Fig. 36.

Figure 38: A perspective view representing the third

embodiment of the angle adjustment tool of the present invention.

Figure 39: A perspective view of the angle adjustment tool of Fig. 38 when viewed from a different angle.

Figure 40: An exploded perspective view of the angle adjustment tool of Fig. 38.

Figure 41: An exploded perspective view of the angle adjustment tool of Fig. 39.

Figure 42: A partial exploded perspective view representing the state wherein the first and second cover are removed from Fig. 38.

Figure 43: A partial exploded perspective view representing the state wherein the anterior opposing wall means is removed from Fig. 42.

Figure 44: A partial exploded perspective view representing the state wherein the anterior gear plate means is removed from the perspective view of Fig. 43.

Figure 45: A partial exploded perspective view representing the state wherein the wedge operating plate is removed from Fig. 29.

Figure 46: A drawing of the operational processes representing the operating procedures of the angle adjustment tool of the third embodiment.

Figure 47: A drawing of the operational processes following on from Fig. 46.

Figure 48: A drawing of the operational processes following on from Fig. 47.

Figure 49: A drawing of the operational processes following on from Fig. 48.

Figure 50: A drawing of the operational processes following on from Fig. 49.

Figure 51: A drawing of the operational processes following on from Fig. 50.

Best mode of embodying the invention

[0033] 0018 Hereafter, embodiments of the angle adjustment tool of present invention is explained based on the figures 1 ~ 51.

[0034] The angle adjustment tool of the first embodiment is graphically represented in figures 1 ~ 20. In particular, the angle adjustment tool of the first embodiment, as illustrated in figures 3 and 4, provides the first arm 10, the second arm 20, the non-contacted free-floating holding means 30, the floating wedge member 40, the first and second covers 50 and 52. Then, the first arm 10 and the second arm 20 are integrated in the swingable manner centered on the axial center L, via the pivot 56.

[0035] 0019 As illustrated in figures 3 and 4, the first arm 10 provides the attachment means 11, and a pair of parallel opposed wall means 12 and 13 sandwiching one terminal means of said attachment means 11. Said opposed wall means 12 and 13 are caulk fixed to one terminal means of said attachment means 11 by two rivets 14 and 14.

[0036] Now, the method of fixing is not limited to the

above described caulked fixation, and for example, may be fixed using a bolt and nut or welded. Moreover, a fit-on protrusion is provided by protrusion processing to any one of the attachment means 11 or the opposing wall means 12 and 13, and a fitting-on hole may be provided in the other one for the integration thereof.

[0037] 0020 The above described opposing wall means 12 and 13 are formed preferably in mirror symmetry. For example, opposing wall means 13, as illustrated in figure 5, may not only provide an axial hole 15 in one side thereof, but also provide the position control pin 17 facing the inner surface on the other side thereof. Then, combined with the hole 15 and/or the pin 17, or without such combination concerning both or one of these features, the opposing wall means 13 may provide the wedge-shaped window means 18 between the earlier described axial hole 15 and the position regulating pin 17.

[0038] Now, the above described position regulating pin 17 may be formed by protrusion machining, or may be formed by attaching another metallic pin.

[0039] Moreover, the position of the position regulating pin 17 may be modified as required, in order to enable e.g. locking to the later described leaf spring piece 36.

[0040] 0021 The above described position regulating pin 17 and 17, as illustrated in figures 3 and 4, are each preferably each provided so as to be positioned on the same axial line facing inwards on a pair of opposing wall means 12 and 13. Then, the positioning of the earlier described wedge operating plate 31 to a specific position is enabled by locking the leaf spring piece 36 of the later described wedge operating plate 31 to the earlier described position regulating pin 17. Moreover, the prevention of the generation of a loud metallic noise by the wedge operating plate 31 is enabled by means of the earlier described position regulating pin 17 being in contact with the leaf spring piece 36 of the later described wedge operating plate 31 or by having a minute gap with respect there to.

[0041] 0022 As illustrated in figure 5, the earlier described wedge-shaped window means 18 may have a linear shaped wedge surface 18a. That wedge surface 18a may be inclined (See figures 12 to 14) so as to be progressively more proximal to the gear means 26 of the later described second arm 20. The linear wedge surface 18a may enclose an angle α with a middle axis M as shown in figure 5 between 80° and 30°, more preferably between 65° and 50° and most preferably about 57°. Moreover, that wedge-shaped window means 18 may have a guide surface 18b opposite and this surface may be parallel to the earlier described wedge surface 18a. The wedge surface 18a and the guide surface 18b have guiding functions in order to slidably displace the floating wedge member 40. In addition, that wedge surface 18a and guide surface 18b are joined via the preferably inclined surface 18c. The inclination of the preferably also straight surface 18c may be - only mirror like - with the same angles as described concerning 18a. The wedge surface 18a and the inclined surface 18c have preferably

almost the same angle of inclination as the first contact surface 41 and/or the second contact surface 42 of the floating wedge member 40. Then, the above described wedge surface 18a, the guide surface 18b and the inclined surface 18c form a retraction space enabling the storage of the floating wedge member 40, when the floating wedge member 40 is separated from the gear means 26 (Figure 12). Furthermore, the earlier described wedge surface 18a and the guide surface 18b may be connected via a preferably circular arc surface 18d formed preferably in a concentric circular-shape to the axial hole 15. For that purpose, as illustrated in figures 12 to 14, by having a linear shaped wedge surface 18a and a circular arc-shaped gear means 26, a wedge-shaped space is formed which grows smaller in the clockwise revolving direction. The later described floating wedge member 40 can be displaceably fitted in to said wedge-shaped space.

[0042] Now, in view of the opposing wall means 12 and 13 may be formed in mirror symmetry, they have the same reference numerals applied to the same parts thereof and the further explanation thereof is omitted here.

[0043] 0023 The second arm 20, as illustrated in figures 3 and 4, provides an attachment means 21, and a parallel but opposed pair of gear plate means 22 and 23, in addition to sandwiching one terminal means of the earlier described attachment means 21. The earlier described gear plate means 22 and 23 are tightly fixed using e.g. two rivets 24 and 24 to the earlier described attachment means 21.

[0044] Now, the method of fixing is not limited to the above described tight fixing, and for example, may be fixed using a bolt and nut or welded. Moreover, a fit-on protrusion is provided by protrusion processing to any one of the attachment means 21 or the opposing wall means 22 and 23, and a fitting-on hole may be provided in the other one for the integration thereof.

[0045] 0024 The earlier described gear plate means 22 and 23 are preferably formed in mirror symmetry to each other, and each may have the axial holes 25 and 25 for further perforation there through of the pivot 56. Furthermore, the earlier described gear plate means 22 and 23 preferably each form a gear means 26 and 26, for example, in a range of 100° to 120° of the center angle, on the circular arc-shaped outer peripheral edge means of one terminal side thereof. Furthermore, there is the provision of a first protrusion means 27 on the initial terminal means of said gear means 26. In addition, there can be provision of a second projection means 28 on the final terminal means of said gear means 26. Then, the gear plate means 22 and 23 provide one or the locking pins 29 and 29 protruding to the inner facing surface thereof.

[0046] Next, the two plate means 22 and 23 of the second arm 20 are inserted between the opposing wall means 12 and 13 of the earlier described first arm 10, to be connected in a swingable manner via the pivot 56.

[0047] 0025 In this embodiment, there is the disclosure

of an assembly of three constitutive parts from the earlier described first arm 10 and the second arm 20, but it is not necessarily limited to this. For example, the earlier described first arm 10, and the second arm 20 overlay and match the constitutive parts which are two plates formed in mirror symmetry, and may be formed integrally. The integration method, for example, may employ welding, crimping, bolt-and-nut, or a fit-on protrusion.

[0048] 0026 The non-contacted free-swinging holding means 30, as illustrated in figures 3 and 4, provides a wedge operating plate 31 revolving through a limited angle centered on the axial center L, by means of the drag-around friction force with the second arm 20.

[0049] 0027 The wedge operating plate 31, as illustrated in figure 6, may be one plate of preferably a metallic sheet which can be punched-out by press processing, and can be formed by folding over. Then, that wedge operating plate 31 has the axial hole 32 provided on one side thereof, and one or a pair of leaf spring pieces 36 and 36 provided on the other side thereof, and the aperture window means 37 provided between that axial hole 32 and the earlier described leaf spring pieces 36 and 36. Then, the wedge operating plate 31 is supported in a swingable manner together with the second arm 20 in a state wherein it is inserted between the gear plate means 22 and 23. Now, there can be the formation of a locking arc means 35 in the angular means positioned adjacent to the earlier described axial hole 32. This locking arc means 35 may regulate the position of the wedge operating plate 31 by means of locking to the locking pin 29 of the earlier described gear plates 22 and 23. Now, because of the relationship with the position regulating pin 17, the leaf spring piece 36 may be provided in the lower vicinity or the upper vicinity of the wedge operating plate 31.

[0050] 0028 The axial hole 32 has a diameter enabling preferably fitting in to the annular rib 25a provided on the aperture edge means of the axial hole 25 of the gear plate means 22 and 23 (Figure 3, figure 4). Moreover, the axial hole 32 may have a ring-shaped sliding contact means 33 formed on the peripheral edge means thereof. Then, the ring-shaped sliding contact means 33 may be connected to the wedge operating plate 31 via preferably a wave-shaped spring means 34. Said ring-shaped sliding contact means 33 and the wave-shaped spring means 34, after forming multiple discontinuous circular arc-shaped slits in a concentric circular-shaped in the periphery of the axial hole 32, simultaneously form the circular-shaped sliding contact means 33 and the wave-shaped spring means 34 by means of pushing out the earlier described circle shaped sliding contact means 33 to the plate thickness direction.

[0051] Then, the circular-shaped sliding contact means 33 is elastically pressed into contact with the inner facing surface of the gear plate means 22 and 23 of the second arm 20, by means of elastic deformation of the earlier described wave-shaped spring 34. With that, an appropriate drag-around friction force is generated be-

tween the wedge operating plate 31 and the second arm 20. As a result, the wedge operating plate 31 and the second arm 20 are caused to revolve together by means of that drag-around friction force.

[0052] 0029 Now, by means of the provision of the earlier described circular shaped sliding contact means 33, the earlier described wave spring means 34 is reinforced, and not only is longevity increased, there is also the benefit that the swinging operation is smoother and more stable. Moreover, the earlier described wedge operating plate 31 need only have the wave-shaped spring means 34 provided in the periphery of the axial hole 32.

[0053] 0030 The earlier described leaf spring pieces 36 and 36, as illustrated in figure 6, one or both of them may have a long slit provided along the other direction side peripheral means of the earlier described wedge operating plate 31, forming a substantially perpendicular bent upwards means on the other side edge which are left after cutting. With that, both terminal means of the long direction of the leaf spring piece 36 are integrally connected to the wedge operating plate 31.

[0054] Furthermore, the earlier described leaf spring piece 36 may have an outwardly protruding protrusion means 36a in the center means of the long direction thereof. Then, the earlier described leaf spring piece 36 may form a recessed means 36b for use in locking-in the basal means of one side of that protrusion means 36a. By the locking of the e.g. position regulating pin 17 into this recessed means 36b for use in locking, the wedge operating plate 31 is positioned regulated so as not to be revolved by means of the drag-around friction force with the second arm 20 (Figures 10 and 11). In addition, the earlier described leaf spring piece 36 may form a recessed means 36c for use in guidance in the other side of the earlier described protrusion means 36a. The position regulating pin 17 may be positioned in that recessed means 36c for use in guidance, and when guided, the wedge operating plate 31 revolves together with the second arm 20 as a result of the drag-around friction force.

[0055] Now, the earlier described position regulating pin 17 may be in contact with the recessed means 36c for use in guidance described above, or may have a minute gap there with.

[0056] Moreover, there is no necessity to provide a pair of the earlier described leaf spring pieces 36 in every case, and just one on one side may suffice.

[0057] 0031 The earlier described aperture window means 37, as illustrated in figure 6, displaces the later described floating wedge member 42 to a specific position, in addition to having a shape enabling the holding thereof without generating a harsh metallic noise.

[0058] In other words, the earlier described aperture window means 37 has the upper and lower pair of first supporting means 37a and second supporting means 37b. The first supporting means 37a and the second supporting means 37b face off from each other at a distance enabling the contact and support to the upper terminal

edge means and the lower terminal edge means of the later described floating wedge member 40 (See figures 10, 11). Then, the first supporting means 37a and the second supporting means 37b are connected to the first connecting means 37c and the second connecting means 37d. The earlier described first connecting means 37c has a circular arc surface which is concentric with the earlier described axial hole 32. Moreover, the second connection means 37d has a curved surface which does not contact with the floating wedge member 40.

[0059] 0032 The floating wedge member 40, as illustrated in figures 7 and 8, are formed in mirror symmetry. With that, because the assembly direction of the floating wedge member 40 is limited to one direction, the assembly operation is facilitated.

[0060] In other words, the floating wedge member 40 not only has the first contact surface 41 and the second contact surface 42 on one side thereof, but also forms the toothed surface 43 on the other side thereof. The earlier described first contact surface 41 and the second contact surface 42 are both flat surfaces. Then the angle between the first contact surface 41 and the second contact surface 42 is almost the same as the angle between the wedge surface 18a and the inclined surface 18c provided in the opposing wall means 12 and 13 (See figures 9 and 12). This angle can be, as outlined above, two times the angle α , between 160° and 60° , with further narrower ranges as also described, and most preferably be about 114° .

[0061] Furthermore, the third contact surface 44 and the fourth contact surface 45, which are parallel with the earlier described first contact surface 41 and the second contact surface 42, are provided on the upper and lower edge means of the earlier described toothed surface 43. The earlier described third contact surface 44 and the fourth contact surface 45 are both flat surfaces.

[0062] Then, the circular arc surfaces 46 and 47 which have identical curvatures are formed between the first contact surface 41 and the second contact surface 42. In addition, the circular arched surface 48 having a different curvature to the circular arched surfaces 46 and 47 is formed between the circular arc surfaces 46 and 47. By the provision of the earlier described circular arc surfaces 46, 47 and 48, there is the benefit that the movement of the floating wedge member 40 becomes remarkably smoother.

[0063] Also with reference to figure 12, the relation between the longitudinal extension a of the linear wedge surface 18a shall be explained with respect to the extension of the respective linear extension b at the floating wedge member 40. As shown in this figure, a is about 1.83 times the extension of b. But there can be, as outlined above, a relation between 1.4 to 2.2 and more preferably between 1.6 and 2.0 concerning these dimensions.

[0064] 0033 Now, as illustrated in figure 8, multiple teeth are formed in the toothed surface 43 of the floating wedge member 40. This toothed surface 43 and the gear

means 26 and 26 mesh at two locations in the left and right horizontal direction, in addition to all of the teeth of the toothed surface 43 simultaneously meshing with the gear means 26 and 26 (figure 14).

[0065] Then, for example, 13 to 20 teeth are formed in the toothed surface 43 of the floating wedge member 40, and 40 or more teeth, more preferably 45 to 65 teeth may be formed in the gear means 26. By this means, 40 or more stages of the angular adjustment stages are enabled.

[0066] 0034 The first and/or second covers 50 and 52 may be provided for in order to prevent the drop-off of the earlier described floating wedge member 40. With that, the first and second covers 50 and 52 have an elevated shape covering each of the outer peripheral surfaces of the opposing wall means 12 and 13 of the earlier described first arm, in addition to providing each of the axial hole 51 and 53. Then, the first and second covers 50 and 52 may be mutually joined and unified via preferably a pair of e.g. elastic clasps 54 and 54 provided in the second cover 52.

[0067] 0035 Next, the assembly method of the constituent of parts described above of the first embodiment is explained.

[0068] Firstly, the wedge operating plate 31 is preliminarily assembled between the gear plates means 22 and 23 of the second arm, and integrated with the second arm 20 by being tightly fixed by the rivet 24. Then, the earlier described gear plate means 22 and 23 and the wedge operating plate 31 are inserted and positioned between the opposing wall means 12 and 13 of the integrated first arm 10. In addition, after positioning the second cover 52 on the earlier described opposing wall means 13, the pivot 56 is inserted through the axial holes 53, 15, 25, 32, 25 and 15 and is provisionally fixed therein. Next, the floating wedge member 40 is inserted from the wedge-shaped window means 18 of the opposing wall means 12, and is inserted to the aperture window means 37 and the wedge-shaped window means 18 of the opposing wall means 13. Then, the axial hole 51 of the first cover 50 is fitted on to the pivot 56, preventing the drop-off of the earlier described floating wedge member 40. Finally, the metal washer 55 is fitted on to the pivot 56, and the earlier described constituent of parts are joined and unified by the closure of one terminal means of the protruding pivot 56.

[0069] 0036 Next the usage method of the angle adjustment tool of the first embodiment is explained.

[0070] Firstly, as illustrated in figure 15, when the second arm 20 is lowered in the direction of arrow A with respect to the first arm 10, the toothed surface 43 of the floating wedge member 40 adopts a meshed state with the gear means 26. Moreover, the floating wedge member 40 is formed between the linear shaped wedge surface 18a and the gear means 26, in addition to being pushed into the wedge-shaped space which grows progressively narrower along the clockwise revolving direction. With that, the floating wedge member 40 regulates

the swinging of the second arm 20 to the direction A, by means of the wedge effect, sustaining the angle of inclination of the first arm 10 with respect to the second arm 20 (held fixed). In other words, if there is a meshed state as illustrated in figure 15, the inclined angle between the first arm 10 and the second arm 20 is sustained securely, without slippage of the second arm 20, by means of the meshing the toothed surface 43 of the floating wedge member 40 with the gear means 26.

[0071] 0037 Conversely, as illustrated in figure 16, when the second arm 20 is swung to the direction of arrow B, the wedge operating plate 31 begins to revolve jointly with the second arm 20, as a result of the drag-around friction force generated based on the spring force of the wave-shaped spring means 34. With that, the separation of the toothed surface 43 of the floating wedge member 40 from the gear means 26 begins. Simultaneous with this, the first support means 37a of the wedge operating plate 31 presses down the upper terminal surface of the floating wedge member 40. With that, the floating wedge member 40 is slidably displaced to the downward inclined side direction along the linear wedge surface 18a and the guide surface 18b, and the wedge-shaped window means 18 is displaced to the lower side direction. As a result, a minute gap is generated between the toothed surface 43 and the gear means 26, and the floating wedge member 40 is in a non-contact free-floating state. In the non-contact free-floating state, the floating wedge member 40 is supported on the four locations of the wedge surface 18a of the wedge-shaped window means 18, the guide surface 18b, and the first and second support means 37a and 37b of the wedge operating plate 31. Then, in the non-contacted free-floating state, because there is no contact between the floating wedge member 40 and the gear means 26, no harsh metallic noise is generated, and the second arm 20 can be swung quietly to the direction of arrow B. Moreover, while there is the generation of drag-around friction force between the wedge operating plate 31 and the second arm 20, because the floating wedge member 40 is pressed from the upper direction by the wedge operating plate 31, there is no meshing of the toothed surface 43 with the gear means 26.

[0072] In other words, while there is the performance of the operation of swinging the second arm 22 to the direction of arrow B, the floating wedge member 40 is held so as not to generate a harsh metallic noise, and the non-contacted state of the toothed surface 43 of the floating wedge member 42 the gear means 26 is sustained.

[0073] 0038 In addition, as illustrated in figure 17, when the second arm 20 is swung to the direction of arrow B, the upper terminal surface of the floating wedge member 40 is pressed by the second projection means 28. With that, the lower terminal means of the floating wedge member 40 presses down the second support means 37b of the wedge operating plate 31. As a result, by means of the joint revolution with the wedge operating

plate 31, the position regulating pin 17 rides over the protrusion means 36a of the leaf spring piece 36, and locks to the recessed means 36b for use in locking. Then, the second contact surface 42 of the floating wedge member 40 comes into contact with the inclined surface 18c to adopt the retracted state (Figure 18).

[0074] In the retracted state, the floating wedge member 40 is stored in the retracted space, in addition to the recessed means 36b for use in locking of the leaf spring piece 36 locking to the position regulating pin 17. With that, even if the second arm 20 is swung to the direction of A, as a result of the spring force of the leaf spring piece 36 locked to the position regulating pin 17, the non-meshing of the gear means 26 and the toothed surface 43 in the non-contacted free-floating state is held. As a result, the wedge operating plate 31 does not revolve in unison, and only the second arm 20 swings freely to the direction A (Figure 19).

[0075] 0039 Next, as illustrated in figure 19, when the second arm 20 is swung to the direction of arrow A, immediately before the final deployed position comprising the linear state of the second arm 20 with respect to the first arm 10, the locking pin 29 of the gear plate means 23 locks with the locking lug means 36 of the wedge operating plate 31. In addition, when the second arm 20 is swung somewhat strongly to the direction of arrow A, the wedge operating plate 31 also swings to the clockwise revolving direction (direction A) about the pivot 56. With that, the position regulating pin 17 is released from the recessed means 36b for use in locking of the leaf spring piece 36, and the position regulating pin 17 is positioned in the recessed means 36c for use in guiding of the leaf spring piece 36 (Figure 20). As a result, the second support means 37 of the wedge operating plate 31 presses of the lower terminal surface of the floating wedge member 40, displacing the floating wedge member 40 which is in the retracted state upwards. On this occasion, because the upper terminal surface of the floating wedge member 40 is in contact with the first support means 37a of the wedge operating plate 31, there is no generation of a harsh metallic noise by the floating wedge member 40. Then, as a result of the drag-around friction force generated between the wedge operating plate 31 and the second arm 20, the wedge operating plate 31 revolves in unison there with. As a result, the floating wedge means 40 is displaceably slid to the upper part of the wedge-shaped window means 18 (the wedge-shaped space) along the linear wedge surface 18a and the guide surface 18b, and the toothed surface 43 of the floating wedge member 40 and the gear means 26 adopt the meshed state.

[0076] 0040 Now, in this embodiment, the final deployed position of the second arm 20 in respect of the first arm 10 is a linear state (180°), but there is no necessary limitation there to. For example, a final deployed position wherein the angle formed by the second arm 20 in respect of the first arm 10 may be 120° by appropriate selection of the range of the center angle provided for

the gear means 26.

[0077] 0041 Next, when the second arm 20 is swung once more to the direction of arrow B, the wedge operating plate 31 begins to revolve in unison with the second arm 20 as a result of the drag-around friction force resulting from the spring force of the wave-shaped spring means 34. Then, the first support means 37 a of the wedge operating plate 31 presses down on the upper terminal surface of the floating wedge member 40. With that, the floating wedge member 40 is displaceably slid along the wedge surface 18a of the wedge-shaped window means 18 and the guide surface 18 be, in a small displacement separating away from the gear means 26. As a result, a small gap is generated between the toothed surface 43 and the gear means 26, and the floating wedge member 40 adopts a non-contacted free-floating state once more (figure 16). Therefore, there is no occurrence of a harsh metallic noise even if the second arm 20 is swung in the direction of arrow B. Then, when the second arm 20 is swung in the direction of arrow A, the second support member 37b of the wedge operating plate 31 pushes up the lower terminal means of the floating wedge member 40, causing sliding displacement thereof. With that, the toothed surface 43 of the floating wedge member 40 and the gear means 26 adopt a meshed state. In addition, the floating wedge member 40 is formed between the wedge surface 18a and the gear means 26, in addition to being pushed into a wedge-shaped space which grows successively narrower along the clockwise direction (figure 15). With that, the floating wedge member 40 regulates the swinging of the second arm 20 to the direction A, as a result of the wedge effect, and the angle of inclination between the first arm 10 on the second arm 20 is sustained (held fixed).

[0078] 0042 As is clear from the explanation provided above, by means of the first embodiment, even if the second arm 20 is swung in either of the directions A or B, there is absolutely no generation of a harsh metallic noise, with the benefit that a quiet angle adjustment tool is enabled.

[0079] 0043 The second embodiment, as illustrated in figures 21 to 37, has almost the same configuration as that of the earlier described first embodiment. The points of difference are the assembly of a biasing spring 60 wherein a bar shaped spring material is folded in a substantially gate shape. The object of that is that there is absolutely no generation of a harsh metallic noise during operation, but it resolves the unease of the user by the generation of an impact noise only after initiating operation of the second arm and immediately after termination of operation.

[0080] 0044 As illustrated in figures 23 and 24, the second embodiment is almost the same as the first embodiment, and provides a first arm 10, a second arm 20, a non-contacted free-floating holding means 30, a floating wedge member 40, first and second covers 50 and 52, and the biasing spring 60.

[0081] In this embodiment, other than the first arm 10,

the wedge operating plate 31, and the biasing spring 60, because it is almost the same as the earlier described first embodiment, the same reference numerals are applied to the same parts and the further explanation thereof is abbreviated.

[0082] 0045 The first arm 10 is almost the same as in the first embodiment, but the configuration thereof is different from the first embodiment in order to attach the later described biasing spring 60. As illustrated in figure 25, the opposing wall means 12 and 13 of the second embodiment are almost the same as the opposing wall means 12 and 13 of the first embodiment. The points of difference are that the shape of the wedge-shaped window means 18, and the configuration in order to attach the later described biasing spring 60.

[0083] In other words, the wedge-shaped window means 18a of the opposing wall means 13, as illustrated in figure 25, just as in the first embodiment, not only has the mutually parallel wedge surface 18 and the guide surface 18b, but also has the inclined surface 18c, and the circular arc surface 18d. In addition, the wedge-shaped window means 18 provides a cut-out means 18a in the substantial center of said guide surface 18b.

[0084] Moreover, the opposing wall means 13 provides both the vertical locking hole 19a of the earlier described wedge-shaped window means 18 and the contact pin 19b.

[0085] 0046 The wedge operating plate 31, as illustrated in figure 26, is almost the same as the wedge operating plate 31 of the first embodiment, and the point of difference are the shape of the aperture window means 37. That aperture window means 37, just as in the first embodiment, displaces the later described floating wedge member 40 to a specific position, in addition to having a shape which enables the holding thereof so as not to generate a harsh metallic noise.

In other words, the earlier described aperture window means 37 has the upward and downward opposed first supporting member 37a and the second supporting member 37b.

[0086] The first supporting member 37a and the second supporting member 37b are opposed at a distance enabling contact and support of the upper terminal edge means and the lower terminal edge means, respectively, of the later described floating wedge member 40. However, in figure 26, a one-step lower than the second supporting means 37b stepped means 37e is formed in the substantial right side half of the second supporting means 37b. The opposed gap distance of the first supporting means 37a and the second supporting means 37e is a distance so as to not enable simultaneous contact with the upper terminal surface and the lower terminal surface of the floating wedge member 40.

[0087] Otherwise, because everything else is the same as in the first embodiment, the same reference numerals are applied to the same parts and the further explanation thereof is abbreviated.

[0088] 0047 The biasing spring 60 as illustrated in fig-

ures 23 and 24, bends a linear spring material into a substantial gate shape. Then, the biasing spring 60 provides the locking terminal means 61 and 61 wherein each are bent to the outer direction of both terminal means, as well as along the same straight line.

[0089] 0048 Next, the assembly method of the constituent of parts of the second embodiment is explained.

[0090] Firstly, after pre-assembling the wedge operating plate 31 between the gear plate means 22 and 23 of the second arm 20, the second arm 20 is integrated by securely fixing by means of the rivets 24 and 24. On the other hand, the biasing spring 60 is inserted between the opposing wall means 12 and 13 of the integrated first arm 10. Then, the locking terminal means 61 and 61 of the biasing spring 60 are respectively locked to the locking holes 19a and 19a of the opposing wall means 12 and 13. Next, the earlier described gear plate means 22 and 23 and the wedge operating plate 31 are not only inserted between the opposing wall means 12 and 13 of the integrated first arm 10, but also the wedge operating plate 31 is inserted to the substantially gate shaped biasing spring 60. In addition, after positioning the second cover 52 on the earlier described opposing wall means 13, the pivot 56 is inserted through and temporarily fixed to the axial holes 53, 15, 25, 32, 25, 15. Next, the floating wedge member 40 is inserted from the wedge-shaped window means 18a of the opposing wall means 12 to be inserted to the aperture window means 37 and the wedge-shaped window means 18a of the opposing wall means 13. Then, the axial hole 51 of the first cover 50 is fitted on to the pivot 56, preventing the drop-off of the earlier described floating wedge member 40. Finally, the metal washer 55 is fitted on to the pivot 56, and the earlier described constituent of parts are joined and integrated by means of a clasp on one terminal means of the protruding pivot 56.

[0091] 0049 Next, the usage method of the angle adjustment tool of the second embodiment is explained.

[0092] Firstly, as illustrated in figure 32, when the second arm 20 is inclined in the direction of arrow A with respect to the first arm 10, the toothed surface 43 of the floating wedge member 40 and the gear means 26 adopt a meshed state. Then, the floating wedge member 40 is formed between the linear wedge surface 18a and the gear means 26, in addition to being pushed into the wedge-shaped space which grows successively narrower in the clockwise revolving direction. With that, the floating wedge member 40 restricts the swinging motion to direction A of the second arm 20, by means of the wedge effect, sustaining the angle of inclination of the second arm 20 with respect to the first arm 10 (held fixed). On that occasion, the lower terminal means of the floating wedge member 40 does not fall into the cut-out means 18e of the wedge-shaped window means 18.

[0093] In other words, if the meshed state is as shown in figure 32, as a result of the intermeshing of the toothed surface 43 of the floating wedge member 40 with the gear means 26, the secure holding of the inclined angle of the

second arm 20 with respect to the first arm 10 is enabled, without slippage of the second arm 20.

[0094] 0050 Conversely, as illustrated in figure 33, when the second arm 20 is swung in the direction of arrow B, the wedge operating plate 31 begins to revolve in unison with the second arm 20 resulting from the drag-around friction force generated based on the spring force of the wave - shaped spring means 34. With that, the toothed surface 43 of the floating wedge member 40 and the gear means 26 begin to separate. Simultaneous with this, the first supporting means 37a of the wedge operating plate 31 presses down on the upper terminal surface of the floating wedge member 40. With that, the floating wedge member 40 is displaceably slid to the downward inclined side, along the linear wedge surface 18a and the guide surface 18b, to be displaced to the lower direction side of the wedge-shaped window means 18. Then, the lower terminal means of the floating wedge member 40 falls into the cut-out means 18e of the wedge-shaped window means 18. As a result, a minute gap is generated between the toothed surface 43 and the gear means 26, and the floating wedge member 40 adopts a non-contact free-floating state. In this non-contact free-floating state on this occasion, the floating wedge member 40 is biased to the pivot 56 side by means of the biasing spring 60. With that, the floating wedge member 40 is supported on the three locations of the cut-out means 18e, the first support means 37a of the wedge operating plate 31, and the biasing spring 60. With that, in the non-contacted free-floating state, because there is no contact between the floating wedge member 40 and the gear means 26, no ear-jarring harsh metallic noise is generated, and the second arm 20 can be swung silently in the direction of arrow B. Moreover, while the wedge operating plate 31 and the second arm 20 revolve in unison, because the floating wedge member 40 is pressed down on the wedge operating plate 31 from above, there is no meshing of the toothed surface 43 with the gear means 26.

[0095] In other words, even if there is the performance of the operation of swinging the second arm 20 to the direction of arrow B, not only is the floating wedge member 40 held without generating any harsh metallic noise, but also the toothed surface 43 of the floating wedge member 40 and the gear means 26 are held in a non-contacted state.

[0096] 0051 In addition, as illustrated in figure 34, when the second arm 20 is swung in the direction of arrow B, the second projection means 28 presses on the upper terminal surface of the floating wedge member 40. With that, because the lower terminal means of the floating wedge member 40 presses down the second supporting means 37b of the wedge operating plate 31, the wedge operating plate 31 swings. As a result, the protrusion means 36a of the leaf spring piece 36 rides-over the position regulating pin 17, followed by the position regulating pin 17 locking to the recessed means 36 for use in locking. Then, the second contact surface 42 of the float-

ing wedge member 40 contacts with the inclined surface 18c, to adopt the retracted state (Figure 35).

[0097] In this retracted state, the floating wedge member 40 is stored in the retraction space, in addition to the recessed means 36b for use in locking of the leaf spring piece 36 locking to the position regulating pin 17. With this, even if the second arm 20 is swung to the direction A, the state wherein the gear means 26 and the toothed surface 43 are not meshed is sustained by the spring force of the leaf spring 36 locked to the position regulating pin 17. As a result, the free swinging of only the second arm 20 to the direction A is enabled without generating a harsh metallic noise and without swinging in tandem with the wedge operating plate 31.

[0098] 0052 As illustrated in figure 36, when the second arm 20 is swung in the direction of arrow A, immediately before the final deployed position comprising the linear state of the second arm 20 with respect to the first arm 10, the locking pin 29 of the gear plate means 23 locks with the locking lug means 35 of the wedge operating plate 31. Furthermore, when the second arm 20 is swung slightly strongly in the direction of arrow A, the wedge operating plate 31 also swings in the clockwise revolving direction (direction A) centered on the pivot 56. With that, the position regulating pin 17 is released from the recessed means 36b for use in locking of the leaf spring piece 36, and the position regulating pin 17 is positioned in the recessed means 36c for use in guidance of the leaf spring piece 36. As a result, the second support means 37b of the wedge operating plate 31 pushes up the lower terminal surface of the floating wedge member 40, and the floating wedge member 40 which is in the recessed state is displaced upwards. On this occasion, because the upper terminal surface of the floating wedge member 40 also contacts with the first support means 37a of the wedge operating plate 31, no harsh metallic noise is generated by the floating wedge member 40. Then, as a result of the drag-around friction force generated between the wedge operating plate 31 and the second arm 20, both revolve in unison. With that, the floating wedge member 40 which is biased by the biasing spring 60 is displaceably slid to the upper part of the wedge-shaped window means 18 (the wedge-shaped space) along the linear wedge surface 18a and the guide surface 18b. As a result, the toothed surface 43 of the floating wedge member 40 and the gear means 26 adopt the meshed state (Figure 37), and an impact noise is generated when the toothed surface 43 and the gear means 26 are meshed together. With this impact noise, the user is informed of the meshing together of the toothed surface 43 and the gear means 26, relieving any anxiety of the user.

[0099] 0053 Now, in this embodiment, the final deployed position of the second arm 20 in respect of the first arm 10 is a linear state (180°), but there is no limitation there to. For example, a final deployed position wherein the angle formed by the second arm 20 in respect of the first arm 10 may be 120° is enabled by appropriate

selection of the range of the center angle provided for the gear means 26.

[0100] 0054 Next, when the second arm 20 is swung to the direction of the arrow B once more, the wedge operating plate 31 begins to revolve in unison together with the second arm 20 as a result of the drag-around friction force resulting from the spring force of the wave-shaped spring means 34. Then, the upper terminal surface of the floating wedge member 40 presses the first support means 37a of the wedge operating plate 31. With that, the floating wedge member 40 is slidably displaced along the linear wedge surface 18a and the guide surface 18b, and is slightly displaced in a direction separating from the gear means 26. Next, the lower terminal means of the floating wedge member 40 falls into the cut-out means 18e. As a result, a minute gap is generated between the toothed surface 43 and the gear means 26, and once more the floating wedge member 40 adopts the non-contacted free-floating state (figure 33). Therefore, even if the second arm 20 is swung in the direction of the arrow B, there is no generation of a harsh metallic noise.

[0101] Then, when the second arm 20 is swung in the direction of arrow A, the step means 37e of the dragged-around wedge operating plate 31 pushes up the floating wedge member 40. With that, after the floating wedge member 40 is removed from the cut-out means 18e, there is sliding displacement along the wedge surface 18a and the guide surface 18b. As a result, the meshed state of the toothed surface 43 of the floating wedge member 40, biased by the biasing spring 60, with the gear means 26 is enabled once more. On this occasion, an impact noise is generated when the toothed surface 43 meshes with the gear means 26. The user will be relieved of any anxiety because the user can confirm the operational status on the user hearing this impact noise. Furthermore, the floating wedge member 40 is formed between the wedge surface 18a and the gear means 26, in addition to being pushed into the wedge-shaped space which grows successively narrower along the clockwise revolving direction. With that, the floating wedge member 40 regulates the swinging of the second arm 20 to the direction A, and the inclined angle between the first arm 10 and the second arm 20 is sustained (held fixed) (Figure 32).

[0102] 0055 As will be clear from the description above, by means of the second embodiment, even if the second arm 20 is swung to either of the directions of direction A or direction B, there is no generation of a harsh metallic noise during the swinging motion, and a silent angle adjustment tool is enabled. However, there is the generation of an impact noise on the occasion of the meshing of the toothed surface 43 of the floating wedge member 40 with the gear means of the gear plate means 23 based on the swinging motion operation. Because of this, the user can be made aware of their operational status, with the benefit that this relieves them of anxiety.

[0103] 0056 The third embodiment, as illustrated in figures 38 to 51, is almost the same as the earlier described

first embodiment, and the points of difference is the point that there is the assembly of a reverse revolution suppression coiled spring 70.

[0104] The angle adjustment tool of this invention, for example, when adapted to the headrest of a sofa, regulates the swinging to the inclined direction of the second arm 20 which is buried in the headrest in multiple stages, and is a configuration which holds the position of the reclining locations. With that, the second arm 20 may be extremely lightly swung to the upright direction.

[0105] However, when the user sits down on the seat part of the sofa, a tensile force acts on the surface material covering the seat part, the back support and the headrest. Because of that, there is an unintentional pull of the headrest to the upright direction, and there is a risk that holding of the desired final reclined state is not enabled. These types of inconveniences often occur during the fabric upholstery stretching operation of the sofa manufacture and during reupholstering thereof. For this reason, it is convenient to upholster the covering so as not to generate slack in the covering.

[0106] In this embodiment, the object is to resolve those earlier described inconveniences.

[0107] 0057 In other words, the third embodiment is almost the same as the first embodiment, and as illustrated in figures 40 and 41, there is the provision of the first arm 10, the second arm 20, the non-contacted free-floating holding means 30, the floating wedge member 40, the first and second covers 50 and 52, and the reverse revolution suppression spring 70. Then, the first arm 10 and the second arm 20 are integrated in a swingable manner centered on the axial center L, via the pivot 57.

[0108] Points of difference between the third embodiment and the first embodiment are the opposing wall means 13 of the first arm 10, the second arm 20, the reverse revolution suppression spring 70, the pivot 57, and the auxiliary pin 58. The same reference numerals are applied to the same parts and the further explanation thereof is abbreviated here.

[0109] 0058 The axial hole 15 of the opposing wall means 13 is not round but a hexagonal shaped hole. This is so that there is prevention of unnecessary revolution of the later described pivot 57. For that reason, the axial hole 15 is not limited to a hexagonal shape, and may be a polygonal shape such as a triangular shape or a quadrangular shape. Moreover, the axial hole 15 may be a mainly round shape, with a revolution stoppage function provided thereto by a substantially letter D shape.

[0110] 0059 The second arm 20 has the opposite attachment position to that of the first embodiment of the gear plate means 22 and 23 with respect to the attachment means 21, but is different from the second arm 20 of the first embodiment.

[0111] 0060 The pivot 57, as illustrated in figure 40, is almost the same as the pivot 56 in the first embodiment. However, the point of difference of the pivot 57 compared with the pivot 56 is that the basal means of the axis means has a hexagonal shaped annular rib 57a, as well as the

provision of a locking groove 57b in the head part thereof. The above described annular rib 57a is so as to prevent the free turning of the pivot 57. For that purpose, the annular rib 57a may be a polygonal shape such as a triangular shape or a quadrangular shape and the like which fits in to the earlier described axial hole 15. Moreover, the annular rib 57a may be a mainly round shape, in addition to having a substantially letter D shape providing a revolution stopping function.

[0112] 0061 The auxiliary pin 58 is for locking to the terminal means of the later described reverse revolution suppression spring 70, and is firmly fastened to the gear plate means 22 and 23 of the second arm 20.

[0113] 0062 The reverse revolution suppression spring 70 has a shape formed by means of winding a band spring material into a coiled shape, and forms the locking terminal means 71 and 72 by folding both termini thereof.

[0114] 0063 Next, the assembly method of the constituent of parts of the third embodiment, other than the usage of the pivot 57 instead of the pivot 56, is almost the same as the earlier described first embodiment. The points of difference are that the tight fastening of the auxiliary pin 58 after terminating the assembly of the first embodiment, in addition to the assembly of the locking of the locking terminal means 71 and 72 of the reverse revolution suppression spring 70 to the locking groove 57b of the pivot 57 and the auxiliary pin 58.

[0115] 0064 Next, the usage method of the angle adjustment tool of the third embodiment is explained.

[0116] Firstly, as illustrated in figure 46, when the second arm 20 is inclined in the direction of arrow A with respect to the first arm 10, the toothed surface 43 of the floating wedge member 40 adopts the meshed state with the gear means 26. Moreover, the floating wedge member 40 is formed between the linear wedge surface 18a and the gear means 26, in addition to being pushed into a wedge-shaped space which grows successively narrower along the direction of clockwise revolution. With that, the floating spring member 40 regulates the swinging of the second arm 20 to the direction A, sustaining the angle of inclination between the first arm 10 and the second arm 20 (holds fixed).

[0117] In other words, if the meshed state is as represented in figure 46, the meshing of the toothed surface 43 of the floating wedge member 40 with the gear means 26 results in no slippage of the second arm 20, and a secure hold on the angle of inclination between the first arm 10 and the second arm 20.

[0118] 0065 Conversely, as illustrated in figure 47, when the second arm 20 is swung to the direction of arrow B, the wedge operating plate 31 begins to revolve in unison with the second arm 20, as a result of the drag-around friction force generated based on the spring force of the wave - shaped spring means 34. With that, the separation of the toothed surface 43 of the floating wedge member 40 from the gear means 26 begins. Simultaneous with this, the first supporting means 37a of the wedge operating plate 31 presses down on the upper terminal

surface of the floating wedge member 40. With that, the floating wedge member 40 is slidably displaced along the linear wedge surface 18a and the guide surface 18b, to be displaced to the lower side of the wedge-shaped window means 18. As a result, a minute gap is generated between the toothed surface 43 and the gear means 26, and the floating wedge member 40 adopts the non-contacted free-floating state. In the non-contacted free-floating state, the floating wedge member 40 is supported on the four locations of the wedge surface 18a of the wedge-shaped window means 18, the guide surface 18b, the first and second support means 37a and 37b of the wedge operating plate 31. Then, in the non-contacted and free-floating state, because there is no contact between the floating wedge member 40 and the gear means 26, there is no generation of the ear jarring metallic noise, and the second arm 20 can be swung silently in the direction of arrow B. moreover, while there is the generation of the drag-around friction force between the wedge operating plate 31 and the second arm 20, because the upper terminal surface of the floating wedge member 40 presses on the wedge operating plate 31, there is no meshing together of the toothed surface 43 and the gear means 26.

[0119] In other words, while the operation of the swinging motion of the second arm 20 to the direction of arrow B is being performed, the floating wedge member 40 is held without generating a harsh metallic noise, holding the non-contacted state between the toothed surface 43 of the floating wedge member 40 and the gear means 26.

[0120] 0066 In addition, as illustrated in figure 48, when the second arm 20 is swung in the direction of arrow B, the upper terminal surface of the floating wedge member 40 is pressed by the first projection means 27. With that, the lower terminal means of the floating wedge member 40 presses the second support means 37b of the wedge operating plate 31. As a result, the floating wedge member 40 revolves, and the position regulating pin 17 rides over the protrusion means 36 of the leaf spring piece 36, followed by, locking into the recessed means 36b for use in locking of the position regulating pin 17. Then, the second contact surface 42 of the floating wedge member 40 contacts with the inclined surface 18 c, to adopt the retracted state (figure 49).

[0121] In the retracted state, the floating wedge member 40 is stored in the retracted space, in addition to the recessed means 36b for use in locking of the leaf spring piece 36 locking to the position regulating pin 17. With that, even if the second arm 20 is swung to the direction B, by means of the spring force of the leaf spring piece 36 locking on to the position regulating pin 17, the gear means 26 and the toothed surface 43 are held in a state where they are not meshed. As a result, the wedge operating plate 31 does not revolve in tandem, and only the second arm 20 swings freely in the direction A.

[0122] 0067 Next, as illustrated in figure 50, when the second arm 20 is swung to the direction of arrow A, immediately before the final position comprising the open

angle of the second arm 20 with respect to the first arm 10, the locking pin 29 of the gear plate means 23 locks with the locking lug means 35 of the wedge operating plate 31. With this, when the second arm 20 is swung slightly strongly in the direction of arrow A, the wedge operating plate 31 swings to the clockwise revolving direction (direction A) around the pivot 57. With that, the position regulating pin 17 is released from the recessed means 36b for use in locking of the leaf spring piece 36, and the position regulating pin 17 is displaced to the recessed means 36c for use in guiding of the leaf spring piece 36. As a result, the second support means 37b of the wedge operating plate 31 pushes up the lower terminal surface of the floating wedge member 40, and the floating wedge member 40 which is in the recessed state is displaced upwards. On this occasion, because the upper terminal surface of the floating wedge member 40 is also in contact with the first support means 37a of the wedge operating plate 31, the floating wedge member 40 does not generate a harsh metallic noise. Then, as a result of the drag-around friction force generated between the wedge operating plate 31 and the first arm 10, both revolve in tandem. As a result, the floating wedge member 40 is slidably displaced to the upper part of the wedge-shaped window means 18 (wedge-shaped space) along the linear wedge surface 18a and the guide surface 18b, and the toothed surface 43 of the floating wedge member 40 and the gear means 26 adopt the meshed state (Figure 51).

[0123] 0068 Now in this embodiment, the position where the second arm 20 is in a right angle state (90°) with respect to the first arm 10 is the final deployed position, but it is not necessarily limited to that. By appropriately selecting the range of the center angle provided on the gear means 26, for example, the second arm 20 may have a position forming a 120° angle with respect to the first arm 10, as the final deployed position thereof.

[0124] 0069 Next, when the second arm 20 is swung once more to the direction of arrow B, as illustrated in figure 47, the wedge operating plate 31 begins to revolve in tandem together with the second arm 20 as a result of the drag-around friction force of the spring force of the wave-shaped spring means 34. Then, the first support means 37a of the wedge operating plate 31 presses on the upper terminal surface of the floating wedge member 40. With this, the floating wedge member 40 is displaceably slid along the wedge surface 18a of the wedge-shaped window means 18 and the guide surface 18b, slightly displacing away from the direction of the gear means 26. As a result, a minute gap is generated between the toothed surface 43 and the gear means 26, and once more the floating wedge member 40 adopts the non-contacted free-floating state. Therefore, even if the second arm 20 is swung in the direction of arrow B, there is no generation of a harsh metallic noise.

[0125] Then, when the second arm 20 is swung in the direction of arrow A, the second support means 37b of the wedge operating plate 31 pushes up the lower terminal

means of the floating wedge member 40, for the sliding displacement thereof. With that, the toothed surface 43 of the floating wedge member 40 and the gear means 26 adopt the meshed state. Furthermore, the floating wedge member 40 is formed between the wedge surface 18a and the gear means 26, in addition to being pushed into the wedge-shaped space which grows successively narrower along the clockwise revolving direction. With that, the floating wedge member 40 regulates the swinging of the second arm 20 to the direction A by means of the wedge effect, sustaining the angle of inclination of the first arm 10 and the second arm 20 (held fixed) (Figure 46).

[0126] 0070 As explained above, by means of the third embodiment, even if the second arm 20 is swung to either of the directions A or B, there is no generation of a harsh metallic noise, and there is the benefit of the derivation of a quiet angle adjustment tool.

[0127] 0071 Moreover, by means of this embodiment, for example, in figure 46, by means of the covering material which is not illustrated in the figures, even if a tensile force acts in the direction of arrow B on the second arm 20, this tensile force is suppressed by the spring force of the reverse revolution suppression spring 70. With that, in the third embodiment, the prevention of the generation of the inconveniences based on the tensile force acting on the covering material is enabled. In the same manner, there is the benefit of enabling the prevention of the inconveniences based on the tensile forces of the covering material generated in the manufacturing processes.

[0128] 0072 In the embodiment described above, an explanation was provided wherein the first arm 10 is fixed and the second arm is swung, but there is no limitation to this. For example, the second arm 20 may be fixed and the first arm 10 may be swung.

[0129] 0073 The angle adjustment tool of the present invention may, of course, combine features of the third embodiment in the second embodiment. With that, not only is there the generation of an impact noise on locking, an angle adjustment tool may be derived which enables suppression of the swinging of the second arm to the upright direction by a sofa.

Industrial Utility

[0130] 0074

[0131] The angle adjustment tool of the present invention may be employed in seating chairs, so files, headrests, footrests and the like. In addition, for example, it may also be adapted to shelves with doors which swing open and closed.

Explanation of the reference numerals

[0132] 0075

10 first arm

11 attachment means

12 opposing wall means
 13 opposing wall means
 14 rivet
 15 axial hole
 17 position regulating pin
 18 wedge-shaped window means
 18a wedge surface
 18b guide surface
 18c inclined surface
 18d circular arc surface
 19a locking hole
 19b contact pin
 20 second arm
 21 attachment means
 22 gear plates means
 23 gear plate means
 24 rivet
 25 axial hole
 26 gear means
 27 first projection means
 28 second projection means
 29 locking pin
 30 non-contacted free-floating holding means
 31 wedge operating plate
 32 axial hole
 33 annular sliding contact means
 34 wave -shaped spring means
 35 locking lug means
 36 leaf spring piece
 36a protrusion means
 36b recessed means for use in locking
 36c recessed means for use in guiding
 37 aperture window means
 37a first support means
 37b second support means
 37c first connection means
 37d second connection means
 40 floating wedge member
 41 first contact surface
 42 second contact surface
 43 toothed surface
 44 third contact surface
 45 fourth contact surface
 46 circular arc surface
 47 circular arc surface
 48 circular arc surface
 50 first cover
 51 axial hole
 52 second cover
 53 axial hole
 54 elastic lug means
 55 metal washer
 56 support axis
 57 support axis
 58 auxiliary pin
 60 biasing spring
 61 locking terminal means
 70 reverse revolution suppression spring

71 locking terminal means
 72 locking terminal means
 L axial center
 A swinging direction
 5 B swinging direction
 M middle axis of first arm
 a longitudinal extension of linear wedge surface
 b linear extension at the floating wedge member

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Claims

1. An angle adjustment tool having a first arm (10) providing a wedge-shaped window means (18) having a linear wedge surface (18a), and

15 a second arm (20), wherein the second arm (20) provides for a support for enabling swinging about an axial center of the first arm (10), wherein further the second arm (20) has circular arc-shaped gear means (26), wherein further the adjustment tool provides for a floating wedge member (40) regulating the swinging motion of the second arm (20) to a deployed direction with respect to the first arm (10), the floating wedge member (40) having a toothed surface (43)

20 able to mesh with the gear means (26), wherein the regulating of the swinging motion is performed by slidable displacement of a linear contact surface (41) of the wedge member (40) along a linear wedge surface (18a) of the wedge-shaped window means (18), wherein further the floating wedge member (40) is displaceably stored in a wedge-shaped space concerning which are also, in view of the wedge-shaped window means (18), arranged the gear means (26), wherein further the linear contact surface (41) which is able to contact with the linear wedge surface (18a) is positioned on an edge of the wedge-shaped window means (18),

25 wherein further the floating wedge member (40) has a toothed surface (43) on the other surface side which is able to mesh with the gear means (26) which are not part of the wedge-shaped window means (18).
2. The angle adjustment tool claimed in claim 1, **characterized by** forming a linear guide surface (18b) parallel with respect to said wedge surface (18a) positioned opposite the wedge surface (18a) of the wedge-shaped window means (18).

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3. The angle adjustment tool claimed in claim 1 or claim 2, **characterized by** the formation of the contact surface (44) in parallel with said contact surface (41) on the edge means of the toothed surface (43) of said floating wedge member (40).

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4. The angle adjustment tool claimed in any one claim of claims 1 to 3, **characterized by** the floating wedge member (40) forms a pair of linear contact surfaces

40

(41, 42) in a mirrored surface shape.

claim of claims 1 to 9.

5. The angle adjustment tool claimed in any one claim of claims 1 to 4, **characterized by** the formation of circular arc surfaces (46, 47, 48) between a pair of linear shaped contact surfaces (41, 42). 5

6. The angle adjustment tool claimed in any one claim of claims 1 to 5, **characterized by** the provision of a non-contact free-floating holding means (30) holding the toothed surface (43) of the floating wedge member (40) and the gear means (26) of the second arm (20) in a non-contacted free-floating manner. 10

7. The angle adjustment tool claimed in claim 6, **characterized by** a configuration wherein said non-contacted free-floating holding means (30) provides a wedge operating plate (31) revolved by a small angle amount by means of the drag-around friction force with said second arm (20), 15 20
 and said wedge operating plate (31) causes said toothed surface (43) of said floating wedge member (40) to be non-contacted and free from said gear means (26) in a non-contacted free-floating state, by means of swinging of said second arm (20) to one direction (B) with respect to said first arm (10), 25
 in addition, said floating wedge member (40) is pressed in between the linear shaped wedge surface (18a) formed on said first arm (10) side and said gear means (26), by means of said small angular swinging to the other direction (A), to form the meshed state of said toothed surface (43) of said floating wedge member (40) with said gear mean (26), and the relative swinging of said second arm (20) to said other direction (A) is restricted as a result of the wedge effect of said floating wedge member (40). 30 35

8. The angle adjustment tool claimed in any one claim of claims 1 to 7, **characterized by** the provision of a biasing spring (60), attached to said first arm (10), generating an impact sound when the toothed surface (43) of the floating wedge member (40) meshes with the gear means (26) to form a locked state, by means of the biasing of said floating wedge member (40) to the axial center side 40 45

9. The angle adjustment tool claimed in any one claim of claims 1 to 8, **characterized by** the provision of a reverse revolution suppression spring (70) which suppresses the swinging to the upright direction of the second arm (20) by means of the spring force of a coiled spring material, wherein one terminal means (71) is locked to the pivot (57) disposed in the axial center, and the other terminal means (72) is locked to the second arm (20). 50 55

10. The furniture **characterized by** the assembly thereof of the angle adjustment tool claimed in any one

Fig. 1

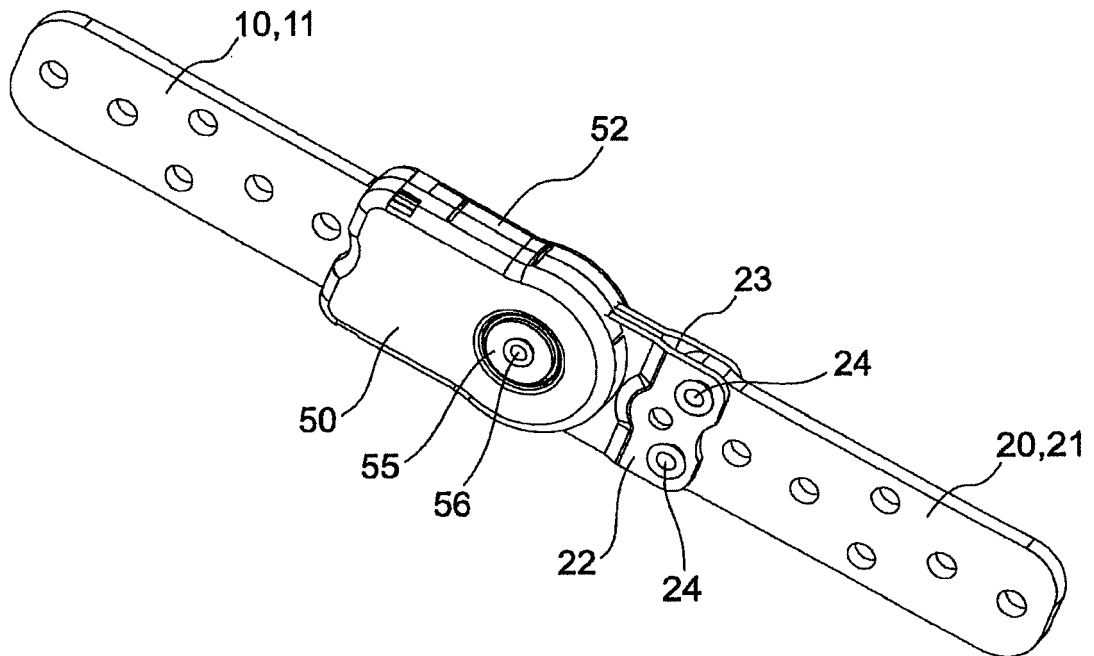


Fig. 2

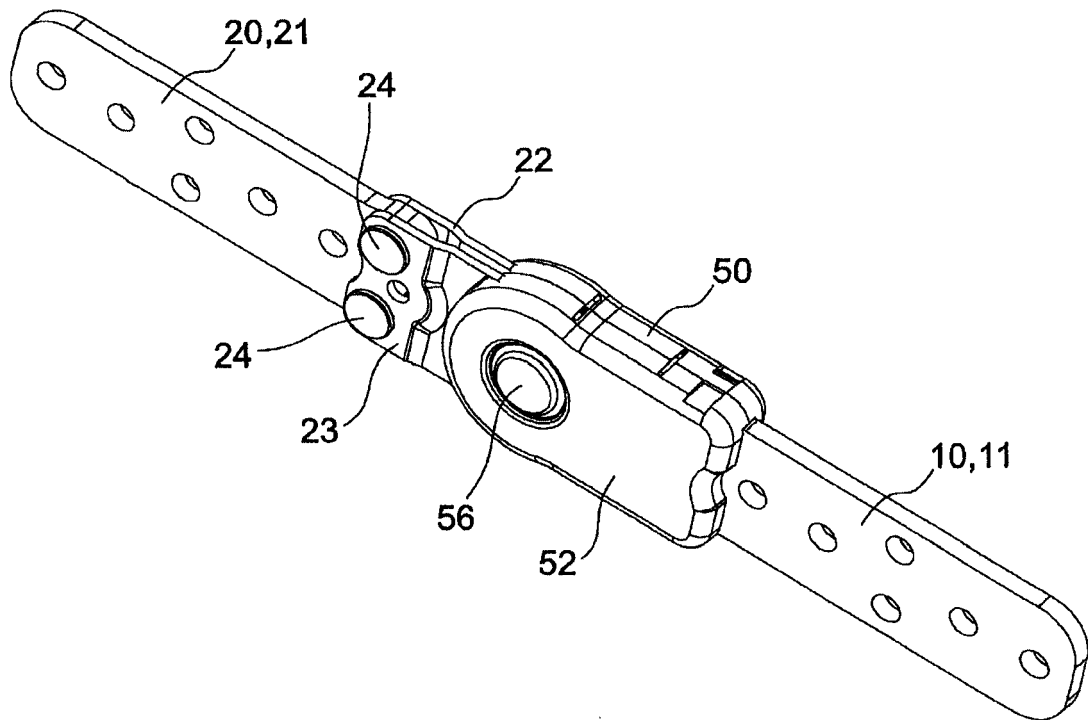


Fig. 3

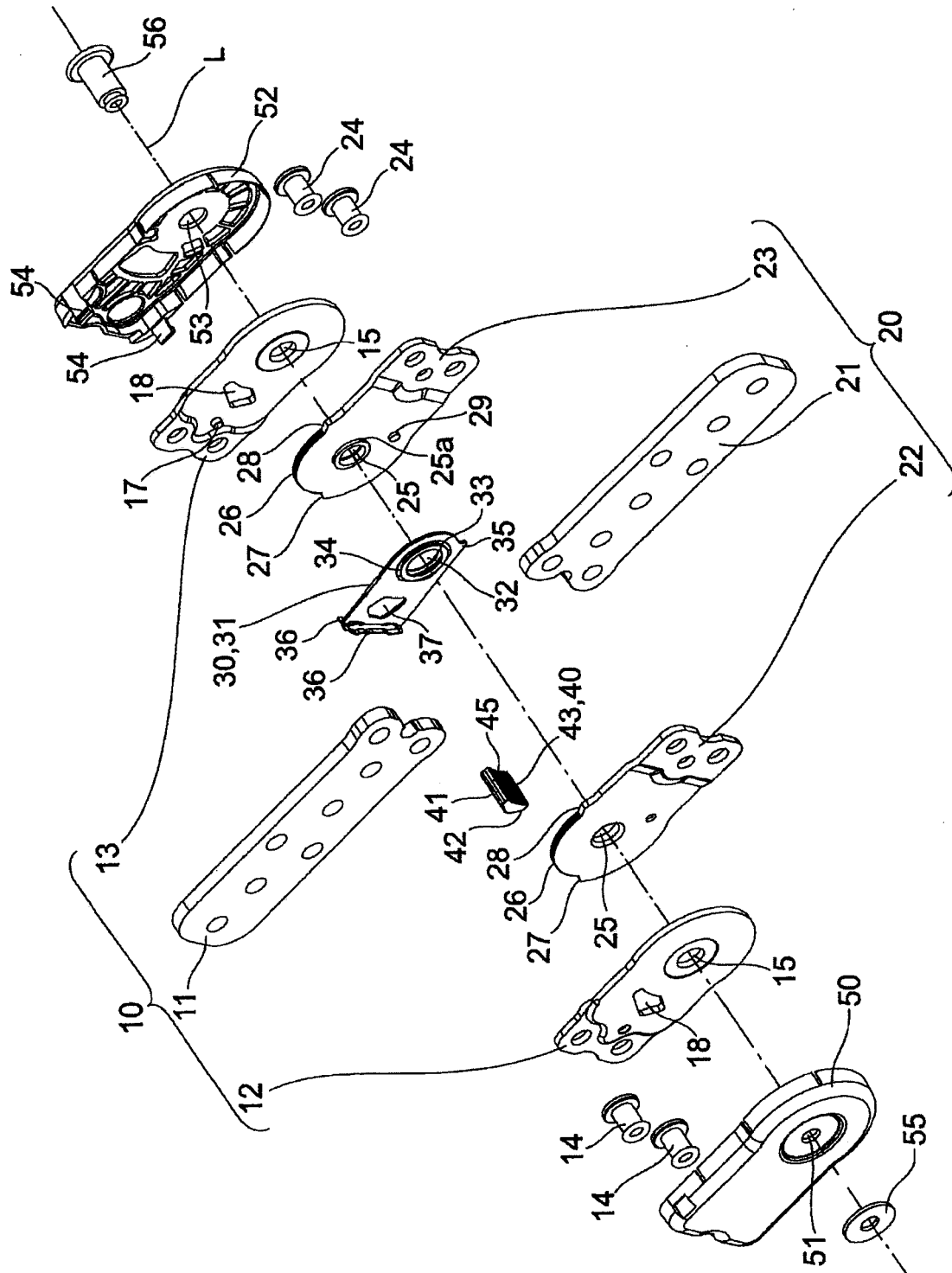


Fig. 4

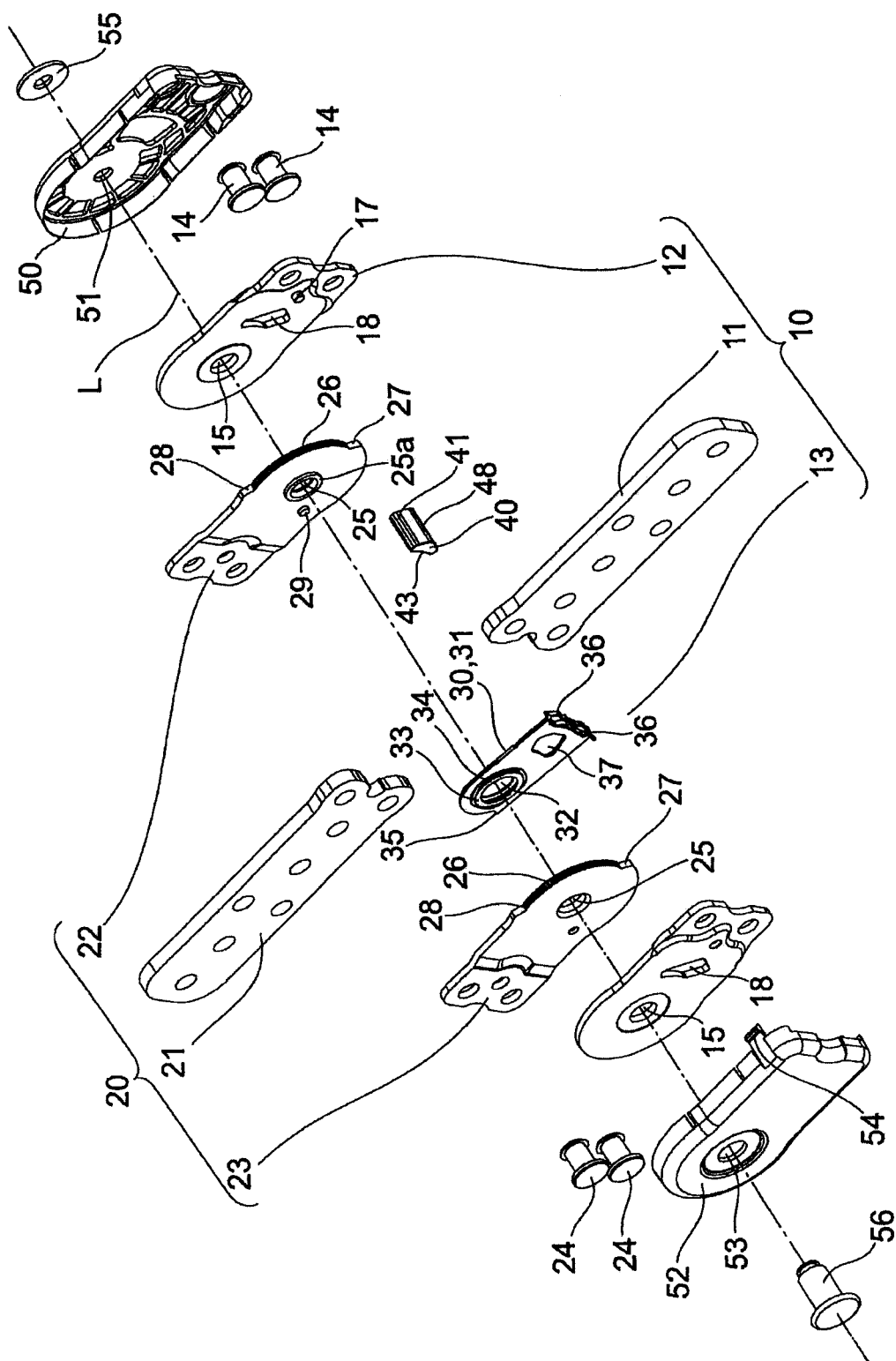


Fig. 5

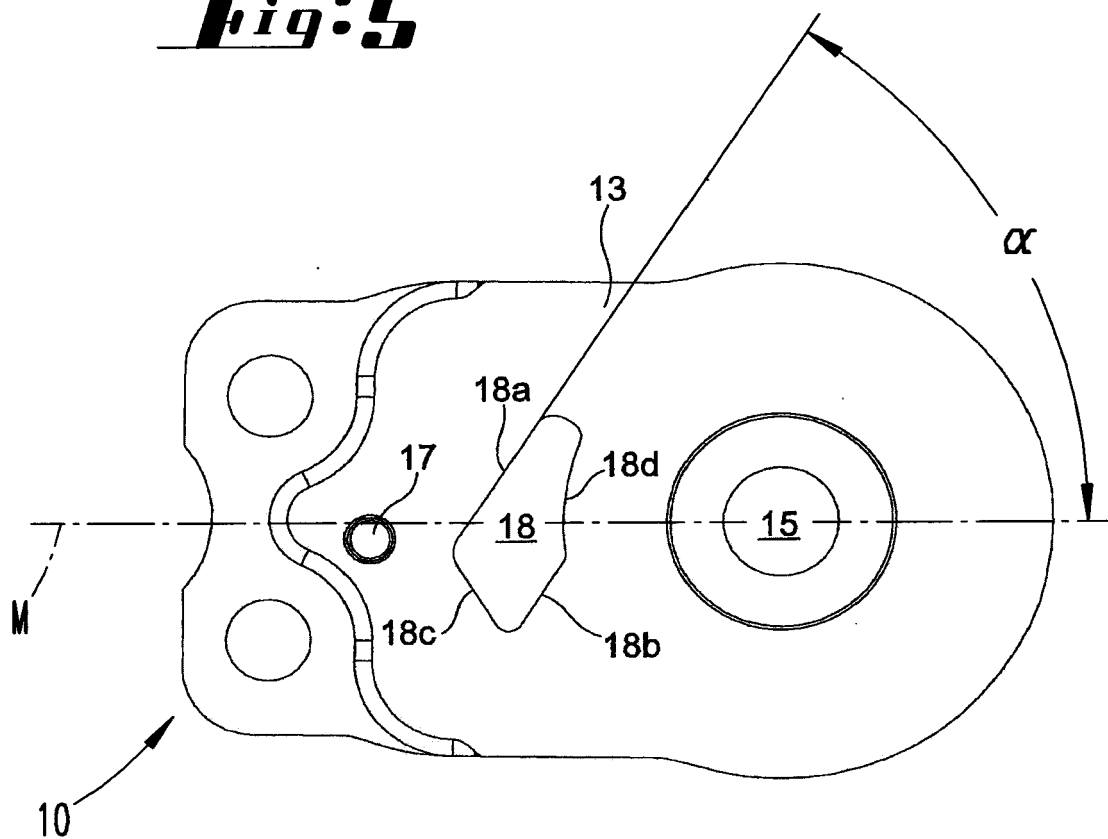


Fig. 6

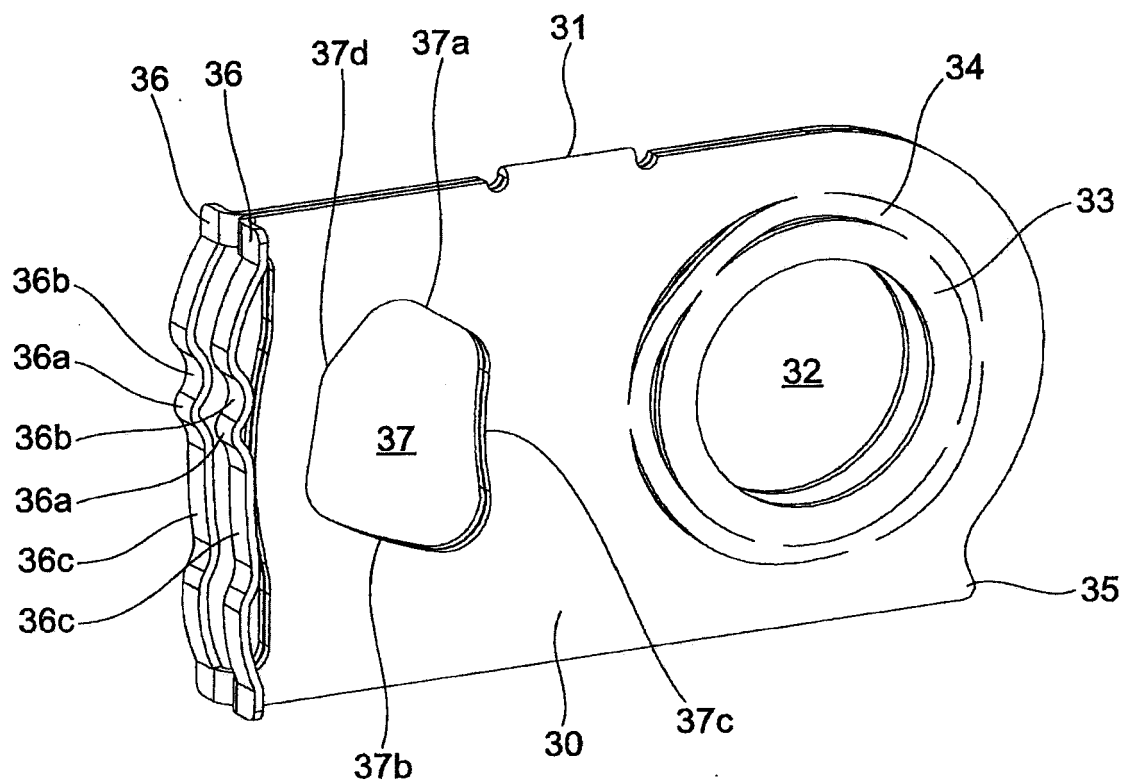


Fig. 7

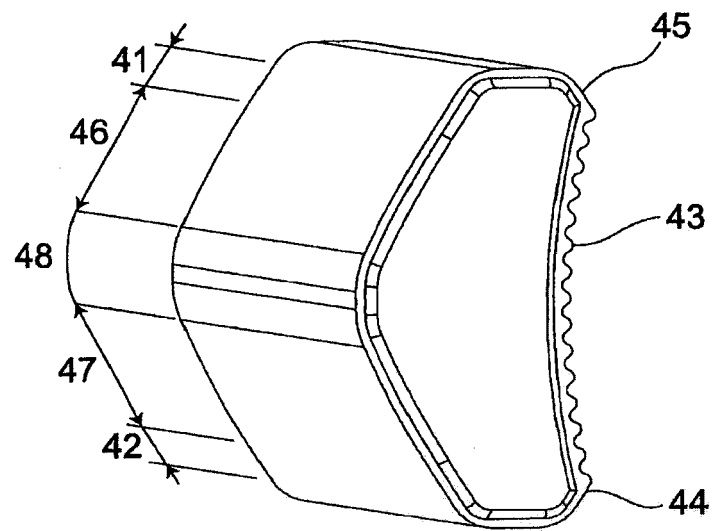


Fig. 8

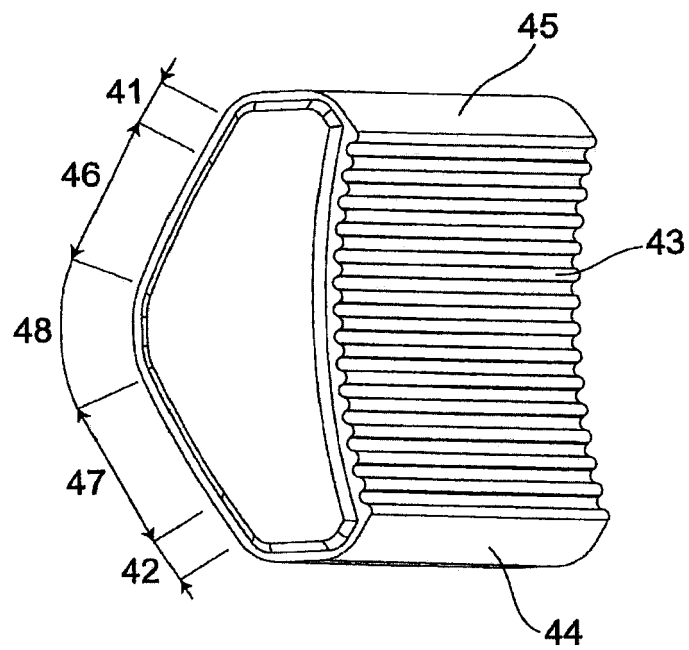


Fig: 9

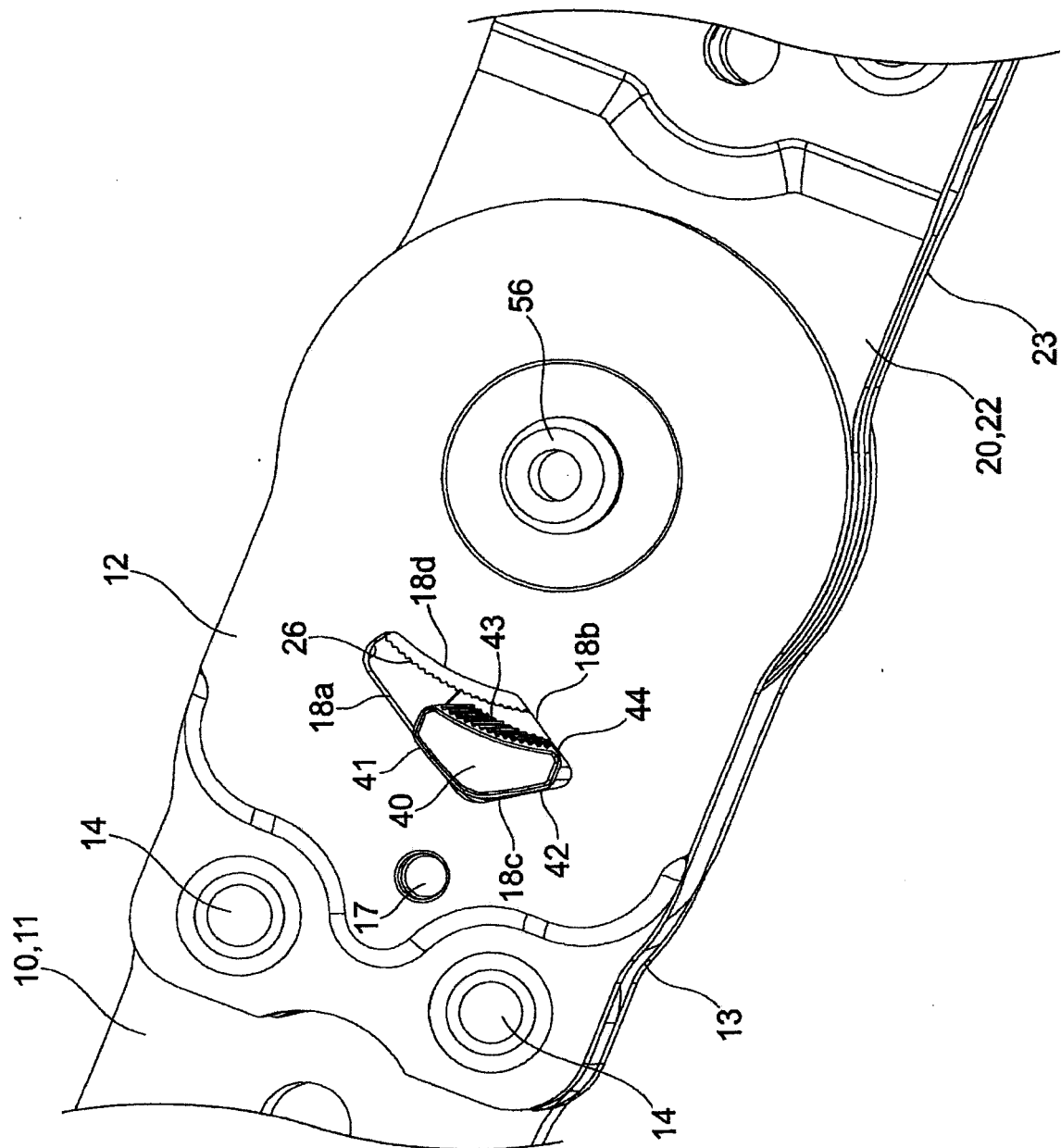


Fig: 10

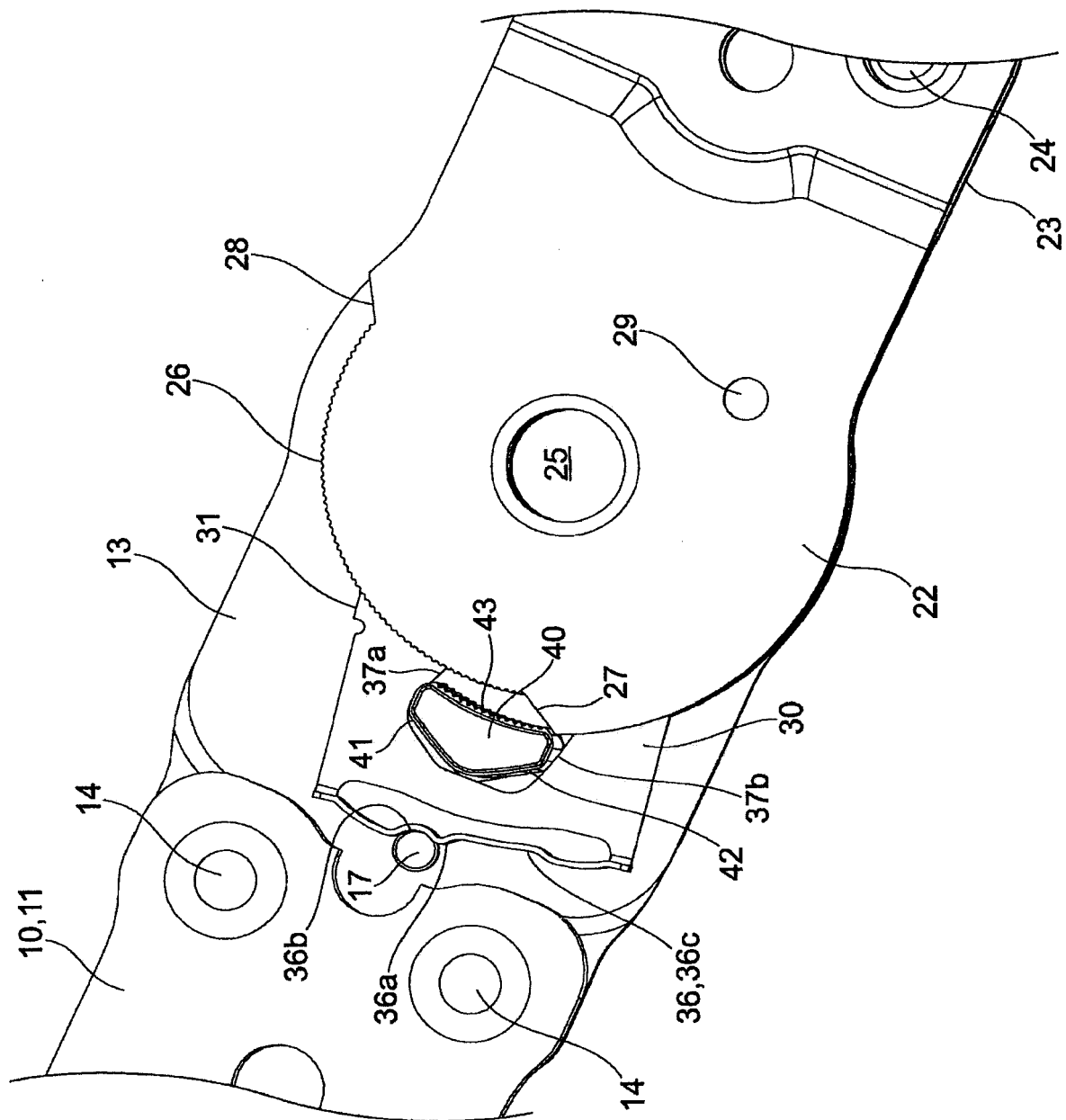


Fig. 11

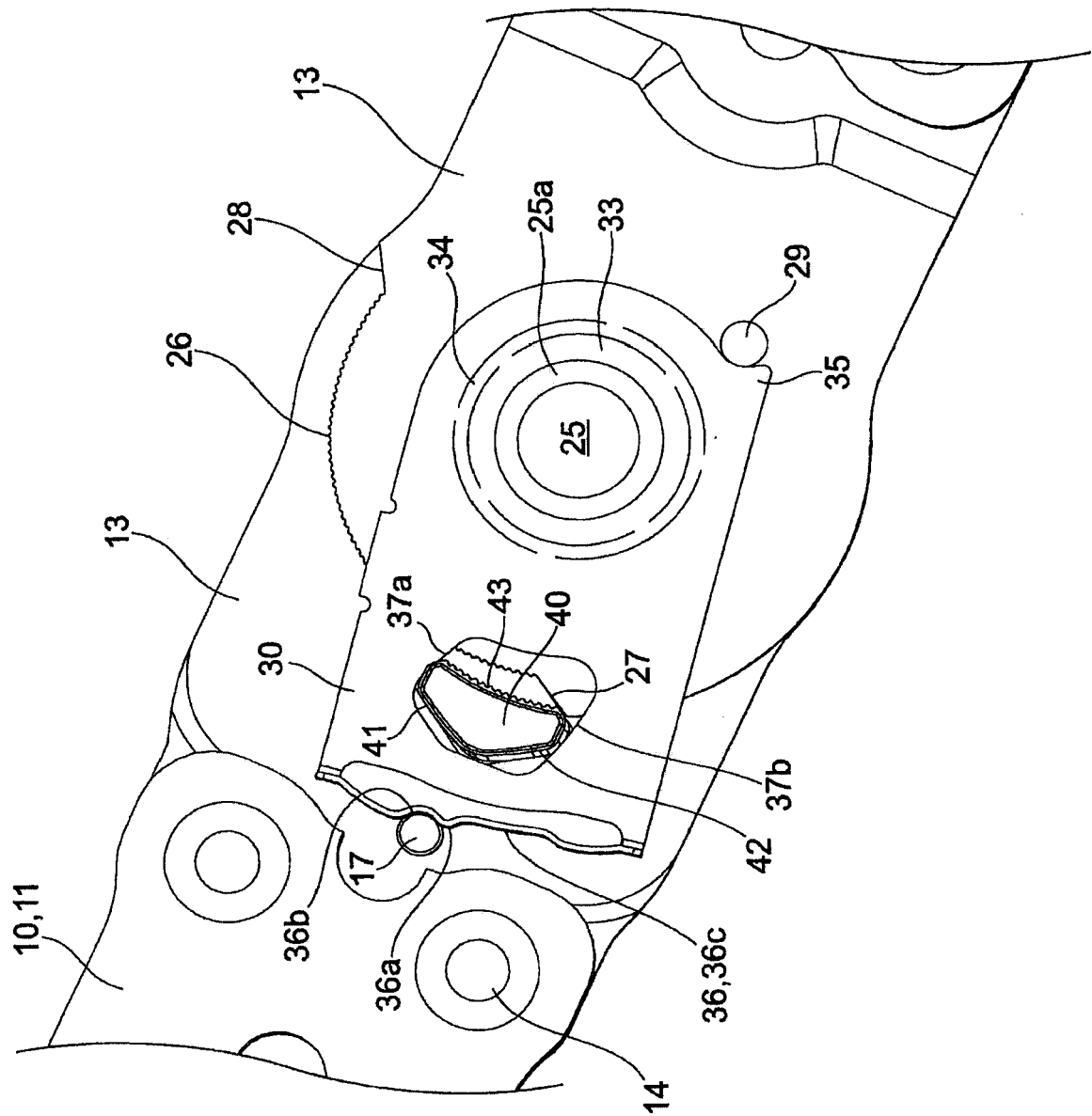


Fig. 12

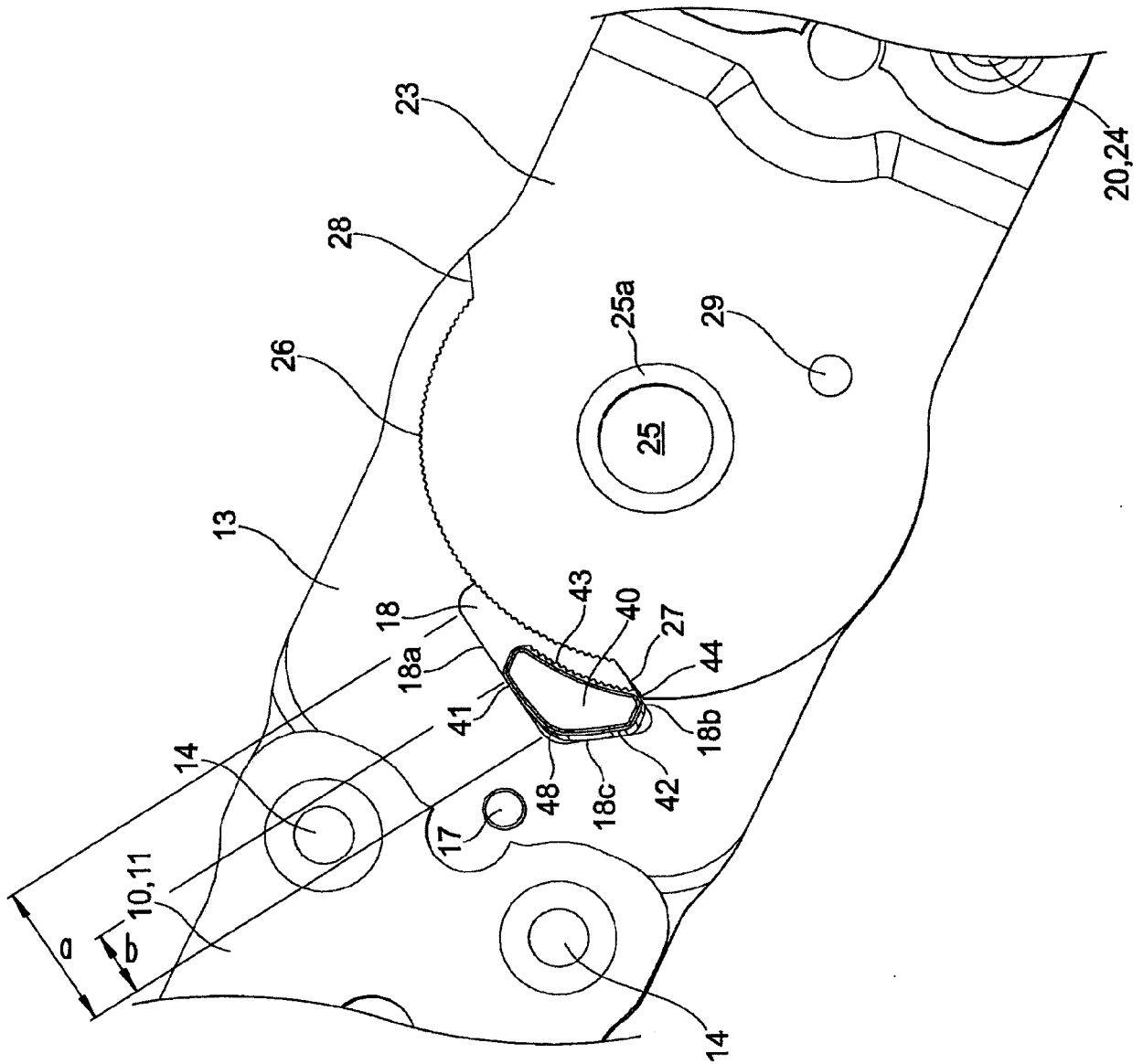


Fig. 13

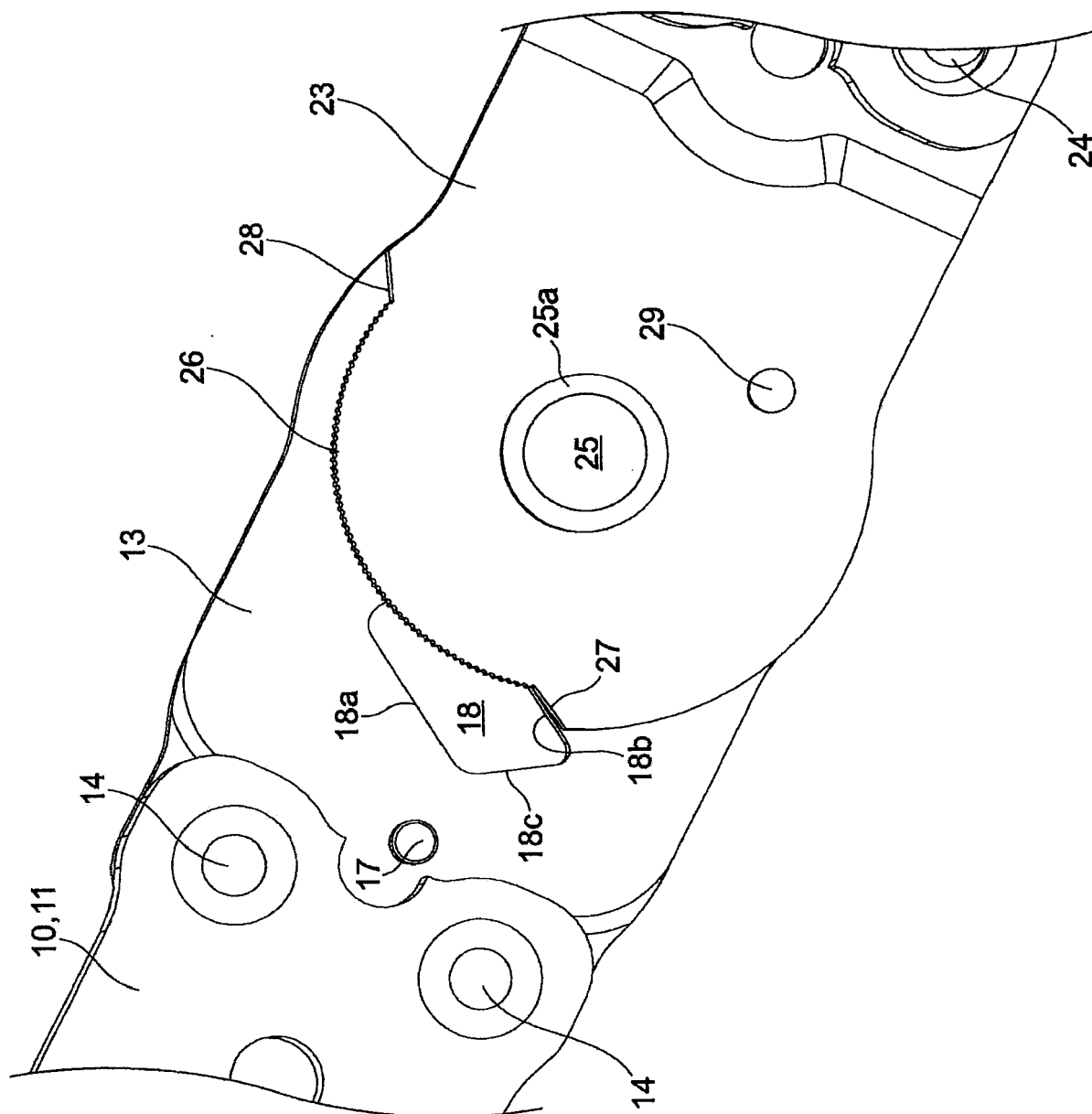


Fig. 14

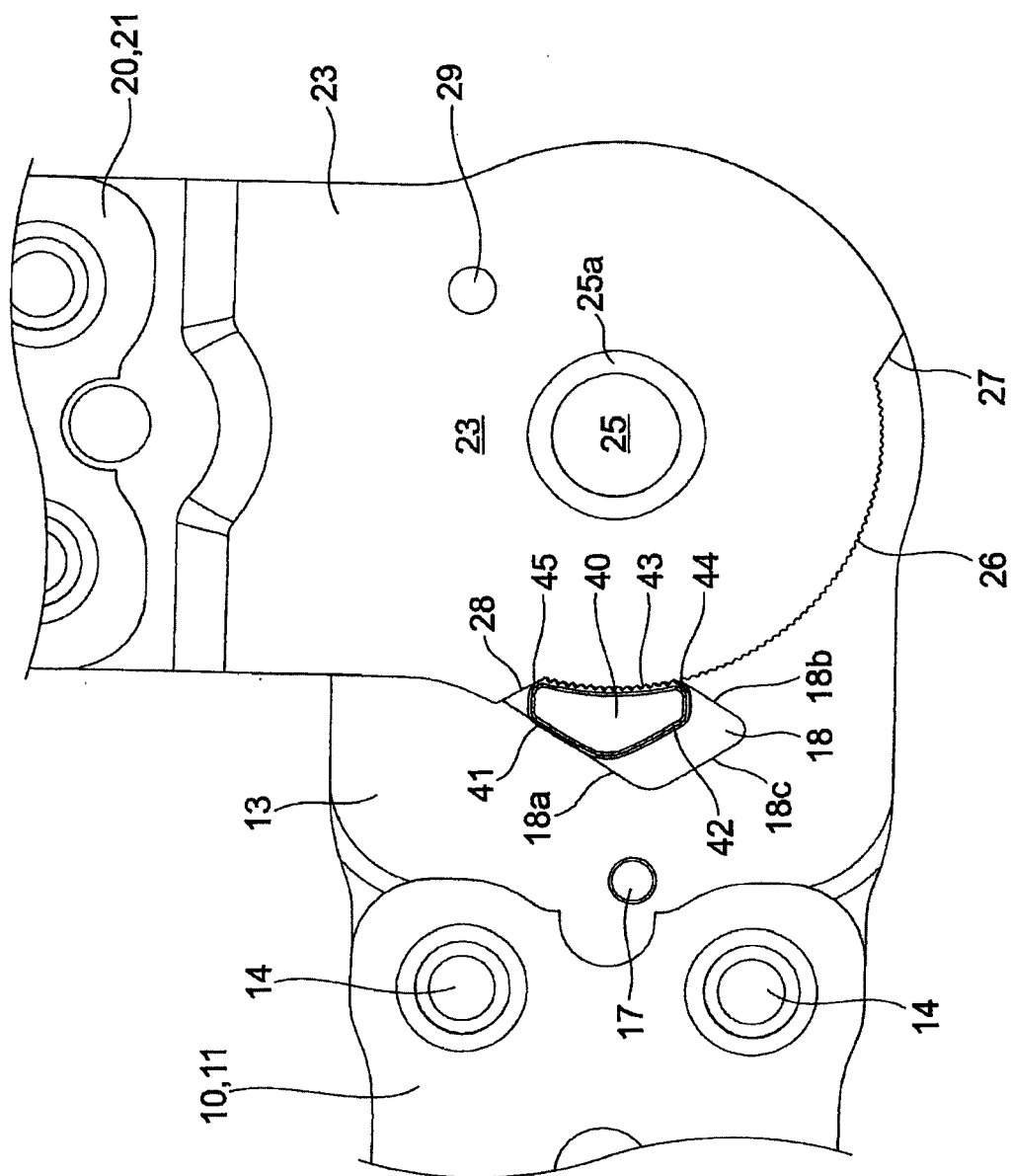


Fig. 15

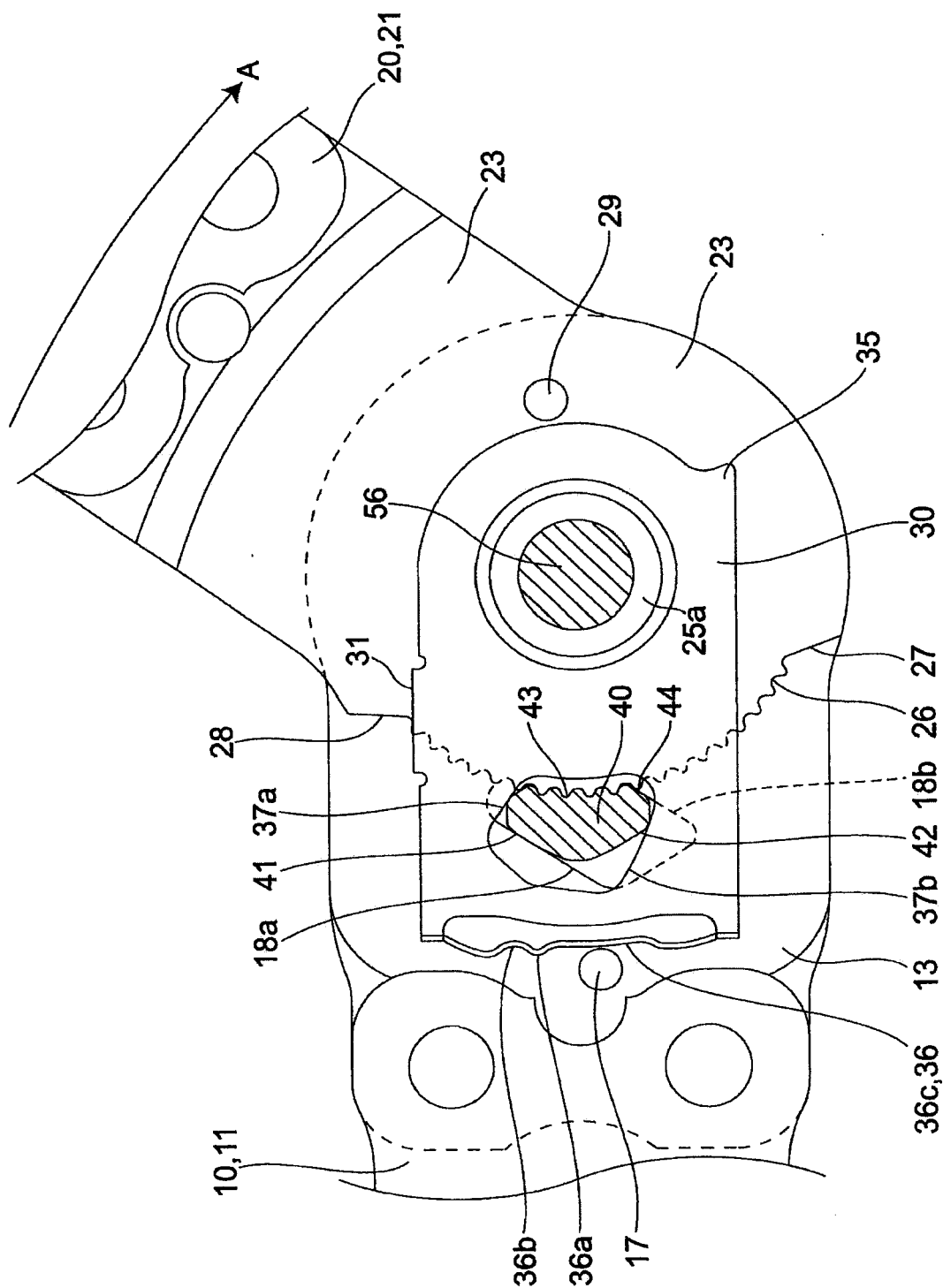


Fig: 16

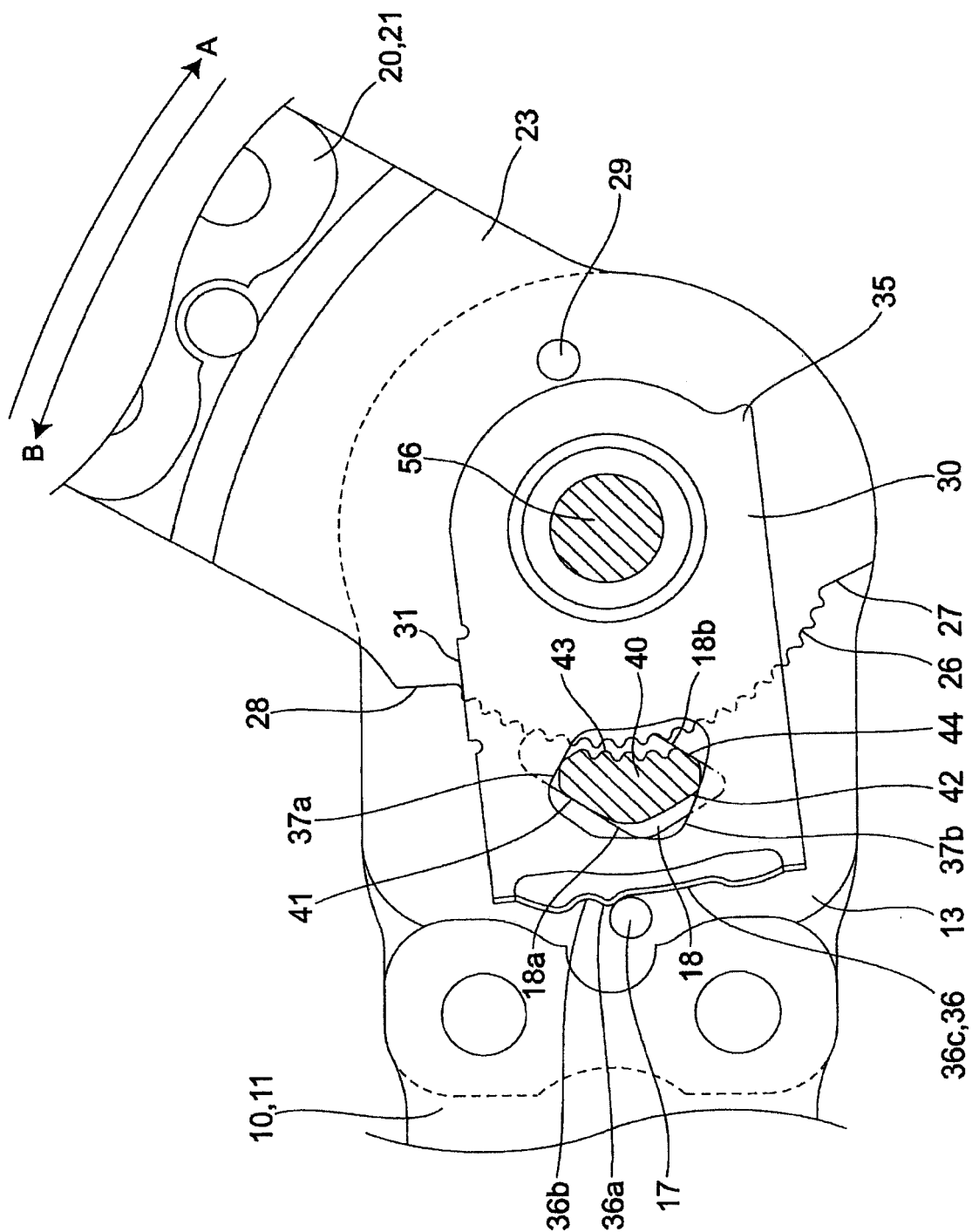


Fig. 17

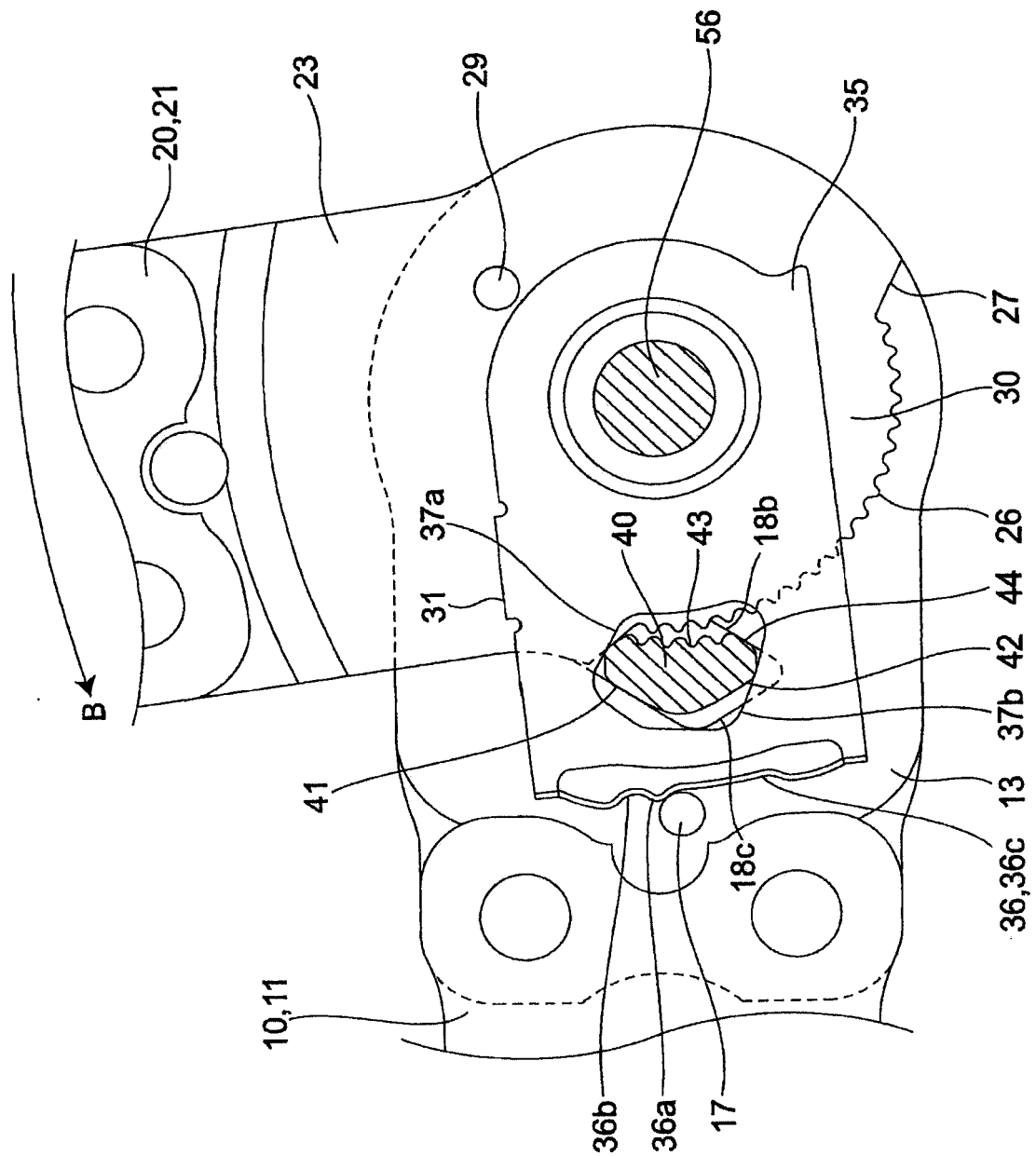


Fig: 18

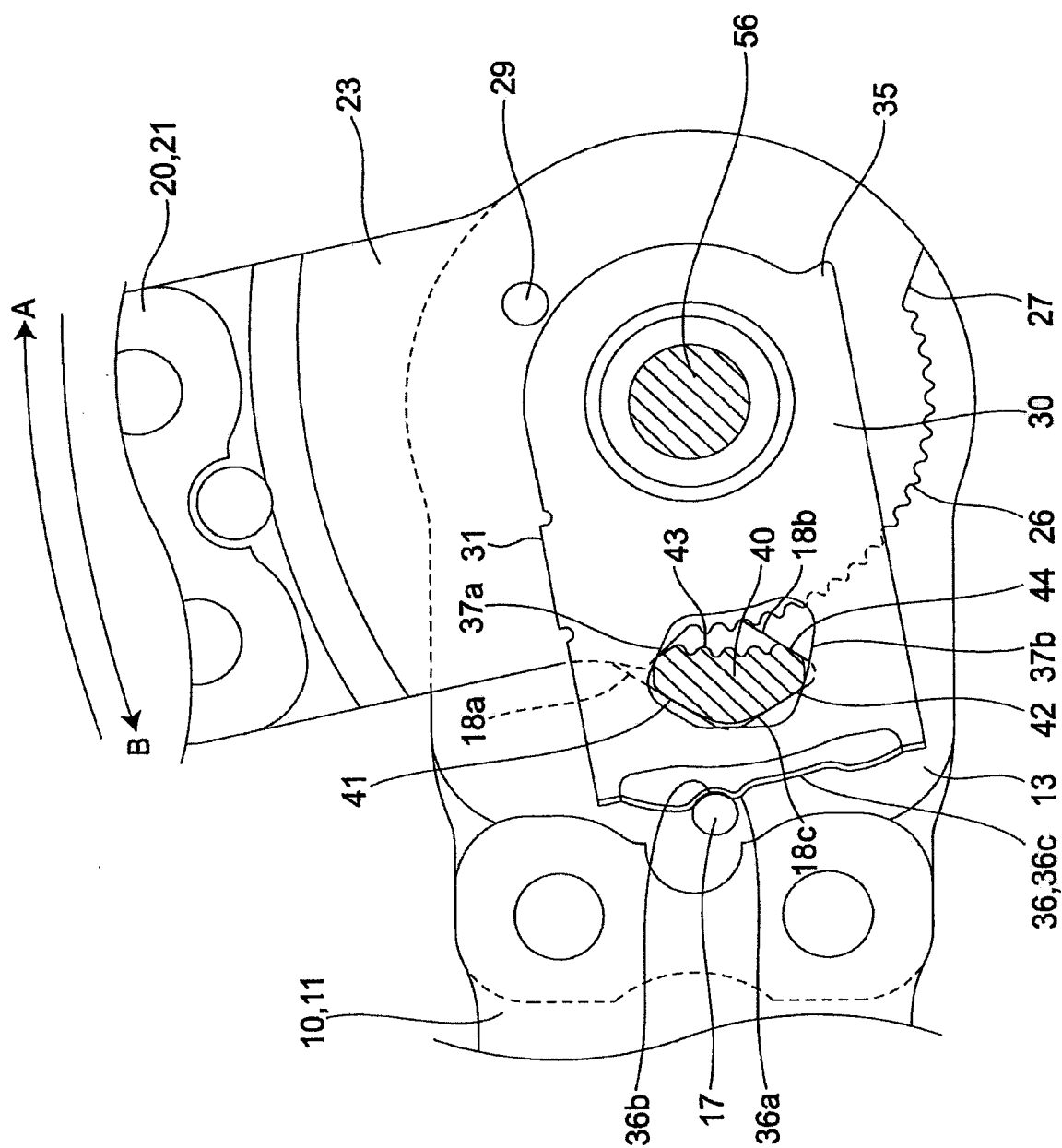


Fig: 19

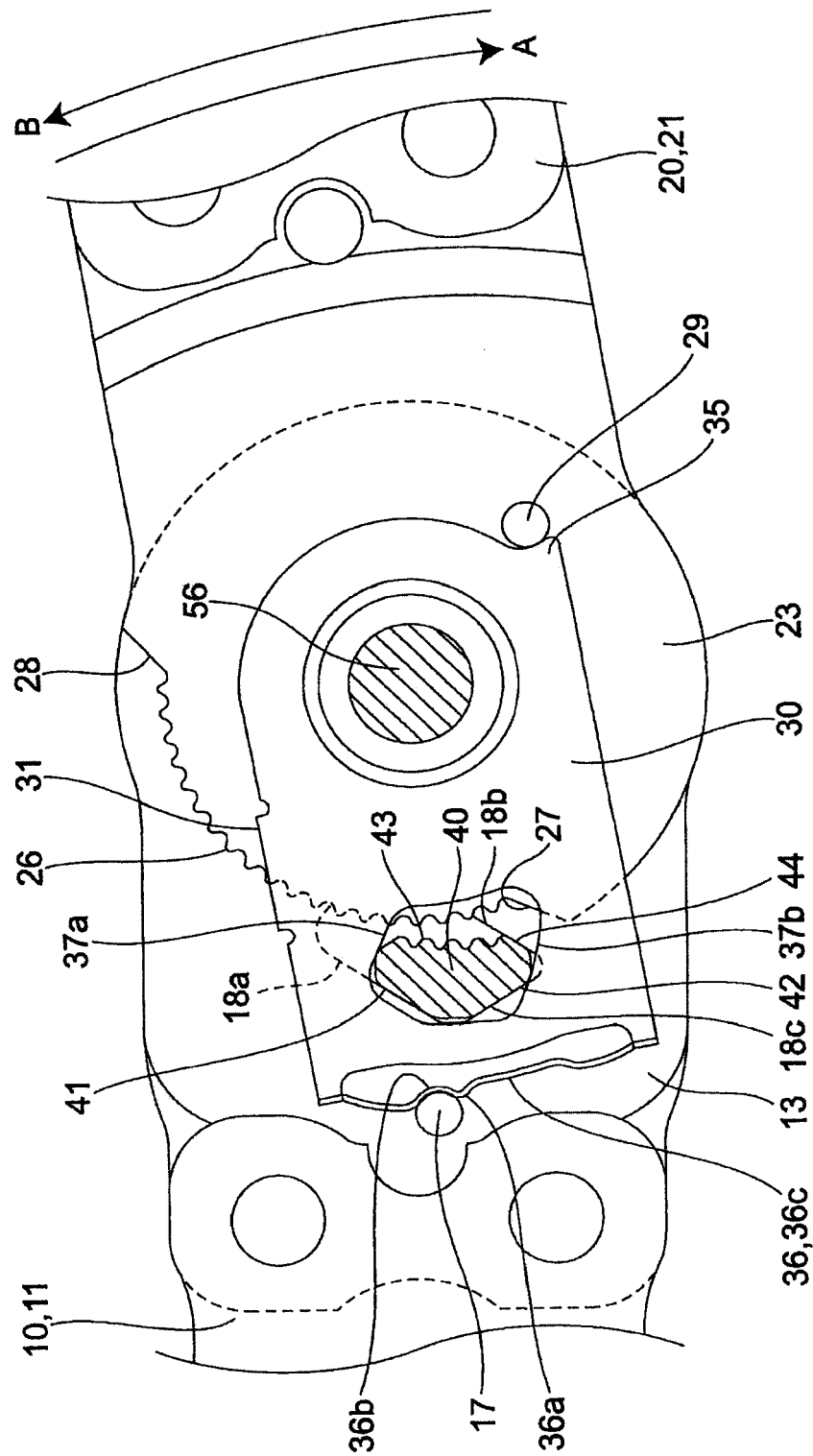


Fig. 20

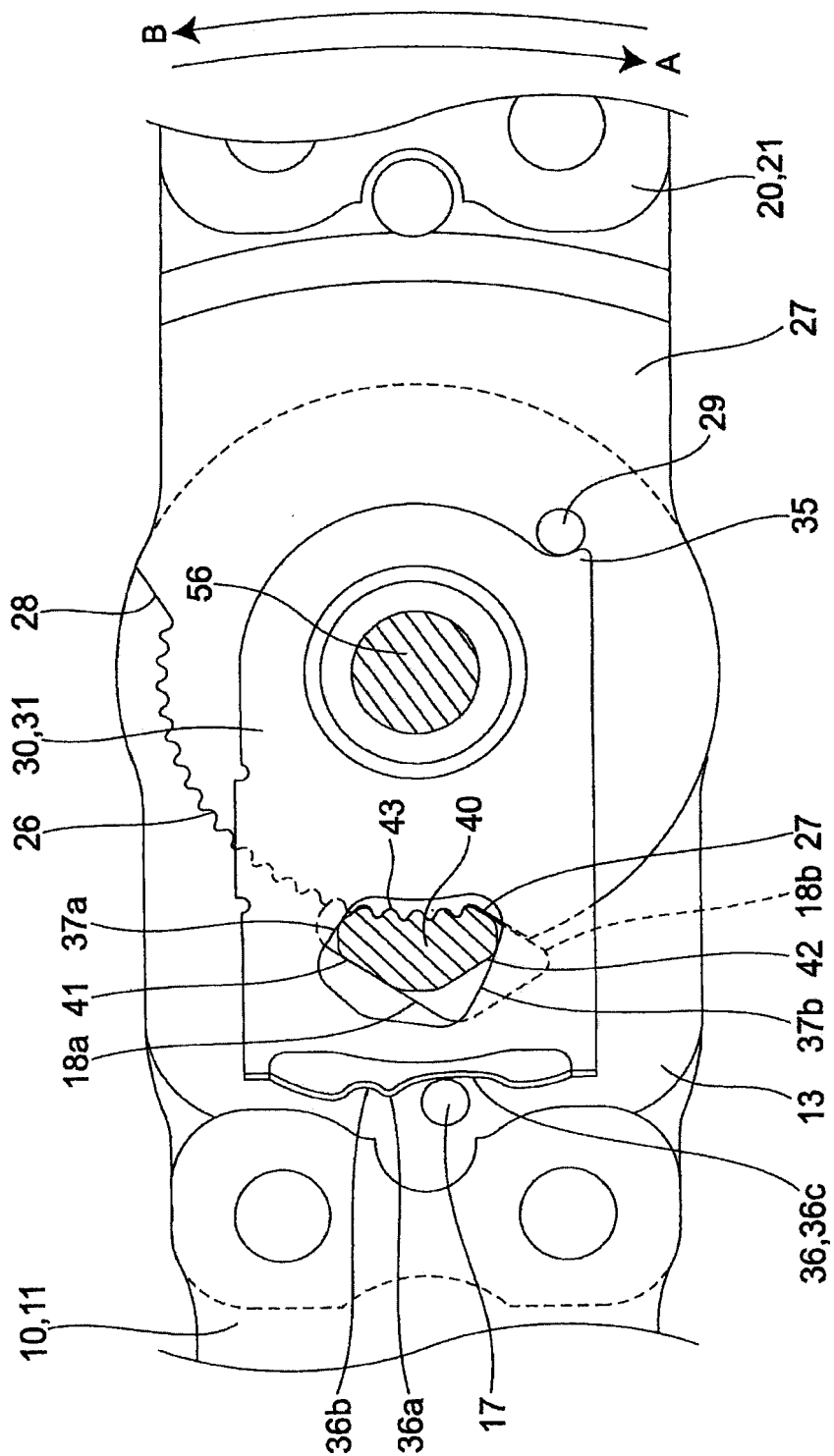


Fig. 21

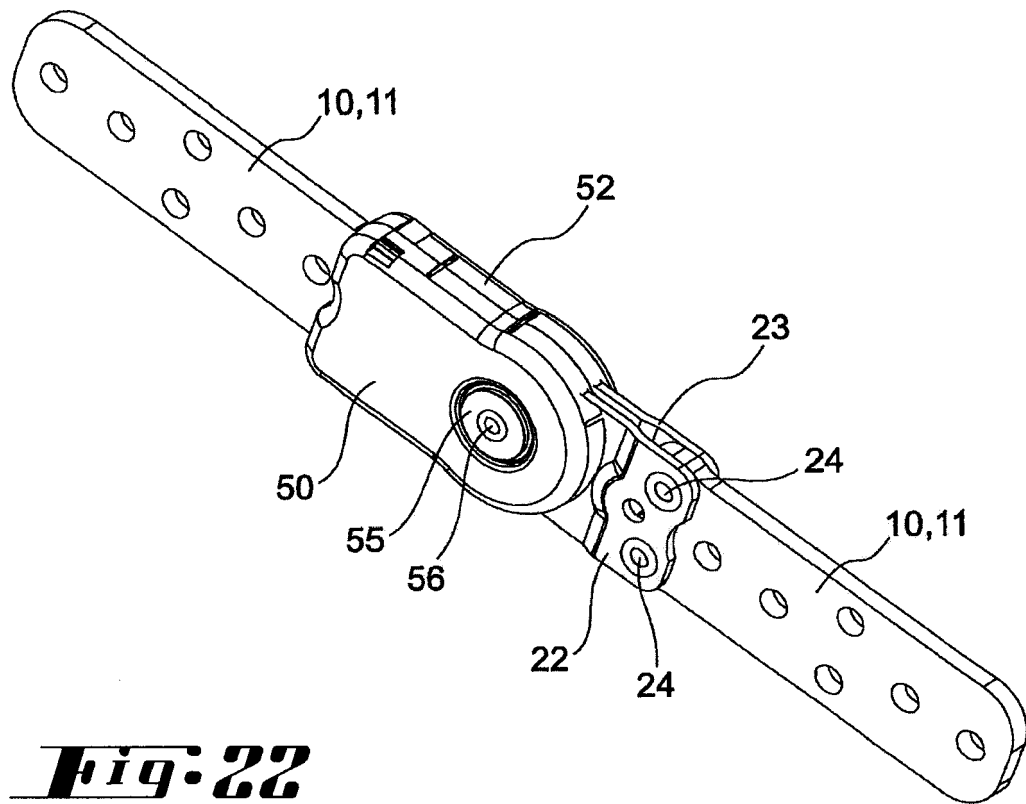


Fig. 22

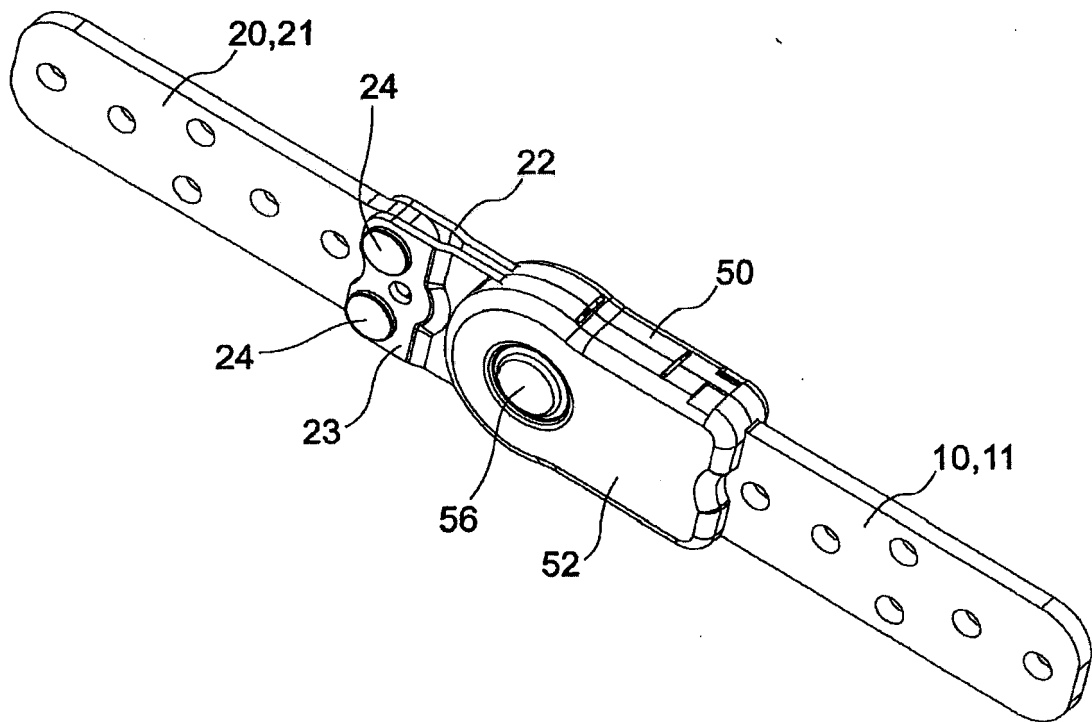


Fig. 23

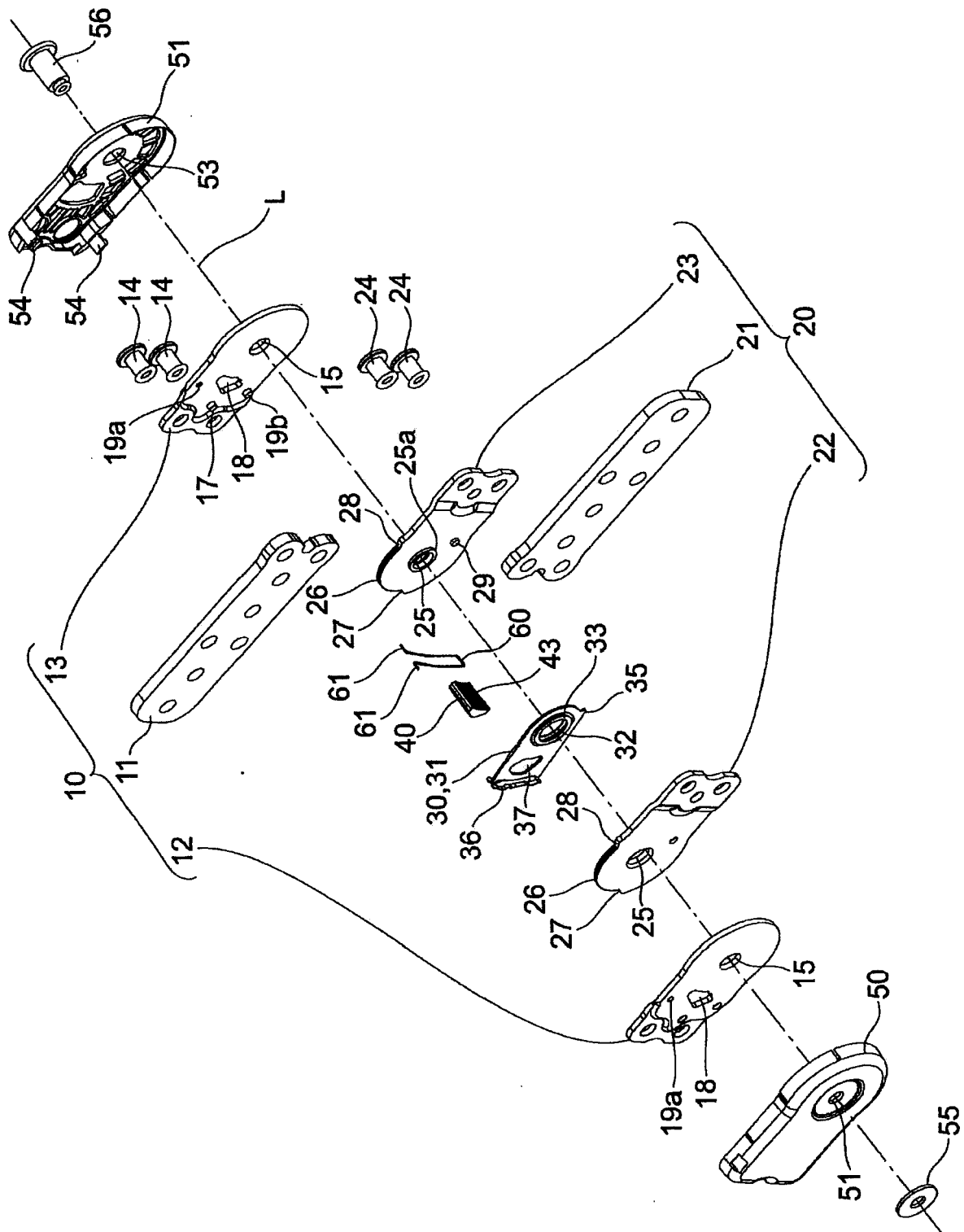


Fig: 24

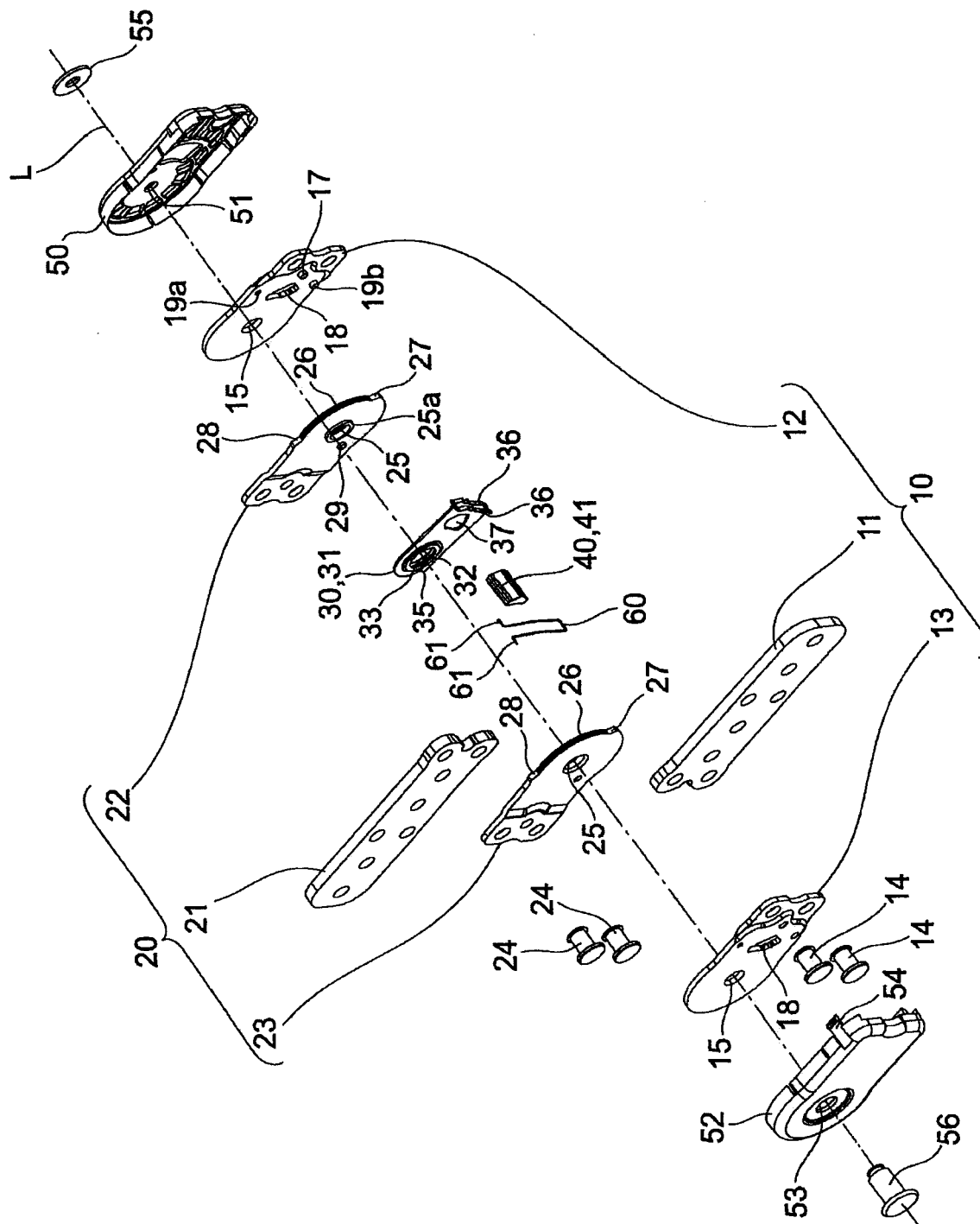


Fig: 25

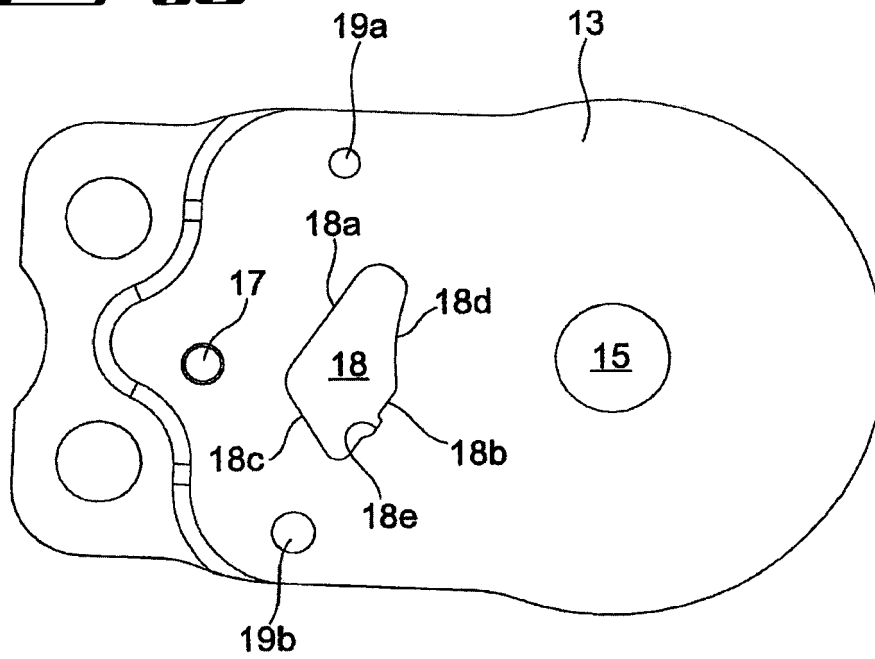


Fig: 26

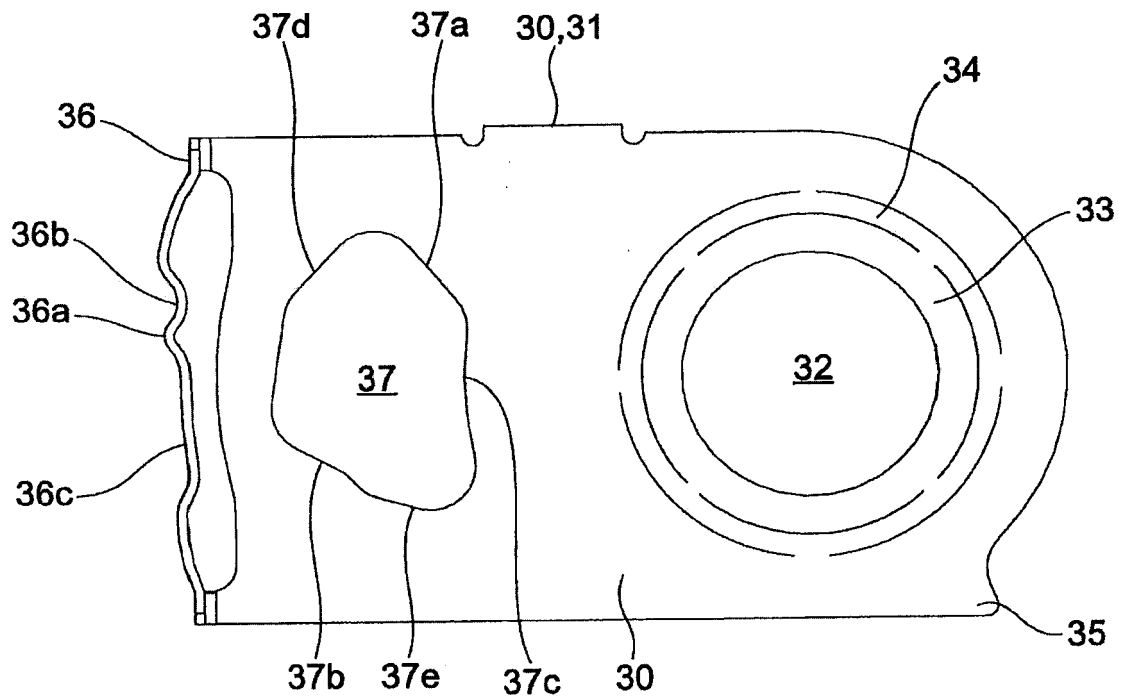


Fig. 27

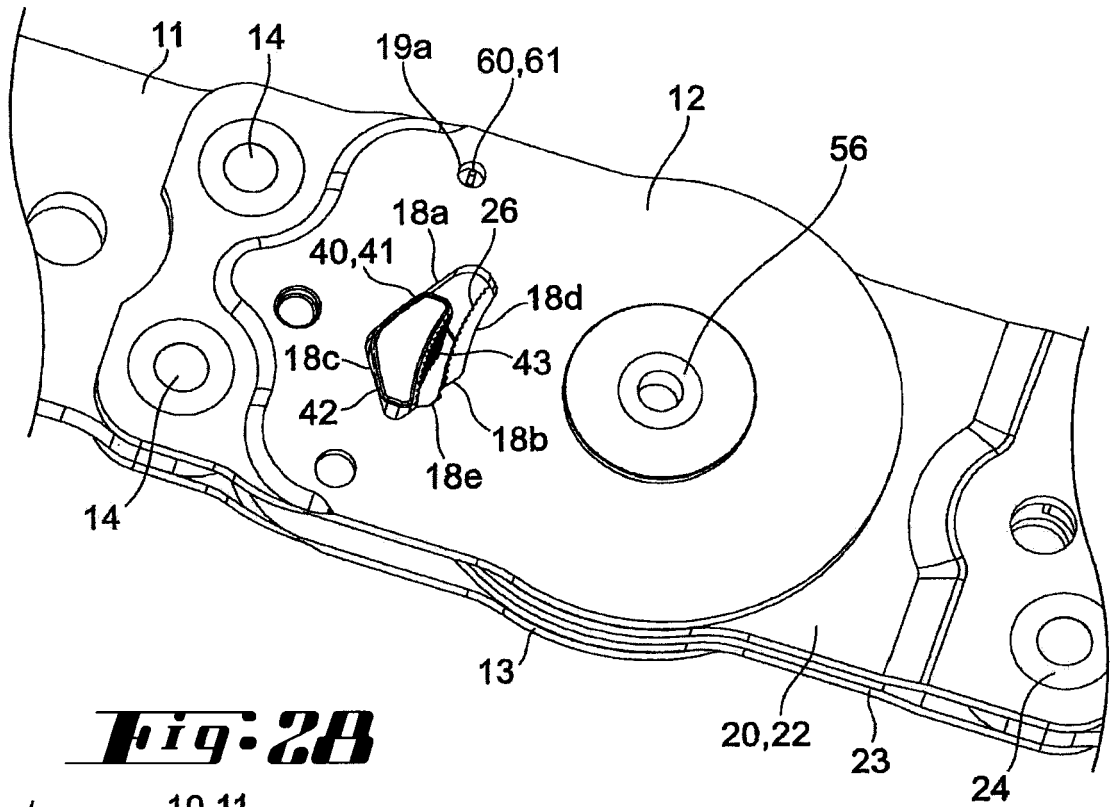


Fig. 28

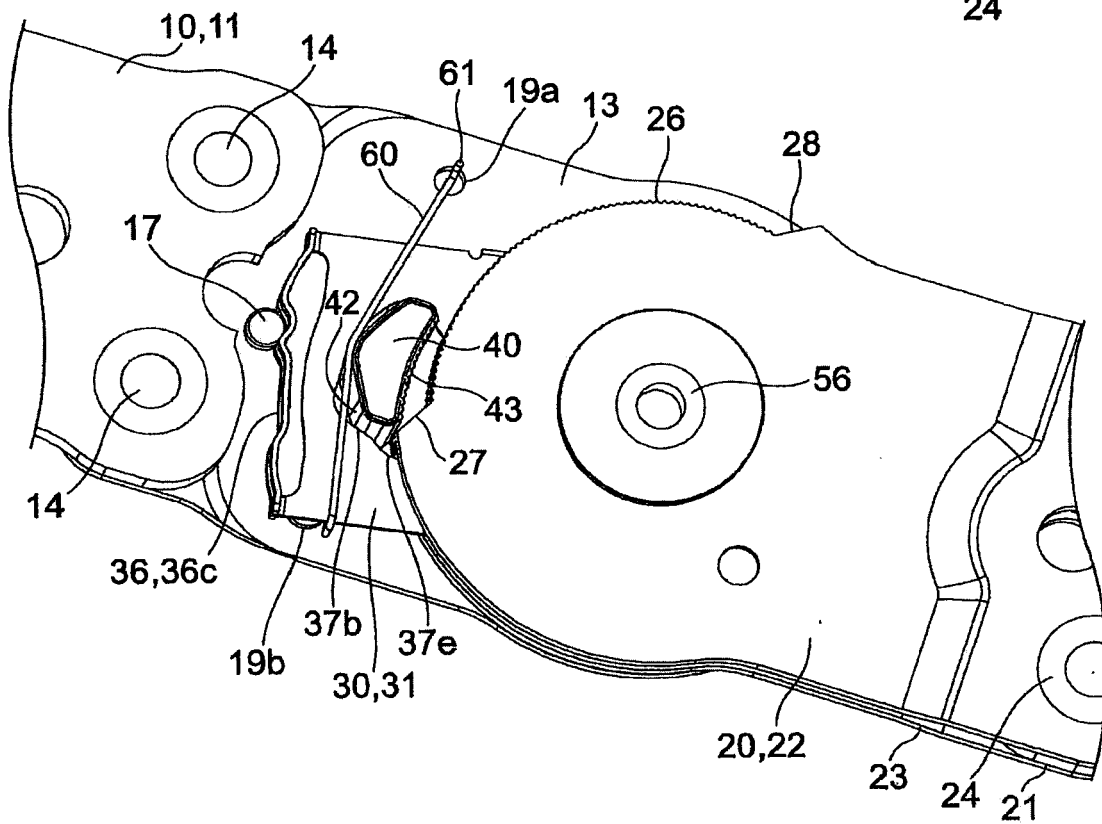


Fig. 29

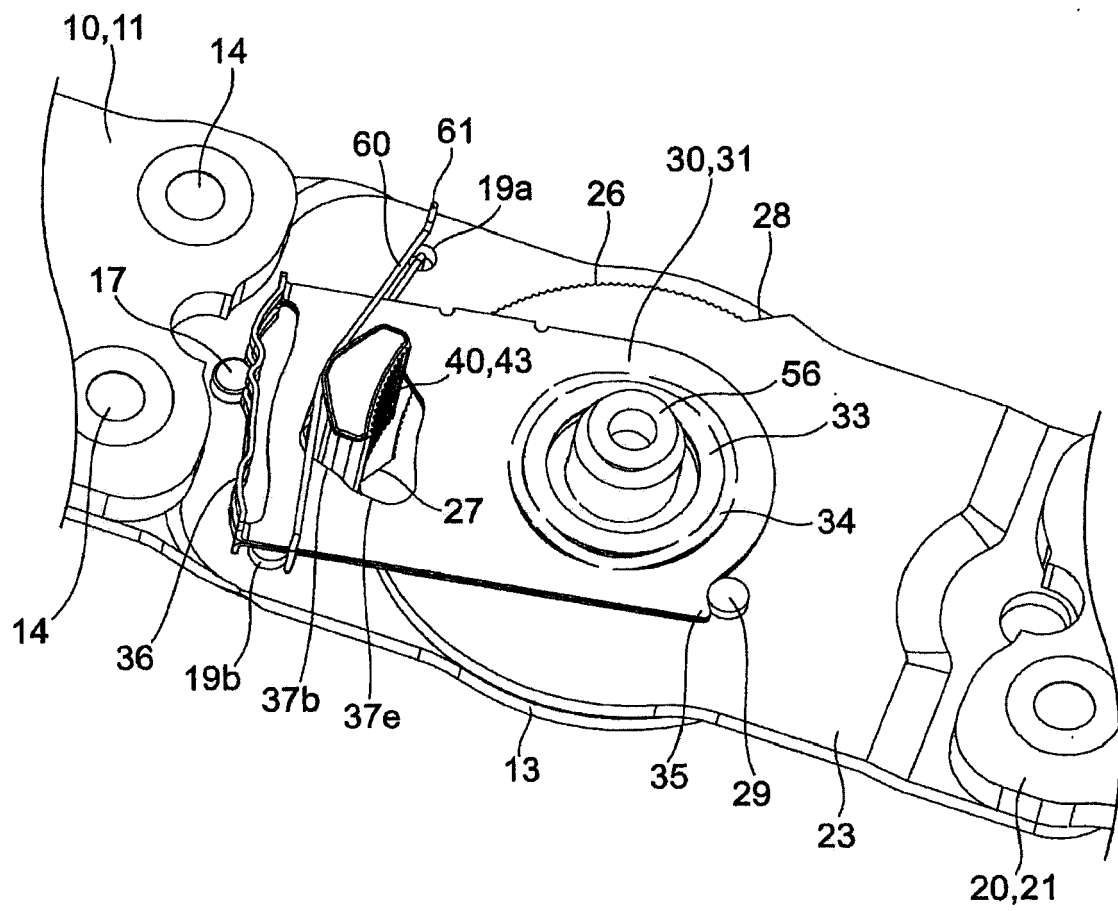


Fig. 30

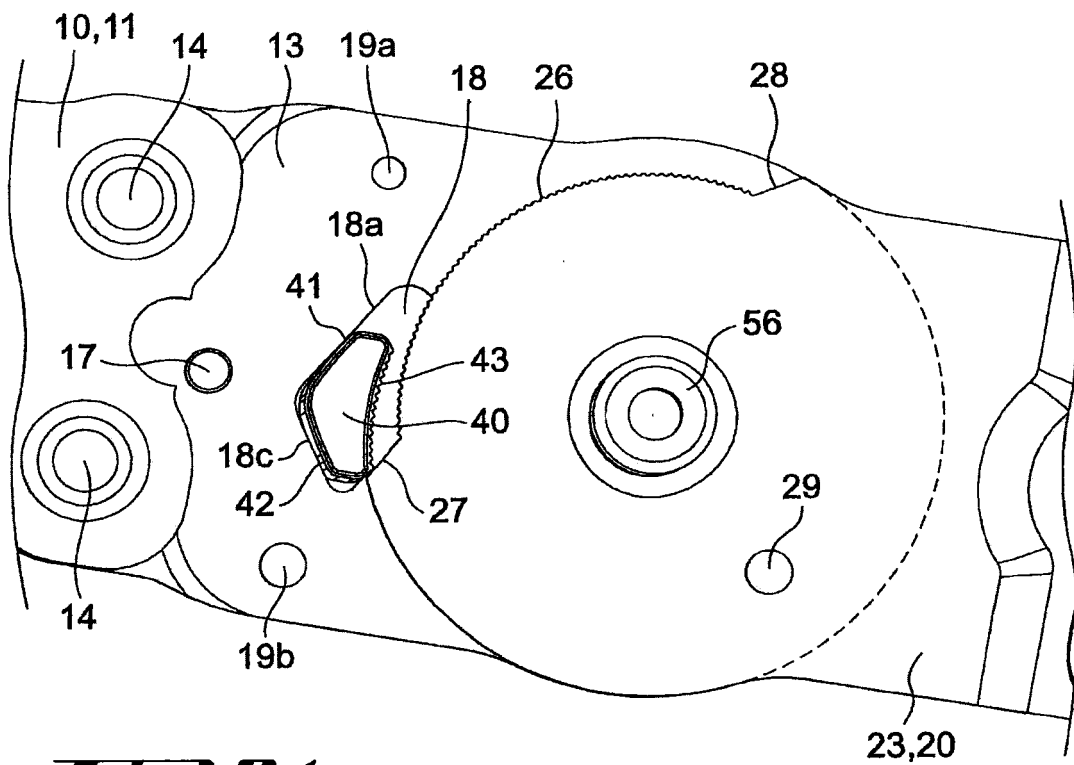


Fig. 31

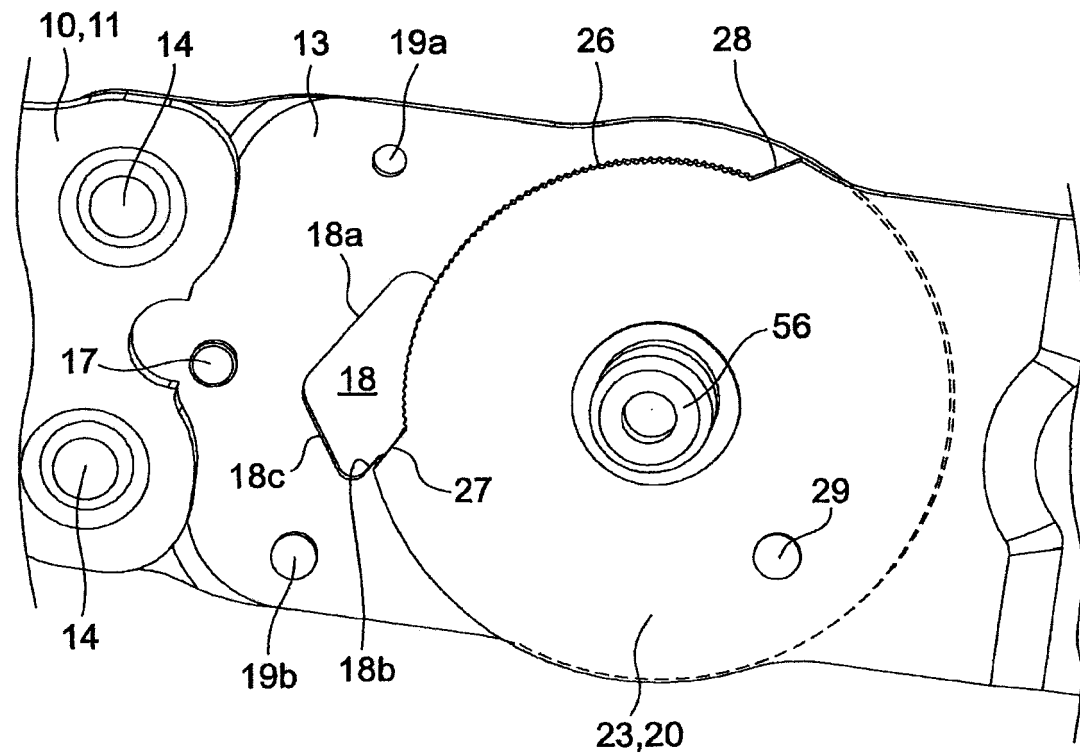


Fig: 32

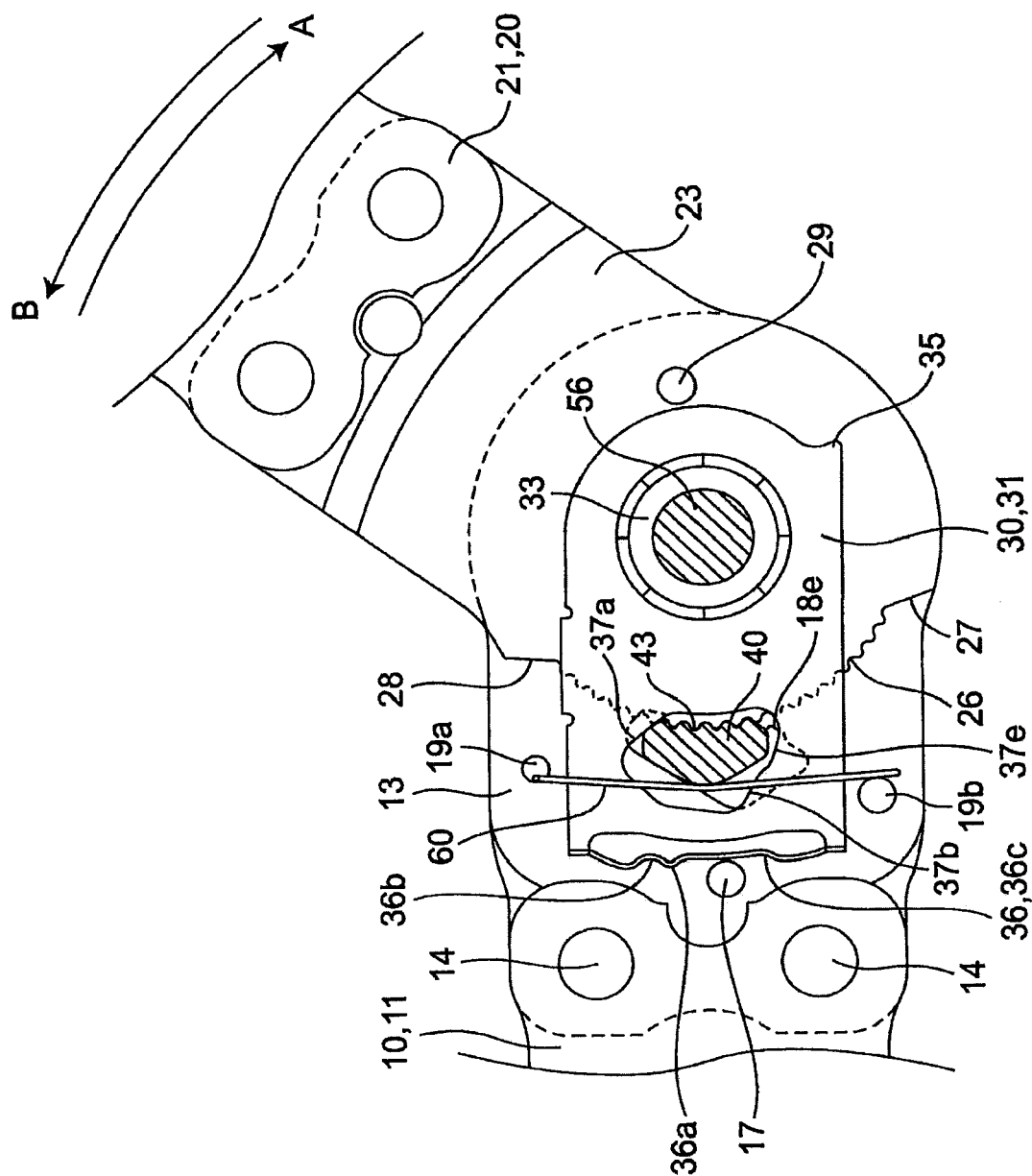


Fig. 33

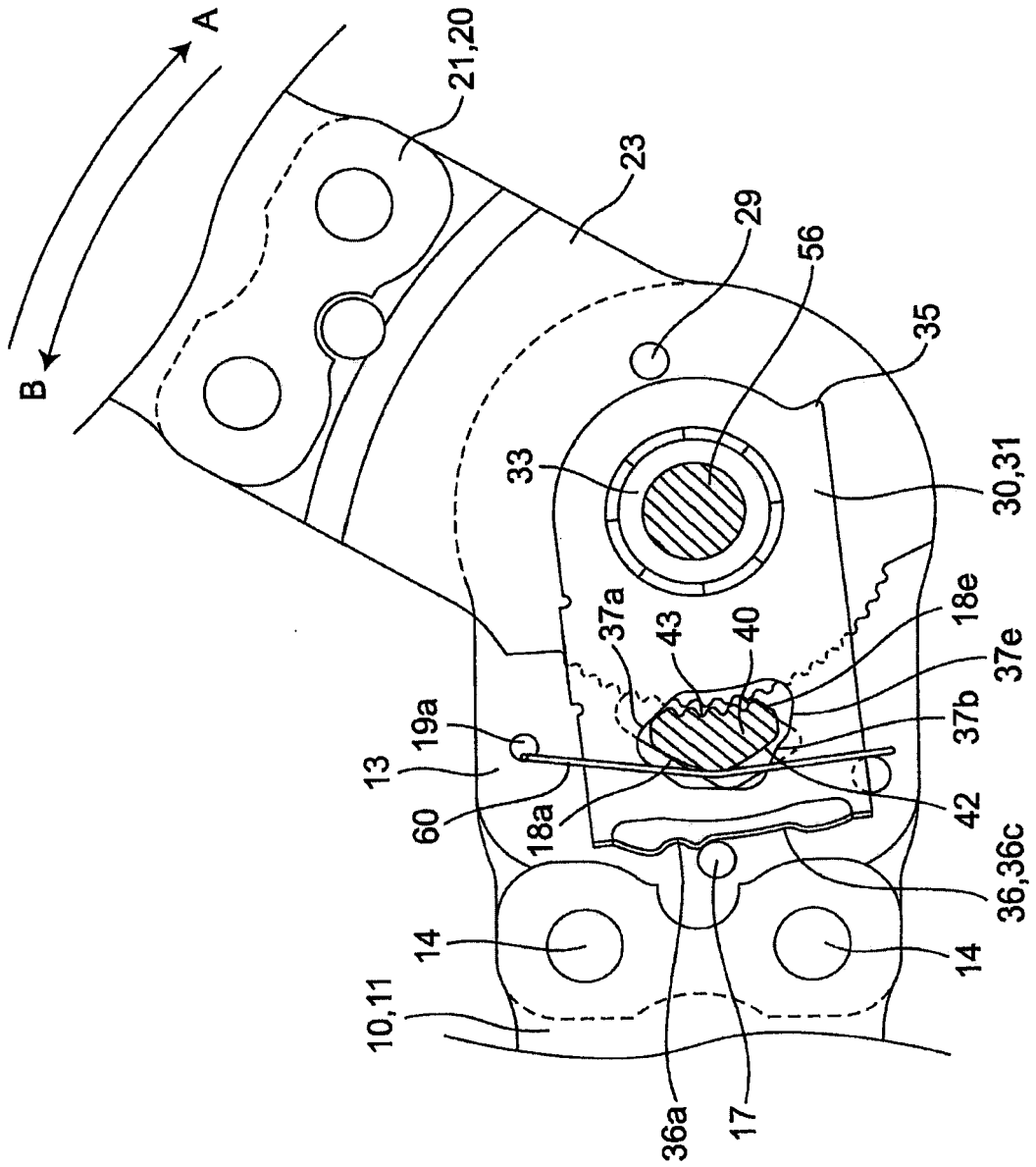


Fig. 34

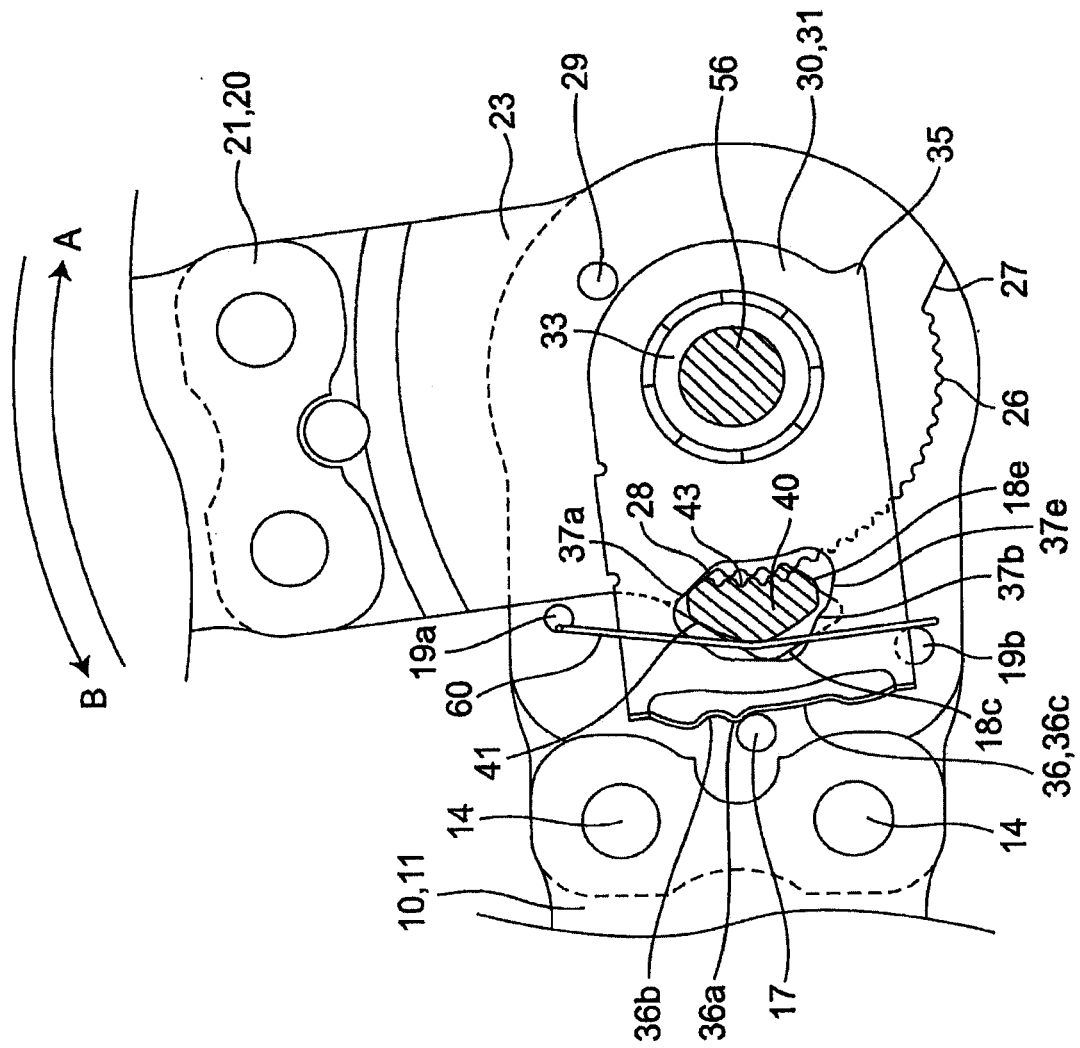


Fig: 35

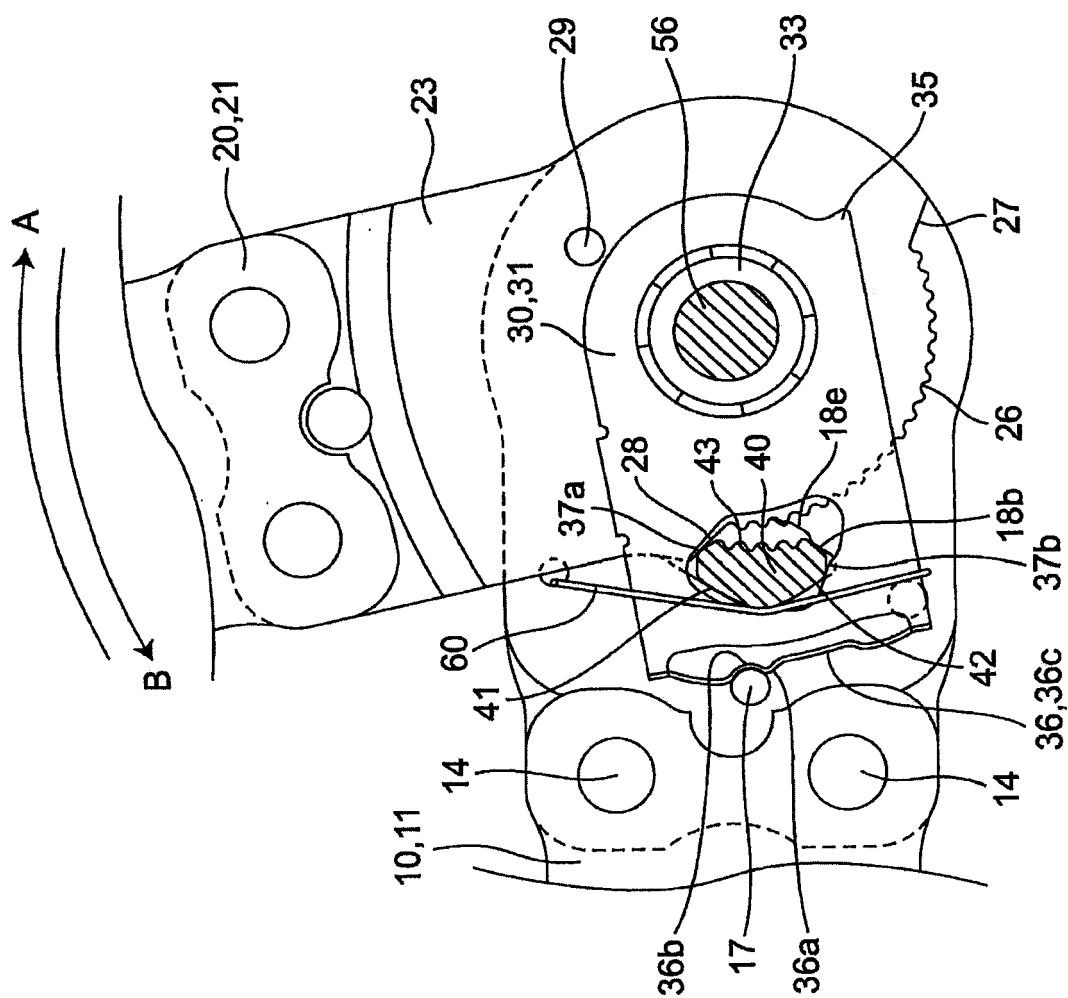


Fig: 36

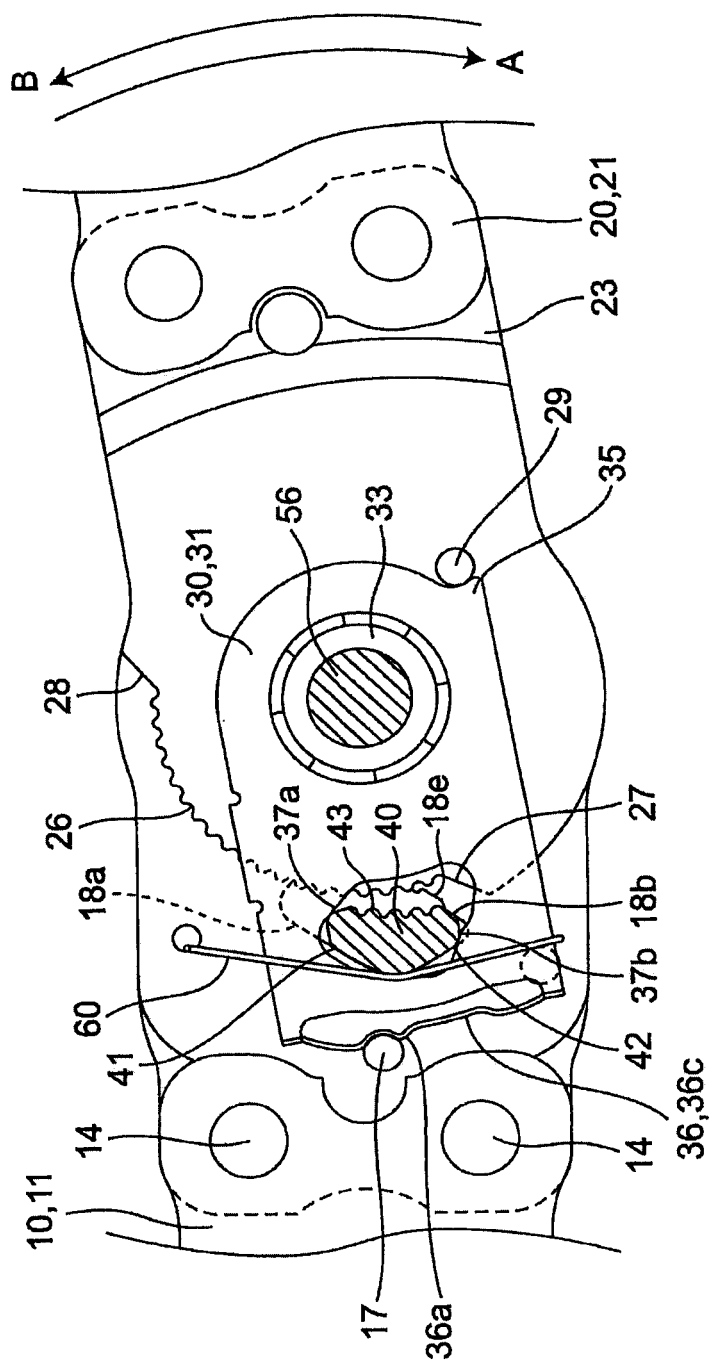


Fig. 37

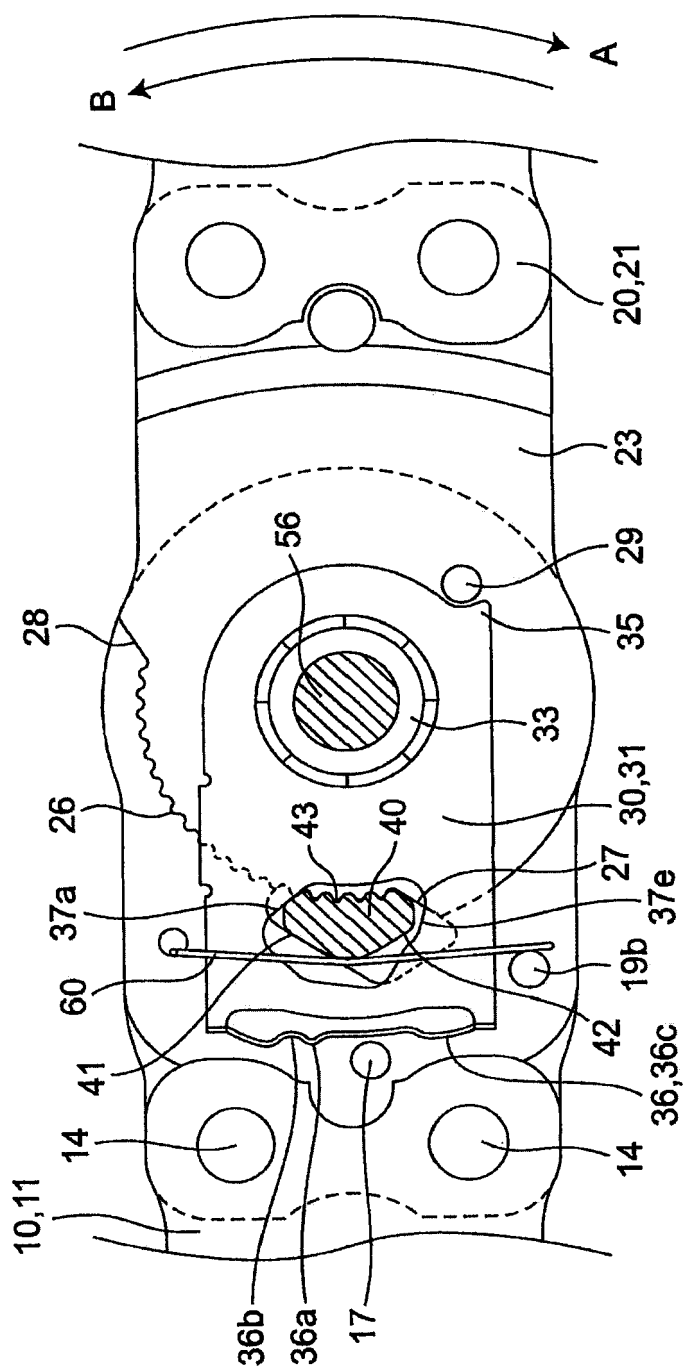


Fig. 38

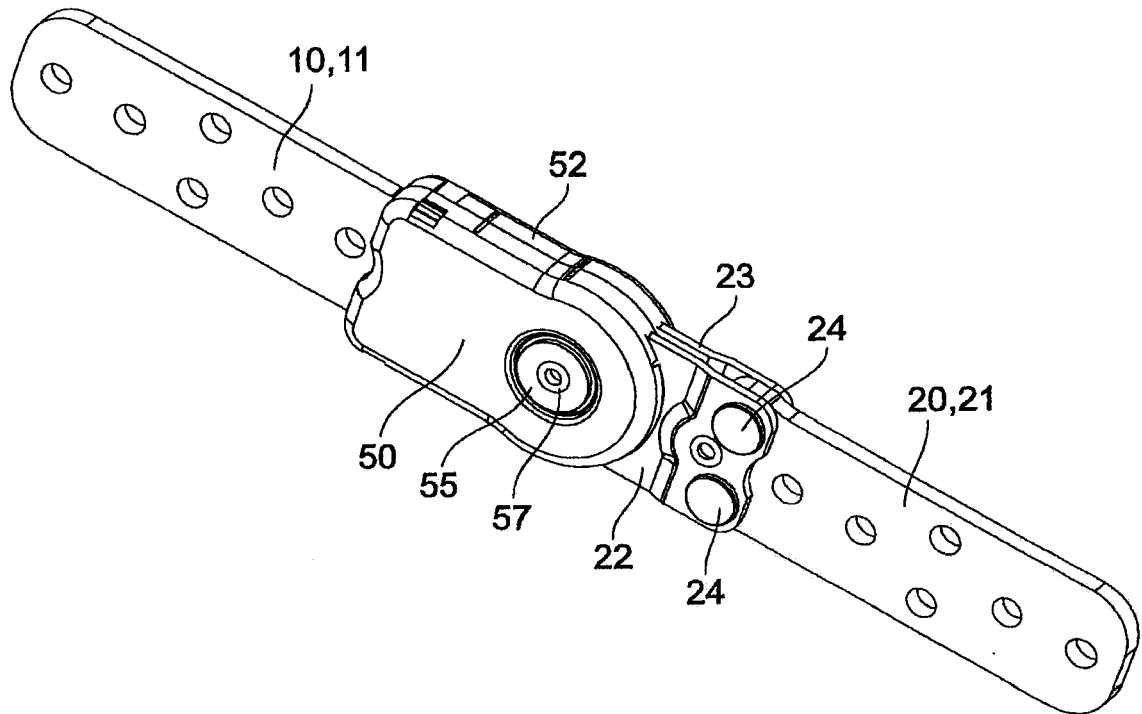


Fig. 39

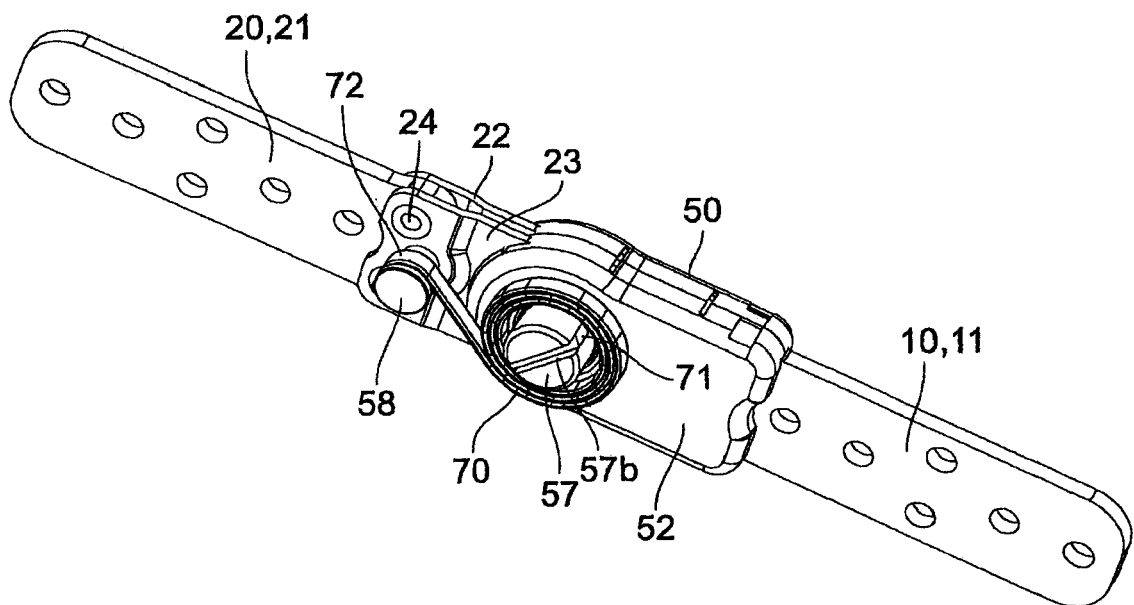


Fig. 40

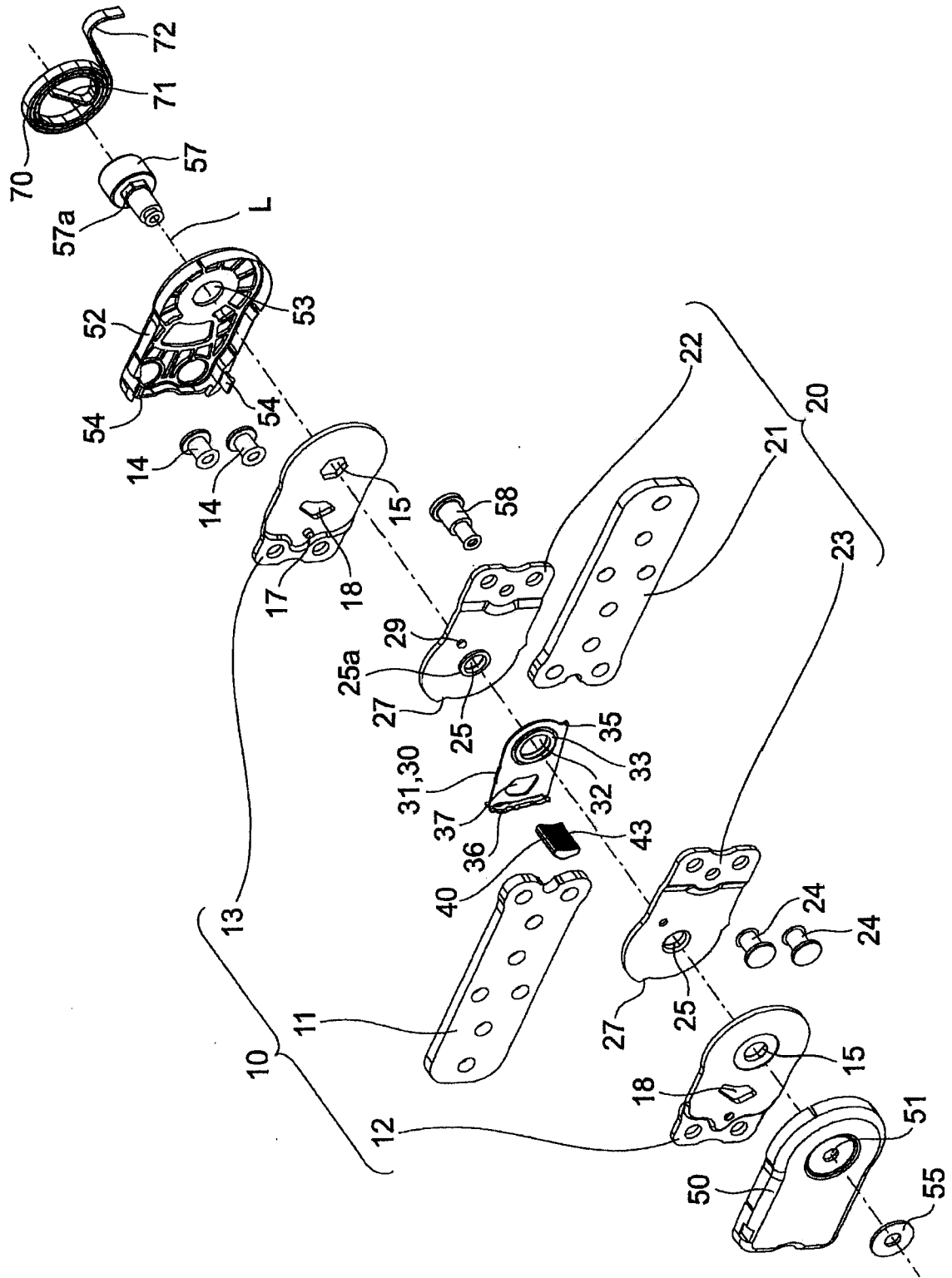


Fig. 41

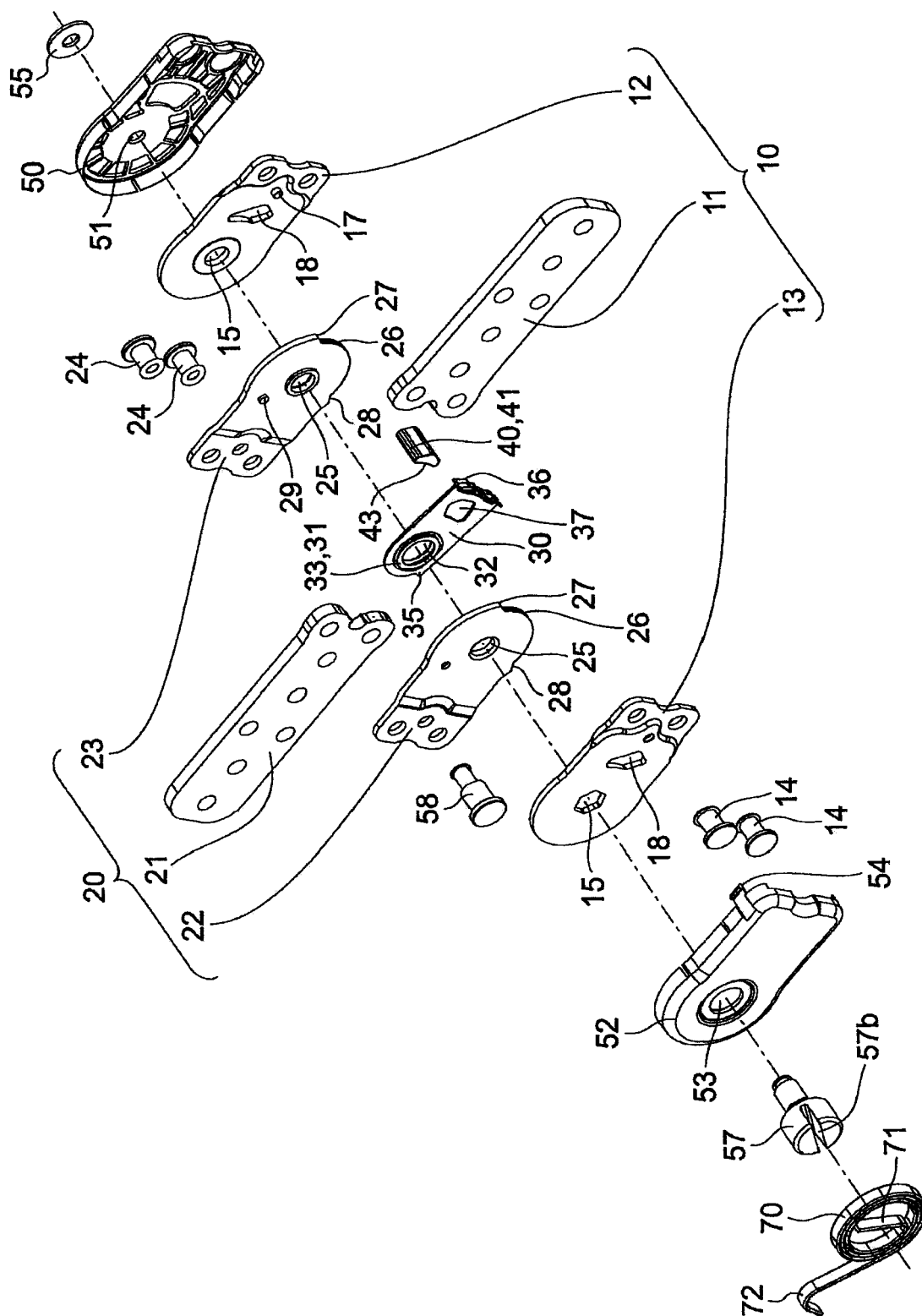


Fig. 42

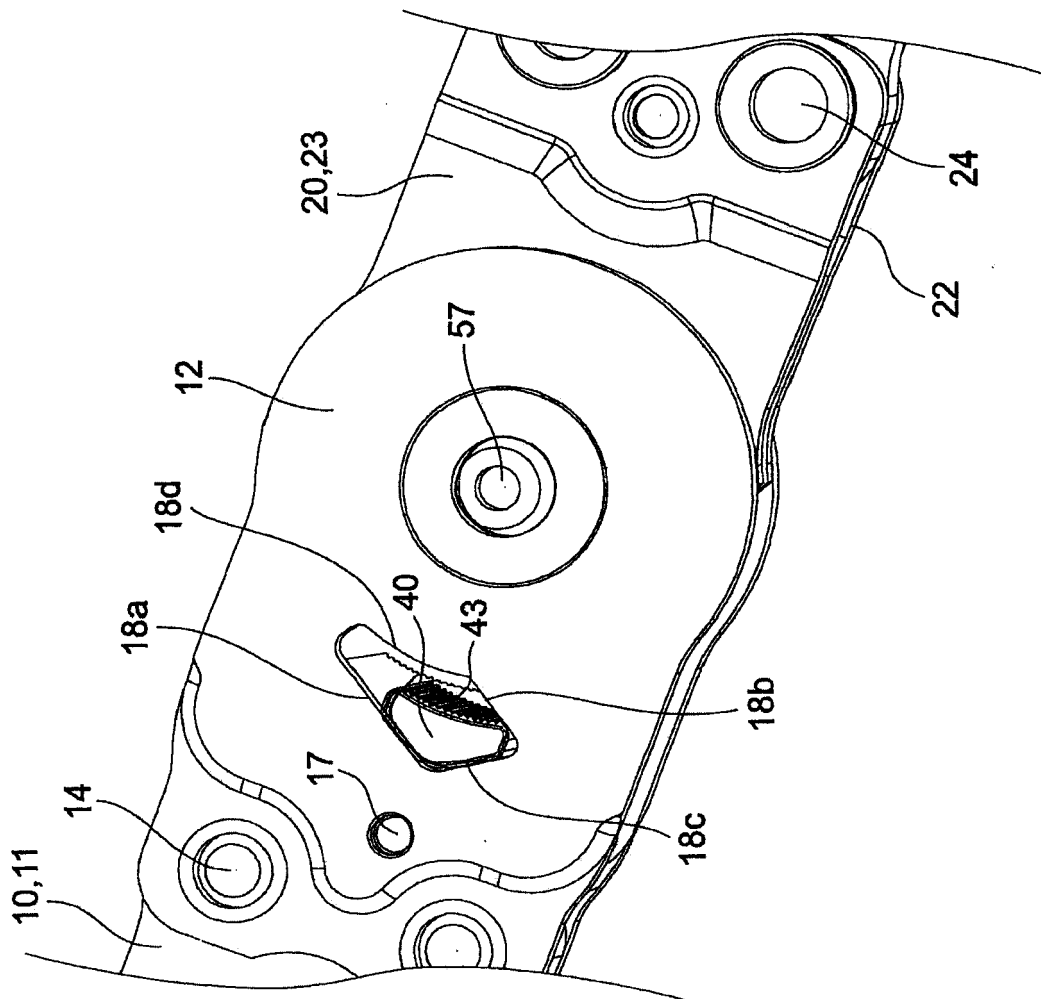


Fig. 4.3

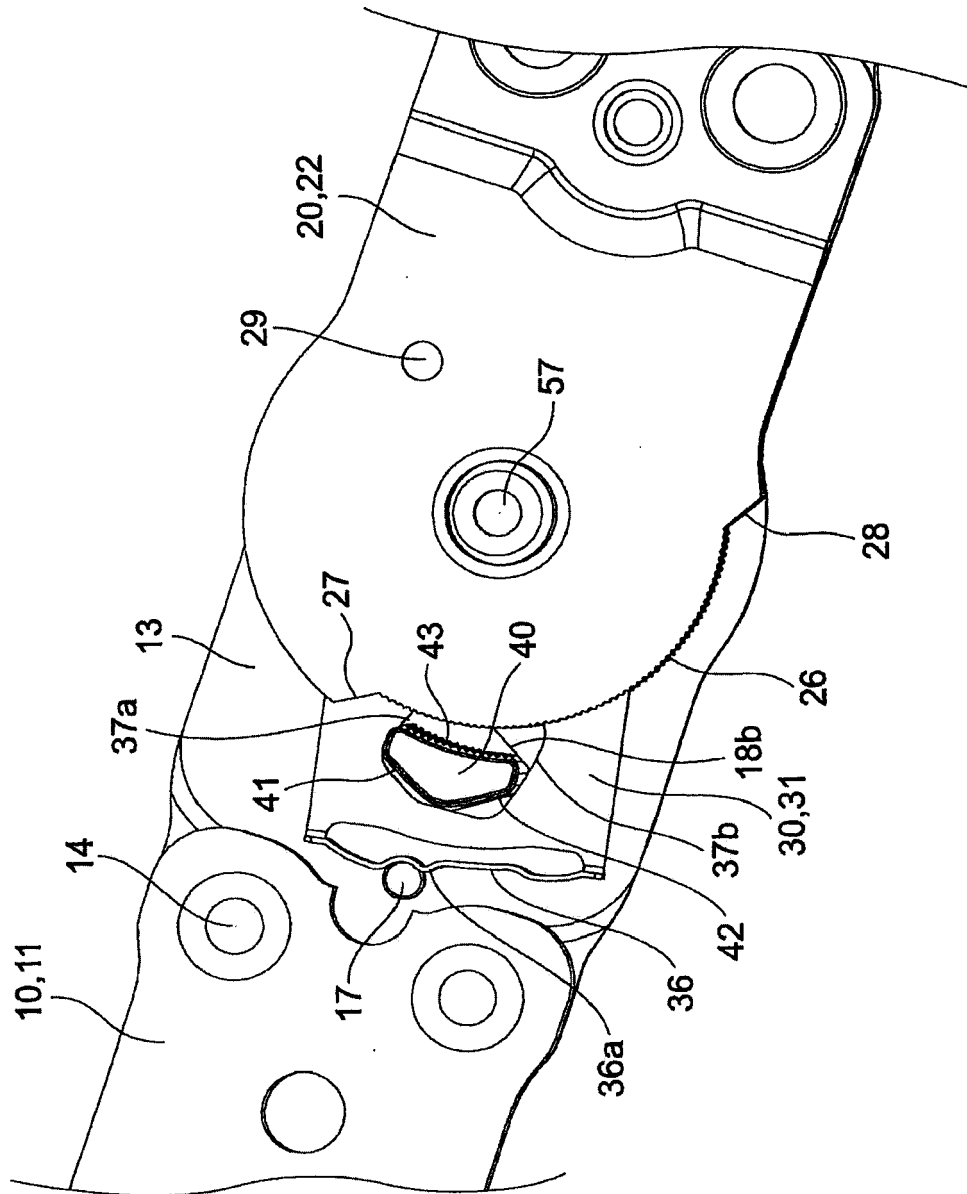


Fig: 44

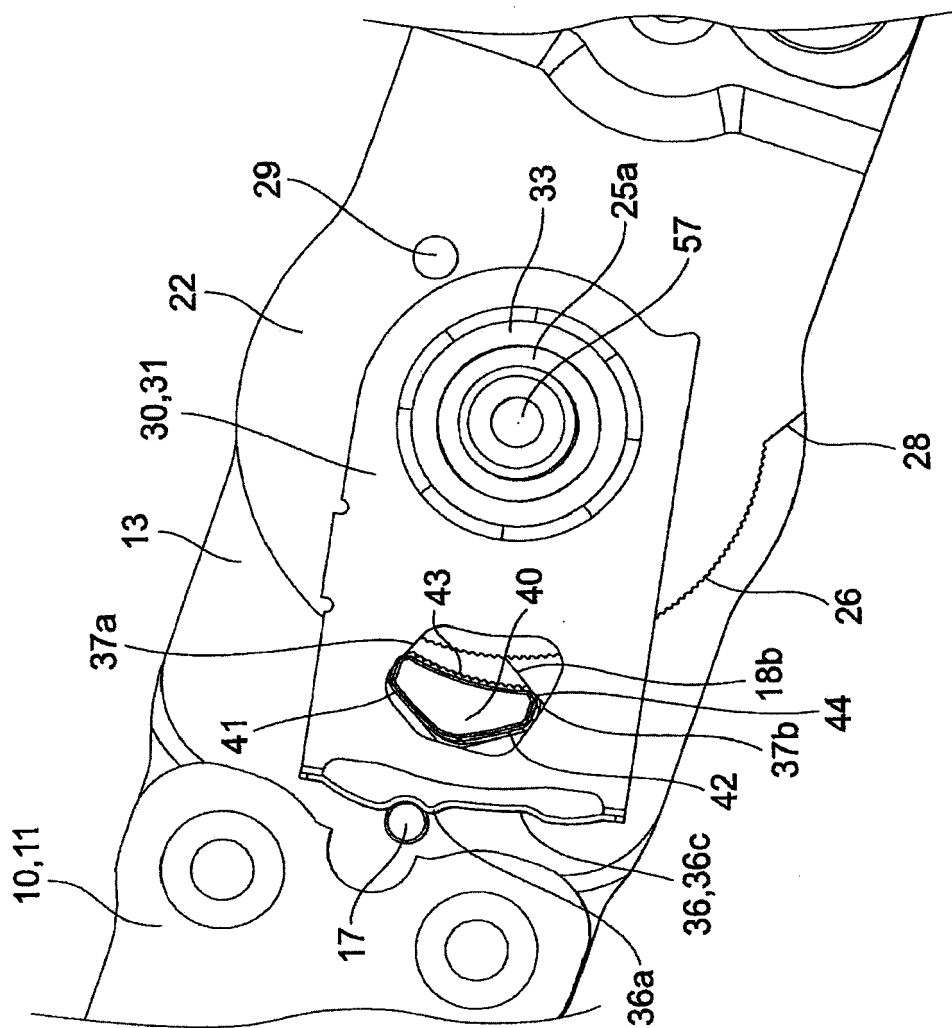


Fig. 45

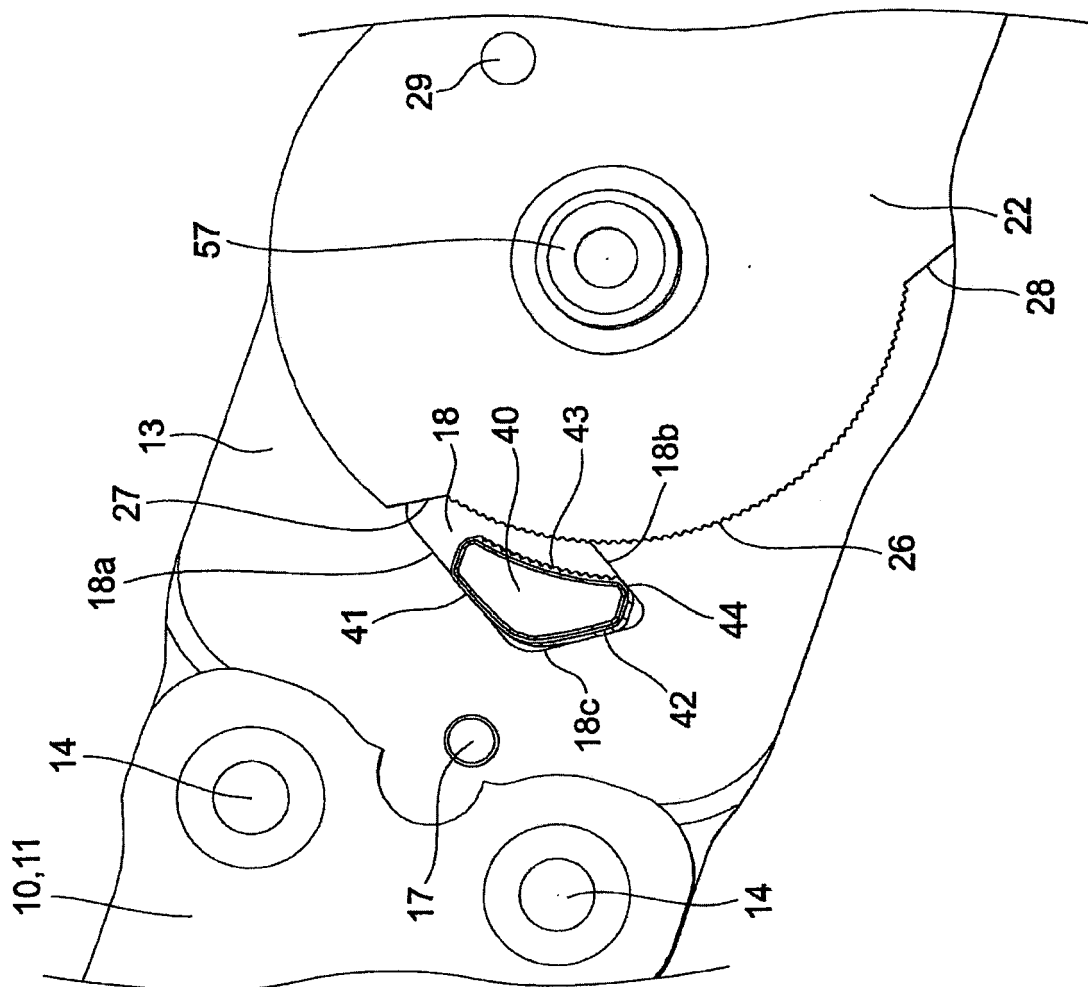


Fig. 46

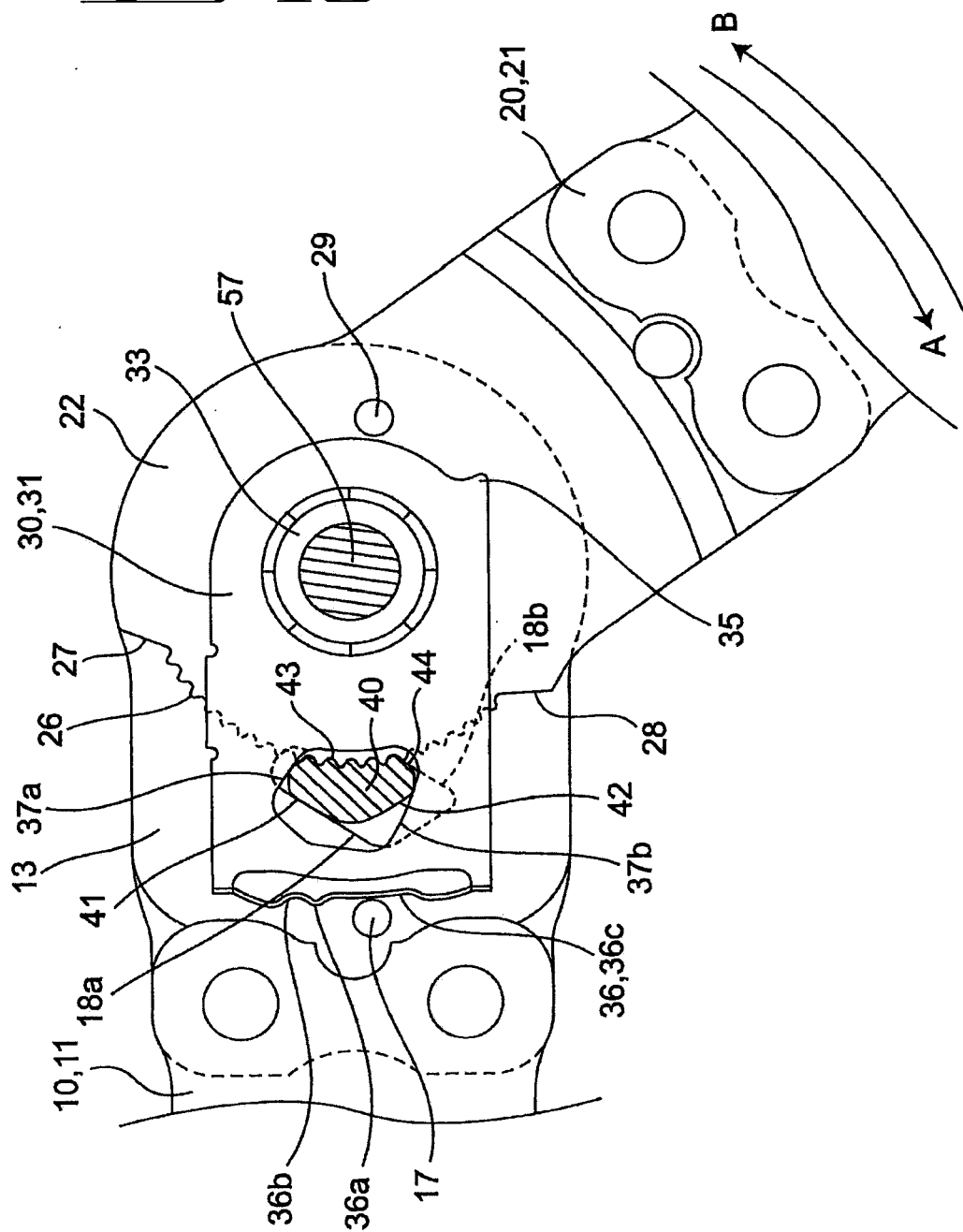


Fig: 47

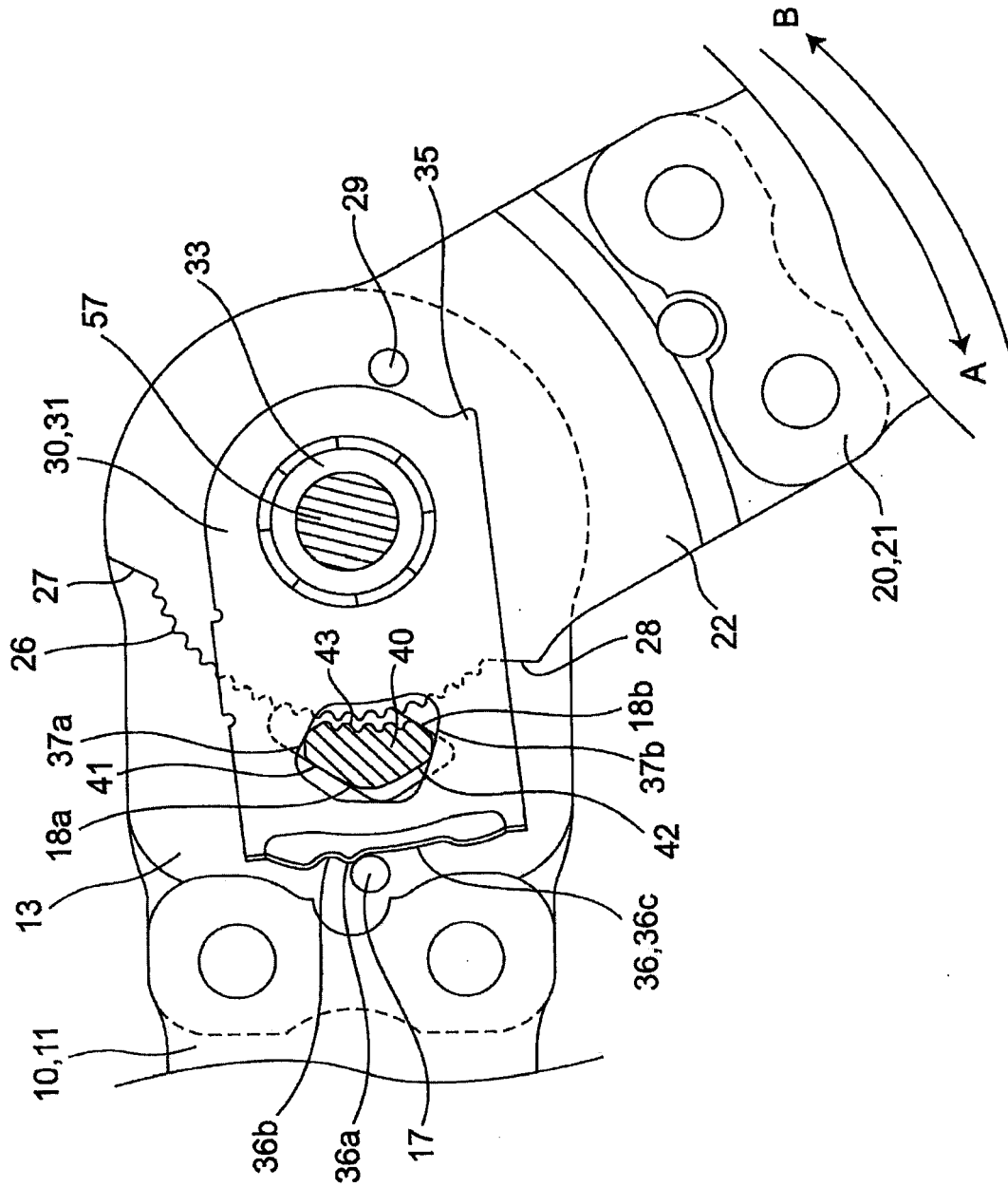


Fig. 4B

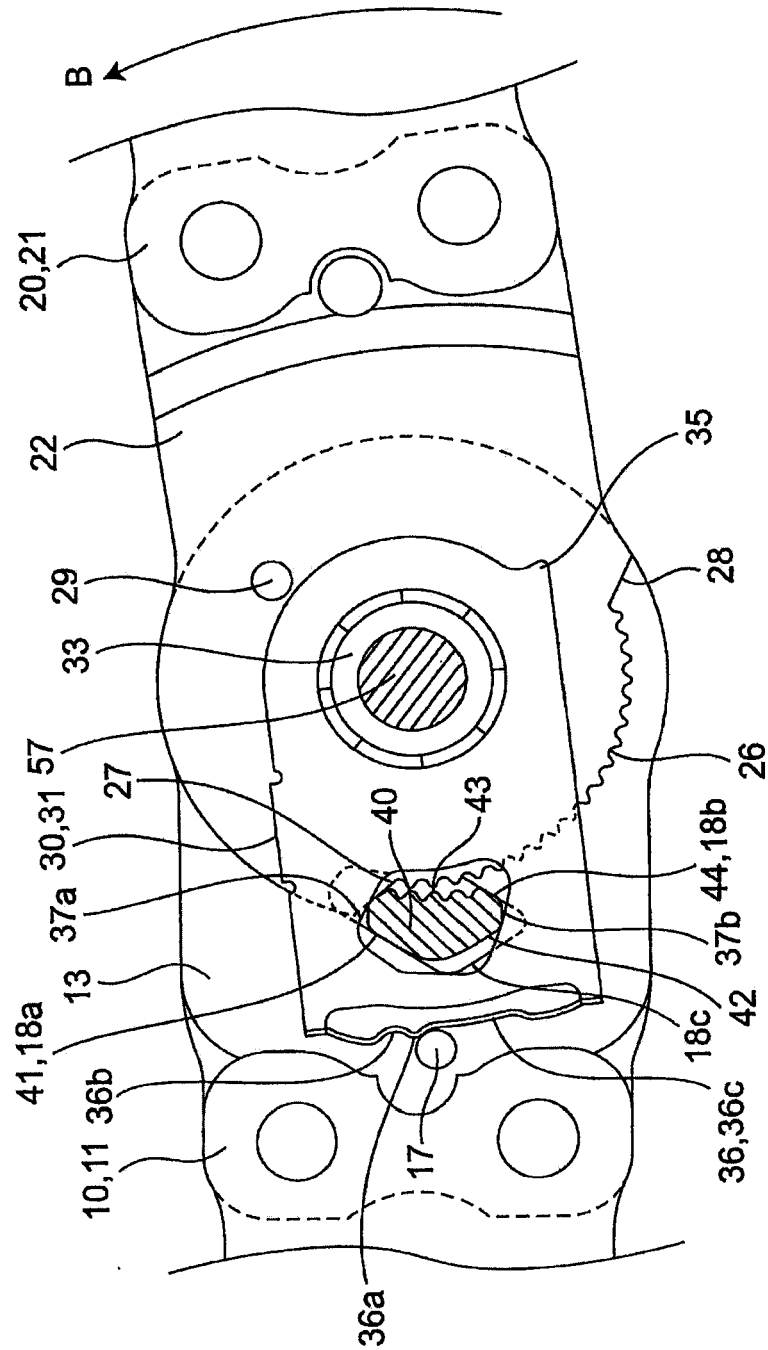


Fig. 4.9

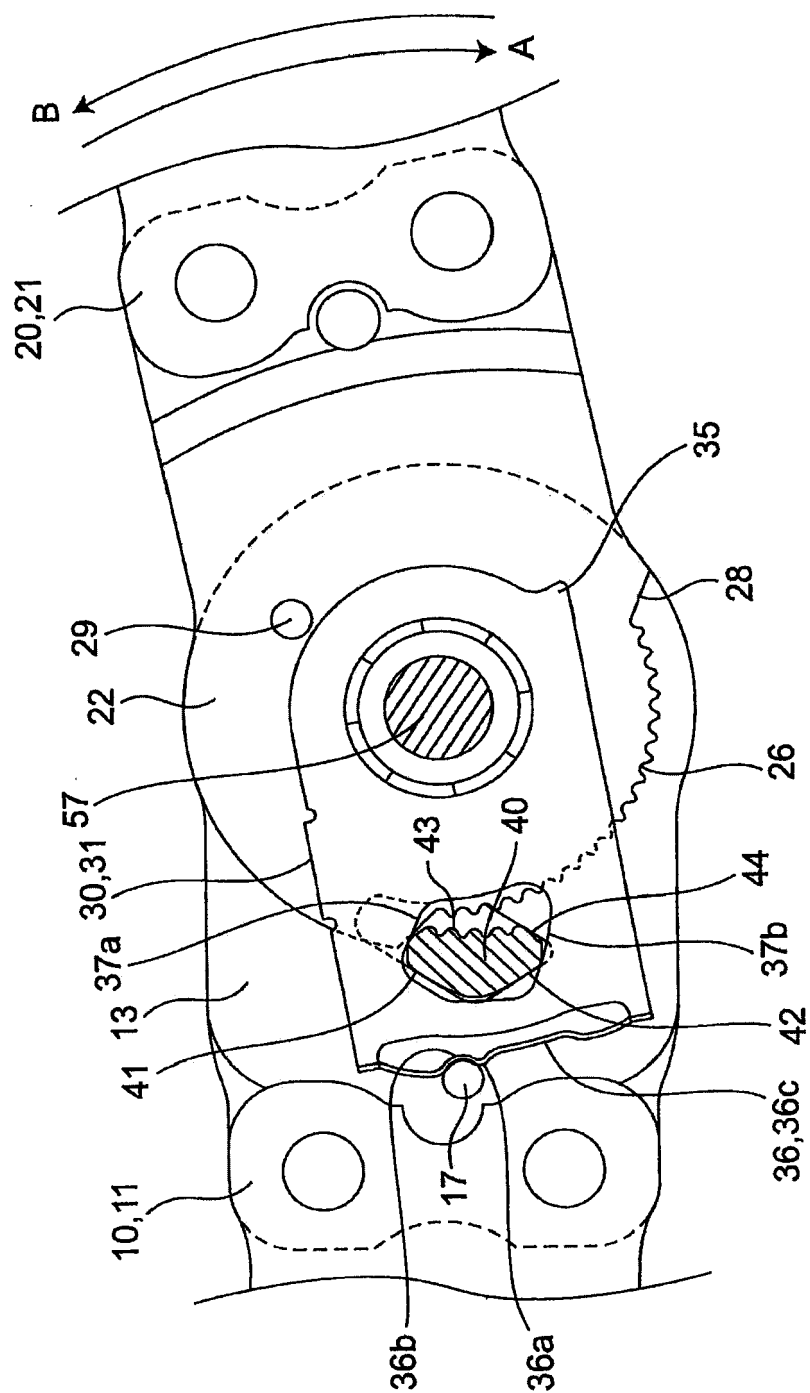


Fig: 50

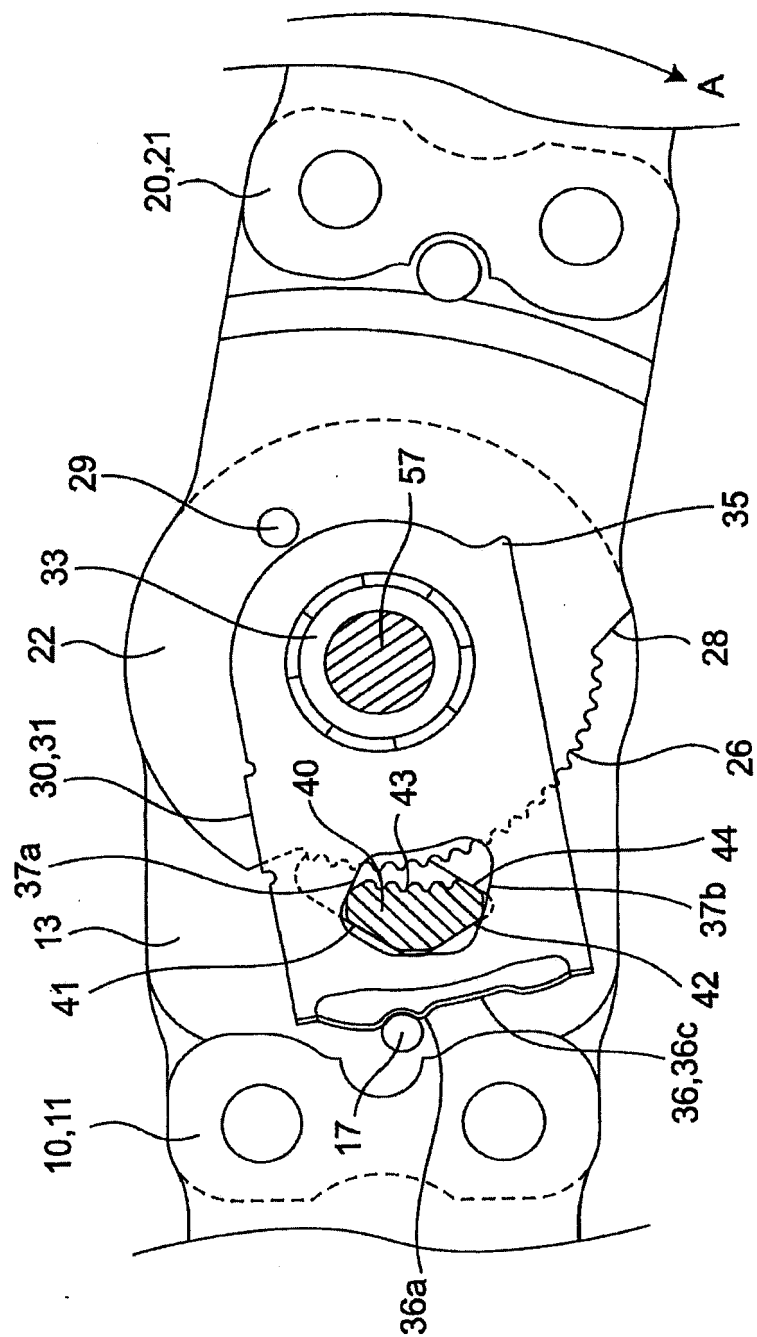
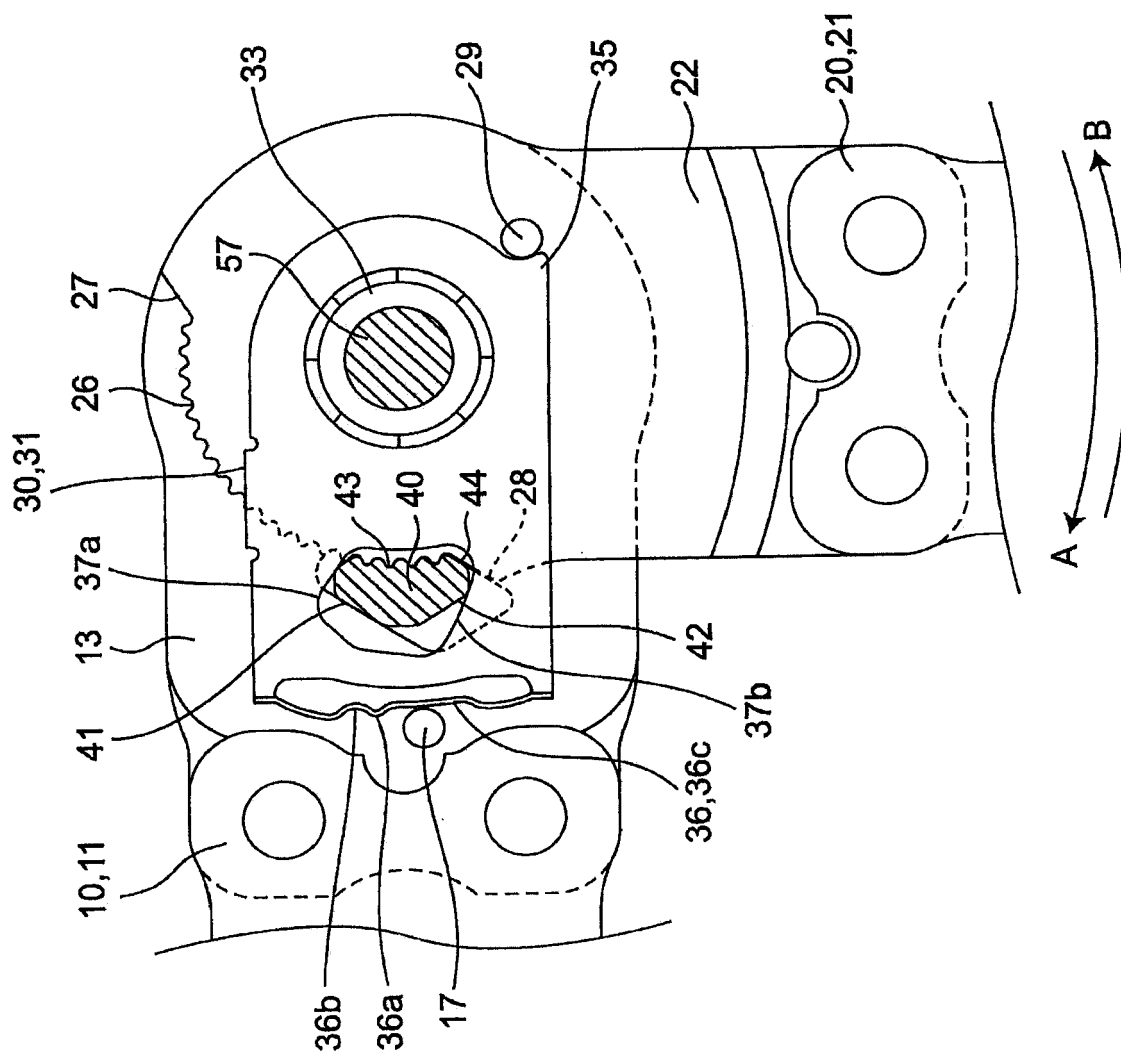


Fig. 51





EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1804

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 3 058 850 A1 (KOYO GIKEN KABUSHIKI KAISHA [JP]; KOYO GERMANY GMBH [DE]) 24 August 2016 (2016-08-24) * claims 1-3,8; figures 1,8,10,15,18,24,28-30 *	1-10	INV. A47C1/026 A47C17/12 A47C7/40
A	EP 2 253 246 A1 (KOYO GIKEN KABUSHIKI KAISHA [JP]) 24 November 2010 (2010-11-24) * abstract; figures *	1	
A,D	JP 2005 076735 A (YAMASHITA NAONOBU) 24 March 2005 (2005-03-24) * figures *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			A47C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 August 2018	Examiner Amghar, Norddin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 17 1804

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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28-08-2018

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