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(54) **LINK SYSTEM, OPERATING LEVER WITH LINK SYSTEM AND METHOD OF OPERATING**

(57) Link system for guiding an operating lever, which is pivot mounted in a first moving direction, featuring a guiding pin and a spring-loaded link, further featuring a guiding surface, which is divided in a first guiding part and a second guiding part by a step, wherein in a condition of use of link system, operating lever is guided by guiding pin along guiding surface.

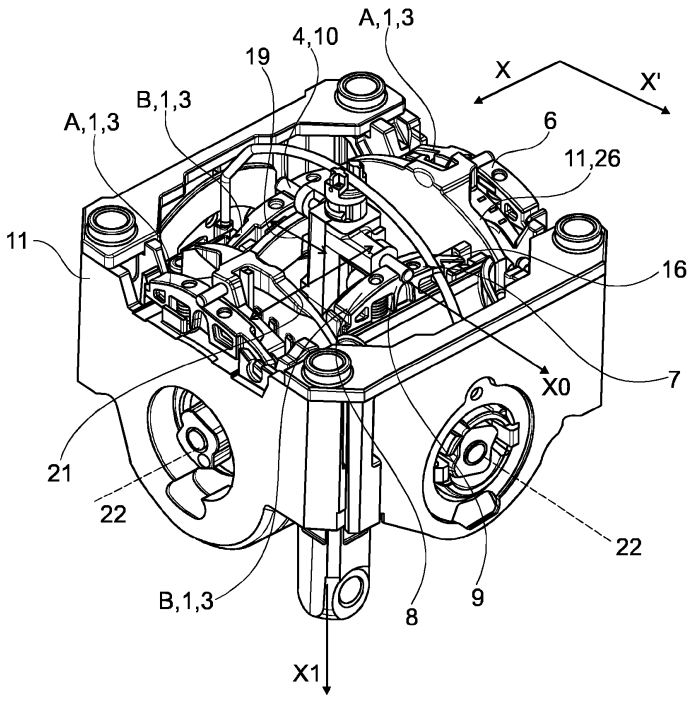

Fig. 1

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Description

[0001] The following application relates to a link system for controlling an operating lever, to an operating lever for controlling of industrial machines, especially for use in agricultural vehicles such as excavators, comprising the link system and to a method of operating said operating lever.

[0002] Nowadays, electronic systems are used to control machines such as agricultural vehicles, in particular excavators. To facilitate user feedback in such systems that are nearly free of sensible mechanical resistance, which has typically given rise to user feedback, special components need to be integrated. These create an artificial mechanical resistance that is noticeable by a machine user. Especially in agricultural vehicles, these feedback forces need to be stronger than the vibrations and jerking that are omnipresent in the typical use environment of these vehicles to be sensible by the user.

[0003] Operating levers are widely used in agricultural vehicles. They are often controlled by a link system guiding their motion. The form of the link system amongst others gives rise to an opposing force enabling user feedback in an electric steering system.

[0004] Known link systems integrated in operating levers are large assemblies comprising pre-loaded springs and are thus complicated to integrate. Changes of the guiding link track, to integrate for example an excessive starting resistance for deflections from a neutral position of a guided operating lever are therefore complicated to be realised in these systems.

[0005] The present invention is thus based on the object of proposing a link system that gives rise to strong user feedback in case, a distinct machine operation is started, by corresponding motion of an operating lever guided by the link system, whilst having a simple structure that is easy to integrate in existing control systems.

[0006] Furthermore, it is another object of the invention, to propose a corresponding operating lever.

[0007] It is another object of the invention to propose a controlling process for an operating lever that creates a user feedback force in a machine starting operation.

[0008] The first object of the invention is solved by the link system according to claim 1.

[0009] The inventive link system for guiding an operating lever, which is pivot mounted in a first moving direction, is featuring a guiding pin and a spring-loaded link, the latter featuring a guiding surface, which is divided by a step in a first guiding part and a second guiding part, wherein in a condition of use of the link system, the operating lever is guided by the guiding pin along the guiding surface.

[0010] Such a kind of link system can be added to and independent from control systems of existing operating levers. The guiding pin needs to be coupled to the operating lever, while a direct or indirect coupling is also possible. The integration of said link system generates an additional resistance against the movement of the guiding pin and thus against the movement of the operating lever in a first moving direction. When the guiding pin is moved against the step that is integrated in the guiding surface of the link, said resistance is increased rapidly. Thus, a user needs to actively push the operating lever against a resistance sensible to him. Then, after having passed the step, the guiding pin switches from movement along a first guiding part to a movement along the thereto relatively elevated second guiding part of the link. Said elevated guiding part is pushed down by the guiding pin against a force of a spring that is mounted underneath the link and the guiding surface, especially underneath the second guiding surface. The strength of the spring, its length, as well as the height of the step can be modified to alter the level of feedback force. Preferably, the link features an aperture to at least partially receive the spring. Thus, the spring is almost without load until the elevated guiding part of the link is pushed down by the guiding pin.

[0011] Said form of link system is usable, when deflection of the guided operating lever over a distinct point, which is preferably the neutral starting position of an operating lever, causes significant change in whatever operation is controlled by the corresponding motion of the operating lever. It is for example usable in the opening of hydraulic valves.

[0012] According to the invention, it is further intended that, when the operating lever is not pivoted in the first moving direction, a lateral surface of the guiding pin is resting at the step.

[0013] This inventive embodiment gives a direct user feedback, whenever the operation lever is deflected from its initial position in the moving direction, which is typically desired, when a certain kind of operation is started, for example the operation lever is used to open a valve.

[0014] According to another embodiment of the invention, the link is detachably attachable to a frame of the operating lever, especially by clipping.

[0015] This makes the link system highly modular. It can be integrated in an existing control system in a fast and easy way. Thus, no separate control system needs to be constructed to add user feedback for an additional on/off operation. It is also simply detachable, if for example stronger feedback forces are required and the link should be changed.

[0016] In a further embodiment of the invention, a first link end features an edge for rotatable attachment to the frame and a second link end features a clipping nose for clipping to the frame.

[0017] Thus, the link can be advantageously simply integrated to the frame by inserting the edge in a corresponding recess in the frame, rotating the link around this edge and clipping the clipping nose into a snapping hook of the frame. This way, the spring can also be partially preloaded, if this should be needed. Detaching the link from the frame works the other way around.

[0018] According to a further embodiment of the invention, the first guiding part and/or the second guiding part

are shaped convexly.

[0019] This configuration prevents the guiding pin to be deflected from its initial position without a user input force acting on it. Thus, simple vibrations cannot deflect the guiding pin from its starting position in negative moving direction. Furthermore, when the guiding pin acts on the relatively elevated first or second guiding part of the guiding surface, and thus, when the corresponding operation controlled by the operating lever has started, small random vibrations cannot simply stop it - a user input force is required. In other words, as described so far, the invention provides for a better and more consistent centring of the operation lever in its neutral or starting position.

[0020] According to another embodiment of the invention, the guiding surface features locking points and/or variation of slope. Thus, snap-in points or higher feedback forces can be integrated. This might be desirably, if the operation controlled by the corresponding motion of the operating lever offers more options than simple on/off conditions a user should feel corresponding feedback forces for.

[0021] According to a further embodiment of the invention, the link system features restoring means, especially a restoring spring, preferably a leg spring, for transferring the guiding pin to a not-deflected starting position, especially the guiding pin to the starting position and operating lever to the not-deflected further starting position, after movement in the first moving direction, wherein the restoring means are separated from the link and not guided along the guiding surface.

[0022] In this advantageous embodiment, the restoring system and the link system are separated from each other. Both are acting on guiding pins and the operating lever, while the restoring means are mounted separately therefrom. Said mounting is such that when the guiding pin moves along the guiding surface, the restoring means at least partially does not need to follow the track of the link system. In other words, the motion of the guiding pin only causes tension, contraction or relaxation of the restoring means and not their overall transversal motion. Preferably, leg springs are used and their windings are installed surrounding a main rotation axis of the operation lever. One leg is fixed to the guiding pin and only this leg is following the motion of the guiding pin. This allows easier construction, maintenance and flexibility of the link system. Moreover, due to the reduced number of moving parts, a friction reduced system is proposed.

[0023] Another object of the invention is solved by the process for guidance an operating lever, pivotable in a first moving direction according to claim 8. The process includes the steps of coupling the movement of operating lever in first moving direction to movement of a guiding pin; acting a displacement force on the not-deflected operating lever in the first moving direction; generating a resistance jump against the movement of operating lever and guiding pin.

[0024] In this way, a user of the operating lever experiences a feedback force whenever he deflects the operating lever from its initial, undeflected position in a first moving direction. Coupling of motion of the operating lever to the motion of the guiding pin creates higher flexibility in the generation of the resistance constituting the user feedback. In an advantageous embodiment, the coupling is a permanent mechanical direct or indirect coupling. This makes the process modular, as a mechanical resistance can be attached in a relatively simple way apart from the moving track of the operating lever itself and apart from its main rotation axis.

[0025] According to a further embodiment of the process according to the invention, after the operating lever and the guiding pin are displaced in a first moving direction, a restoring force acts on the guiding pin and the operating lever, pushing them back to not-displaced conditions in the moving direction.

[0026] This embodiment allows to restore initial, undisplaced conditions. In an advantageous embodiment, the restoring force acts decoupled from the previous displacement motion. Said process further reduces frictional forces.

[0027] The third aspect of the invention is solved by an operating lever according to claim 10. According to the invention, the operating lever features at least one of the link systems according to the invention.

[0028] Thus, an operating lever producing feedback forces for special starting operations is proposed. Advantageously, no elaborate reconstruction of existing link and control systems of operating levers is required by adding the proposed link system.

[0029] According to an advantageous embodiment of the invention, the operating lever features a further link system according to the invention, wherein two of the link systems form a first pair of link systems and wherein the link systems of the first pair are arranged in parallel and rotated 180° to each other.

[0030] This configuration facilitates the link guided motion of an operating lever and its handle bar in positive and negative first moving direction or in other words, back and forth motion along an axis pointing in the first moving direction. If the operating lever is displaced in first moving direction, both guiding pins get displaced in the same direction. While one of the guiding pins needs to overcome the step to move along the second part of the corresponding guiding surface, the other gets pin moved, depending on the actual form of the link slope, nearly free of forces or with comparable low required input force.

[0031] The placement of the operating lever in a neutral, central position in a first moving direction, which corresponds to the starting position of the guiding pins of both link systems of the first pair, is facilitated by said composition of the link systems. Preferably, the central axis of the operating lever is at a centre of a distance between the guiding pins, which further improves and simplifies central positioning of the operating lever as well as its construction. Since the link systems of the first pair don't necessarily need to be equal: different slopes or

different heights of steps can be used. In this case, back and forth motions are causing different feedback forces.

[0032] According to a further embodiment of the invention, the guiding pins of the first pair are arranged such, that they have a common tangent plane. The guiding pins of the second pair also have a common tangent plane. Preferably, both tangent planes are identical and the guiding pins of the first pair are located above the tangent plane and those of the second pair are located below the tangent plane.

[0033] This configuration particularly simplifies central positioning of operating lever and its handle bar in first moving direction and reduces the required space.

[0034] In a further advantageous embodiment of the inventive operation lever, each link system of the first pair is featuring associated restoring means acting on respective guiding pins.

[0035] Thus, said link systems of the operating lever have their own restoring system and deflections of the operating lever, guided by these link systems, can be restored independent from other restoring systems. Preferably, said restoring means are decoupled from the links of the link systems, such that they do not follow transversal movement of guiding pins along the respective guiding surfaces. Most preferably, restoring means are leg springs. One leg of the leg spring is coupled to a corresponding guiding pin. Though said leg gets deflected, windings of the leg spring solely get contracted and do not move transversally.

[0036] In a particularly advantageous embodiment, lateral surfaces of the guiding pins of the link systems are resting at the steps of the corresponding link system in the respective starting position of the guiding pins.

[0037] Thus, to be displaced in a positive or negative first moving direction, a user input force needs to act on the operating lever and its handle bar large enough to overcome the corresponding step. This enables particularly simple resting of the operating lever in its central position and of corresponding guiding pins in their respective starting positions.

[0038] In a further particular advantageous embodiment, each link system of the first pair is featuring associated restoring means acting on the respective guiding pins.

[0039] Displacement of the operating lever in apositive or negative first moving direction thus causes restoring forces in reverse direction acting on both guiding pins of the first pair. This enables improved positioning of the operating lever in its central, force free position.

[0040] Preferably, the restoring means are decoupled from the guiding system, such that they do not need to follow the transversal motion of the connected guiding pin as a whole. Besides eased maintenance and construction, friction forces in operation of the operating lever are clearly reduced.

[0041] According to a further advantageous embodiment, the operating lever features a second pair of link systems according to one of the claims 1 - 7, wherein the link systems of the second pair are arranged in parallel and rotated 180° to each other, and wherein the first pair and the second pair of link systems are arranged orthogonal to each other and centrally around operating lever respectively. This way, user feedback forces for different operations corresponding to a motion of the operating lever in the direction parallel to the first pair and to a different, perpendicular motion, parallel to the second pair can be induced.

[0042] According to a further advantageous embodiment of the operating lever of the invention, the first pair is centred around the operating lever in a first distance and the second pair is centred around the operating lever in a second distance, wherein the first distance is smaller than the second distance.

[0043] Thus, already existing operating levers do not need to be re-planed, link systems according to the invention can simply be added to an cardanic system and an outer frame of the operating lever corresponding to motions in two perpendicular directions. Thus, the operating lever and its cardanic system get centred by use of both pairs of the link systems.

[0044] Hereafter, the invention is described based on drawings. Further advantageous details are obtainable from the individual figures.

Fig. 1 is a cut view of a link system and an operating lever according to the invention.

Fig. 2a shows the assembly of part of the inventive link system at a frame of an operating lever.

Fig. 2b shows the assembly of the link system in another embodiment of a frame.

Fig. 3 shows an operating lever according to the invention in a ready-to-install condition.

Fig. 4 shows parts of the operating lever according to the invention.

[0045] **Fig. 1** shows a cut view of an embodiment of an operating lever 2 according to the invention in a plane perpendicular to a neutral position of the operating lever 2. In Fig. 1, the operating lever is rotated by 180° - upside-down - compared to its position in actual use for ease of understanding and clear presentation. The operating lever 2 is pivotable in two perpendicular first moving directions X, X'. Bearings 29, not depicted in Fig. 1, are intersected by the corresponding rotation axes 22. Operating lever 2 is shown in a neutral starting position X1 with respect to first moving direction X or X'. In this starting or neutral position, no deflection of the operating lever 2 in any of the first moving directions X or X' has taken place.

[0046] Part of the operating lever 2 is a handle bar adapter 27, to which in use-mode a handle bar is attached. The operating lever 2 is movable in first moving

direction X relative to a cardanic system 26, which constitutes a frame 11 according to the invention. Furthermore, said operating lever 2 is movably in the perpendicular first moving direction X' simultaneously with the cardanic system 26. The operating lever 2 is guided by four guiding pins 4 in corresponding links 3 of link systems 1 according to the invention. The shown embodiment features one link system 1 each for forth and back motion in every first moving direction X, X'. Thus, the operating lever 2 features four link systems 1, arranged in a first pair A and a second pair B. In the first moving direction X, the motion of the operating lever 2 is guided by pair B. A perpendicular motion, in first moving direction X', is guided by pair A. For this purpose, guiding pins 4 of the inventive link systems 1 are installed such, that a motion of the operating lever 2 in first moving direction X, X' causes motion of the guiding pins 4 of the corresponding link systems 1 of pair A or pair B in the same direction. For the guided movement in the first moving direction X, two guiding pins 4 are attached directly to the operating lever 2. Each of corresponding links 3 of the link systems 1 is formed on a clip 16 (see Fig. 2a, b) that is integrated in the cardanic system 26. For guided movement in the perpendicular first moving direction X', two guiding pins 4 are attached to cardanic system 26. Corresponding links 3 are attached to a relatively immovable outer frame 25 surrounding the rotation axis 22. The operating lever 2 is arranged centrally with respect to pair A and pair B. Thereby link systems 1 of pair B are arranged in a first distance 19 and link systems 1 of pair A are arranged in a larger second distance 21.

[0047] The force required for a movement of the guiding pins 4 along a guiding surface 6 of the corresponding link 3 is determined by the form of the guiding surface 6. If the guiding pin 4 needs to follow a path with ascending distance relative to a bottom of link 3, a force needs to be introduced into the link system 1. Thus, the form of the guiding surface 6 corresponds to a line of force. Said line of force represents the required input force and thus the feedback, a user feels when operating the operating lever 2. The link systems 1 as shown in Fig. 1 feature each a guiding surface 6 including a step 9. Thus, if the guiding pin 4 reaches step 9 after having finished his movement along a first guiding part 7, a force is required in order to elevate the guiding pin 4 to the relatively shifted second guiding part 8. This force is experienced by a user of the operating lever 2 through a jump in resistance against operating lever 2 movement.

[0048] In **Fig. 1,** operating lever 2 is in a neutral, central position which also corresponds to a second starting position for a second moving direction X1, orthogonal and relative to first moving direction X and first moving direction X' at the same time. Furthermore, this corresponds to a first starting position X0 of the four guiding pins 4 of pair A and pair B simultaneously. In this embodiment, lateral surface 10 of each guiding pin 4 is resting at step 9 of the corresponding guiding surface 6. The guiding pins 4 of pair A and pair B are arranged such, that their central plane contains a central axis of the operating lever 2. This improves central positioning and holding of the handle bar attached to the operating lever 2: Positioned in such a way, operating lever 2 is in a low point in acting forces. Deviation in first moving direction X or X' requires a considerable user input force.

[0049] **Fig. 2a** shows the assembly of link system 1 with links 3 and its integration into a part of frame 11. Left part of Fig. 2a shows link 3 and clip 16 as part of frame 11 before assembly. Right part of Fig. 2a shows assembled link 3 and frame 11. The part of frame 11 shown is a part, which is attached to the cardanic system 26 as depicted in Fig. 1. Shown is the outward facing side of this clip 16. A spring 5 is mounted at the surface of clip 16 facing the relatively elevated part of guiding surface 6 at the reverse side of second guiding part 8, when assembled. Clip 16 features at one end a snap hook 23 and at the other end a recess 24 (see also Fig. 2b). Link 3 features a clipping nose 15 a first end and an edge 13 at the opposing second end. When link 3 is attached to clip 16, snap hook 23 engages the clipping nose 15 and recess 24, not visible in Fig. 2a, receives the edge 13. On a site facing clip 16 and frame 11 if assembled, link 3 features an aperture 20. In the ready-to-use link system 1, aperture 20 is receiving spring 5. Depending on the depth of aperture 20 and a length of spring 5, spring 5 can be preloaded in this condition. For example, spring 5 may be compressed for 2 mm and step 9 has a corresponding height of 2 mm.

[0050] **Fig. 2b** shows assembly of the link system 1 and its integration to a further part of frame 11 of operating lever 2. Shown is a part of the outward facing outer frame 25 as shown in Fig. 1, which is attached to a housing 28 (see Fig. 3). Left part of Fig. 2b shows link 3 and part of outer frame 25 before assembly. Right part of Fig. 2a shows assembled link 3 and part of outer frame 25. Assembly of link 3 works similar as described for Fig. 2a: An edge 13 at a first link end is inserted in recess 24, link 3 is rotated and clipped with its clipping nose 15 on a second link end 14 into snap hook 23 of the outer frame 25. The shown part of outer frame 25 surrounds bearing 29 and thus one of the main rotation axes 22 for pivoting of operating lever 2, generating its movement in first moving direction X'.

[0051] It is to be recognized that all four links 3 are identical to each. The two links 3 of a pair are mounted side-inverted to obtain the same feedback for the user independent of the movement in +X' or -X' direction and +X or - X direction respectively. It is furthermore to be recognized that each of pair A and B contains two links 3. The features of the four links 3 are functionally identical to each other. It certain circumstances, an embodiment of the invention may contain two different sets of links 3 so that the movement in $\pm$ X direction will have a different force feedback than in $\pm$ X' direction.

[0052] **Fig. 3** depicts an outer view of operating lever 2 of Fig.1 in an orientation ready-to-use. Operating lever 2 is in a neutral position and thus in starting position X1 with

respect to first moving directions X, pointing into the drawing plane, and X'. Outer frame 25 is mounted in a housing 28. Guiding pins 4 of link systems 1 of pair A and not depicted pair B are resting at steps 9 on first guiding parts 7 in the neutral position, which equals starting position X0 of all of the four guiding pins 4 respectively. Even though step 9 points down to earth in a ready-to-use position of the operating lever 2, a remarkable resistance needs to be overcome in order to push a guiding pin 4 to the shifted part of the guiding surface 6 of the second guiding part 8. Thus, link 3 gets slightly rotated and second guiding part 8 gets pushed down relative to outer frame 25, for example for 2 mm. The second, opposite guiding pin 4, not to be seen in Fig. 3, gets moved in the same direction by respective movement of operating lever 2. Due to the mirrored assembly of both link systems 1 of pair A, said second guiding pin 4 gets moved nearly free of forces along the not shifted first guiding part 7 of its corresponding links. The same holds true for the pairwise movement of guiding pins 4 of pair B: Deviation from starting position X0 leads to a jump in resistance for one of the guiding pins 4 and an almost force free movement for the other guiding pin 4. After movement in first moving direction ± X' or ± X, each of the guiding pins 4 of pair A or pair B, respectively, is reset by corresponding restoring means 18 as shown in Fig. 4.

[0053] **Fig. 4** shows some parts of an operating lever 2 according to the invention with unassembled clip 16 and link 3. The operating lever 2 is rotated by 180° with respect to its in-use-position. On the downward side of Fig. 4, a handle-bar 27 is shown, which is attached to the operating lever 2.

[0054] Depicted is a part of the cardanic system 26, without mounted clips 16 and links 3. Guiding pins 4 of link system 1 are attached directly to the operating lever 2 and to the cardanic system 26. Thus, they are both attached at least indirectly to the operating lever 2 and its handle bar 27: Movement of operation lever 2 in first moving direction X' is translated to simultaneous pivoted movement of cardanic system 26 while movement of operating lever in first moving direction X causes no co-movement of cardanic system 26 and corresponding guiding pins 4. Depicted are two restoring springs 18 as restoring means 17. Operating lever 2 also includes a restoring spring 18 for each of the guiding pins 4 mounted on the cardanic system 26. These are omitted in Fig. 4 for better understanding.

[0055] In this embodiment, the depicted restoring springs 18 are leg springs. In each case, one of the legs 30 at the ends of a restoring spring 18 is attached to corresponding guiding pins 4 in a ready-to-use condition. Deviation of a guiding pin 4 causes deviation of leg 30 against a spring tension. Thus, after end of movement, when no user input force is acting anymore, restoring spring leg 30 and corresponding guiding pin 4 are reset into the starting position X0 and thus operating lever 2 is in starting position X1.

[0056] The restoring spring 18 is mounted separately from link systems 1 and links 3, which means that a motion of guiding pin 4 causes no overall motion of restoring spring 18. Though, motion of guiding pin 4 leads to transversal motion of leg 30, no transversal movement of spring windings 31 and thus of the main part of restoring spring 18 is induced. The windings contract instead.

[0057] The invention proposes a link system and a corresponding operating lever that allows improved and simplified central positioning of the operating lever as well as generation of user feedback forces in a comparably simple construction with separated guiding and restoring system.

Reference signs

[0058]

1	link system
2	operating lever
3	link
4	guiding pin
5	spring
6	guiding surface
7	first guiding part
8	second guiding part
9	step
10	lateral surface
11	frame
12	link end
13	edge
14	link end
15	clipping nose
16	clip
17	restoring means
18	restoring spring
19	first distance
20	aperture
21	second distance
22	rotation axis
23	snap hook
24	recess
25	outer frame
26	cardanic system
27	handle bar adapter
28	housing
29	bearing
30	spring leg
31	spring winding
X,X'	first moving direction
X0	starting position
X1	second moving direction
A	first pair
B	second pair

Claims

1. Link system (1) for guiding an operating lever (2), which is pivot mounted in a first moving direction (X,

X'), featuring a guiding pin (4) and a spring-loaded link (3), further featuring a guiding surface (6), which is divided in a first guiding part (7) and a second guiding part (8) by a step (9), wherein in a condition of use of link system (1), operating lever (2) is guided by guiding pin (4) along guiding surface (6).

2. Link system (1) according to claim 1, wherein, when operating lever (2) is not pivoted in first moving direction (X, X'), a lateral surface (10) of guiding pin (4) is resting at step (9).

3. Link system (1) according to claim 1 or 2, wherein the link (3) is detachably attachable to a frame (11) of operating lever (2), especially attachable by clipping.

4. Link system (1) according to claim 3, wherein a first link end (12) features an edge (13) for rotatable attachment to the frame (11) and wherein a second link end (14) features a clipping nose (15) for clipping to the frame (11).

5. Link system (1) according to one of the preceding claims,
wherein first guiding part (8) and/or second guiding part (9) are shaped convexly.

6. Link system (1) according to one of the preceding claims,
wherein the guiding surface (6) features locking points and/or a variation of slope.

7. Link system (1) according to one of the preceding claims,
wherein the link system (1) features restoring means (17), especially at least one restoring spring (18), for transferring guiding pin (4) to a not-deflected starting position (X0), especially guiding pin (4) to starting position (X0) and operating lever (2) to its not-deflected starting position (X1), after movement in the first moving direction (X, X'), wherein the restoring means (17) are separated from link (3) and not guided along guiding surface (6).

8. Process for guidance of an operating lever (2), pivotable in a first moving direction (X, X'), including the steps of coupling the movement of operating lever (2) in first moving direction (X, X') to movement of a guiding pin (4); acting a displacement force on the not-deflected operating lever (2) in first moving direction (X, X'); generating a jump of resistance against the movement of operating lever (2) and guiding pin (4).

9. Process according to claim 8, wherein after operating lever (2) and guiding pin (4) are displaced in first moving direction (X, X'), a restoring force acts on guiding pin (4) and operating lever (2) pushing them back to not-fisplaced conditions in moving direction (X,X').

10. Operating lever (2) featuring at least one link system (1) according to one of claims 1 - 7.

11. Operating lever (2) according to claim 10, featuring a further link system (1) according to one of claims 1 - 7, wherein two of the link systems (1) form a first pair (A) of link systems (1) and wherein link systems (1) of the first pair (A) are arranged in parallel and rotated 180° to each other.

12. Operating lever (2) according to claim 11, wherein the guiding pins (4) of the first pair (A) are arranged such that they have a common tangent plane.

13. Operating lever (2) according to claim 11 or 12, wherein each link system of the first pair (A) is featuring associated restoring means (18) acting on respective guiding pins (4).

14. Operating lever (2) according to claim 11, 12 or 13, featuring a second pair (B) of link systems (1) according to one of the claims 1 - 7, wherein the link systems (1) of the second pair (B) are arranged in parallel and rotated 180° to each other, and wherein the first pair (A) and the second pair (B) of link systems (1) are arranged orthogonal to each other and centrally around operating lever (2).

15. Operating lever (2) according to claim 12, wherein the first pair (A) is centred on operating lever (2) in a first distance (19) and the second pair (B) is centred on operating lever (2) in a second distance (21), wherein the first distance (19) is smaller than the second distance (21).

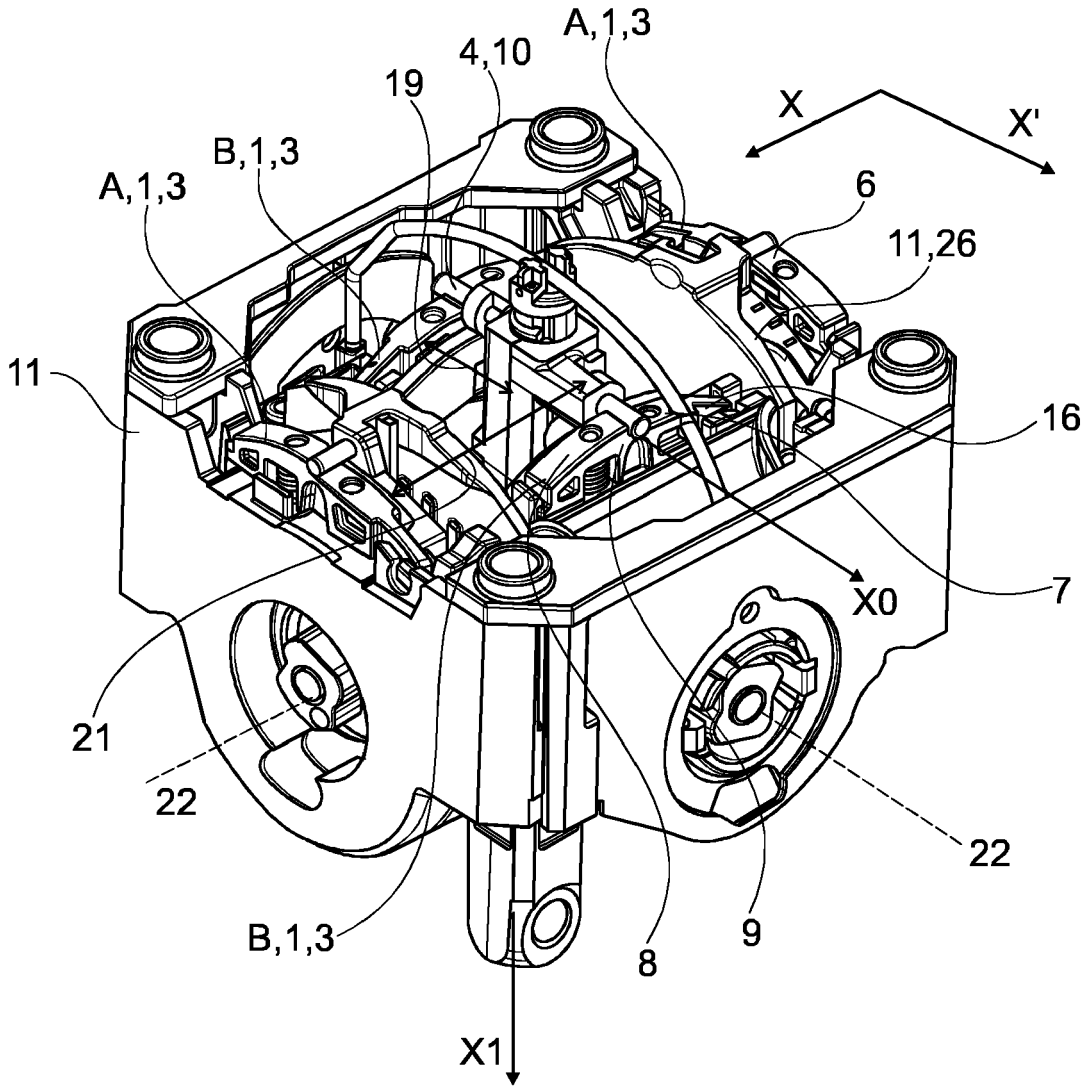

Fig. 1

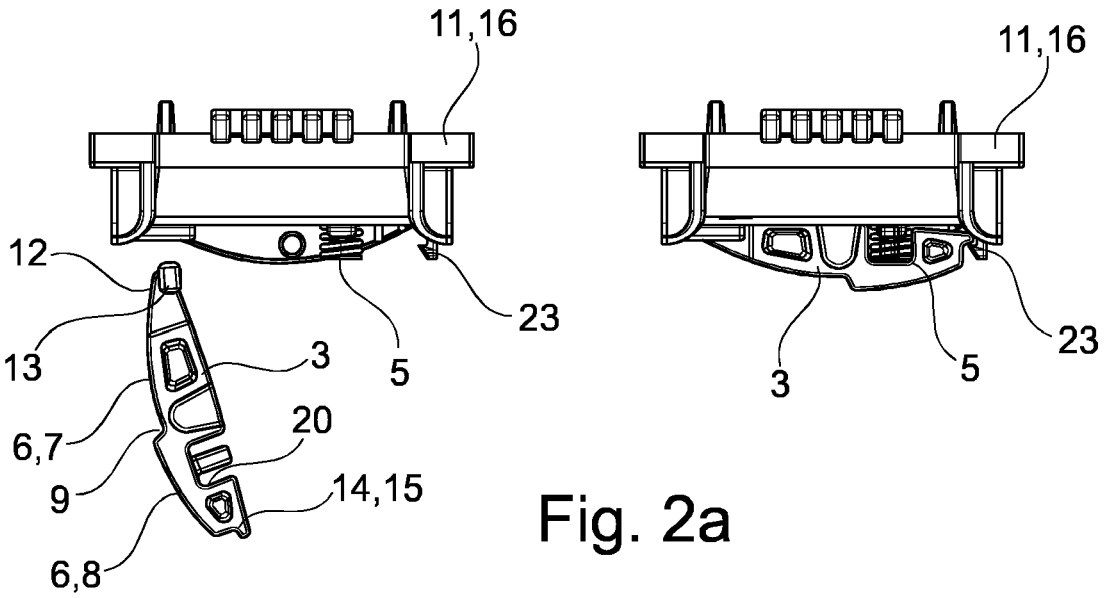
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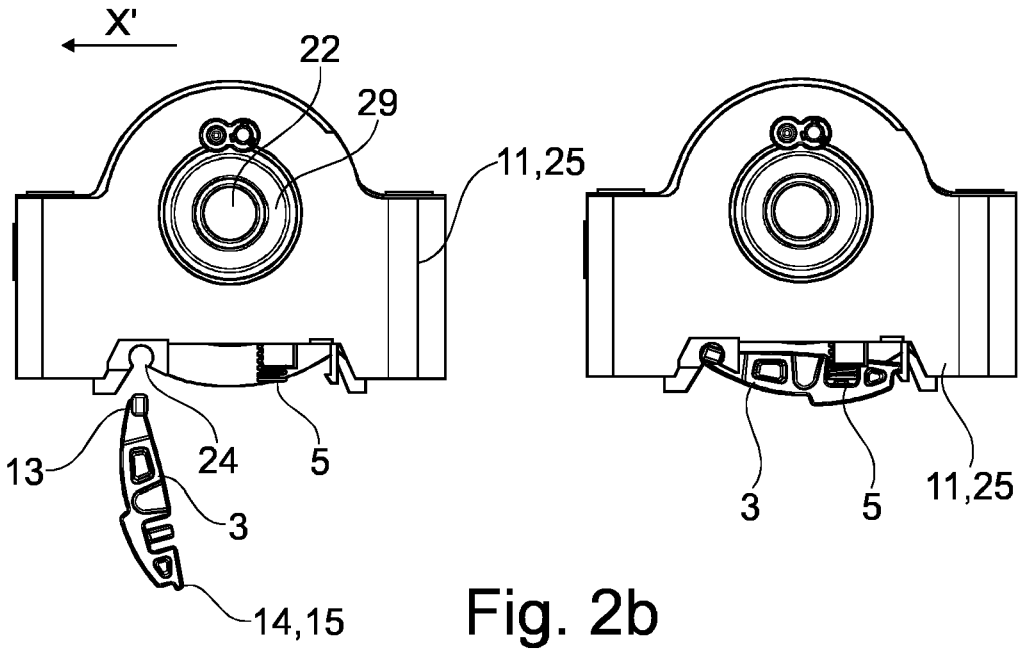
Fig. 2a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11,25

Fig. 2b

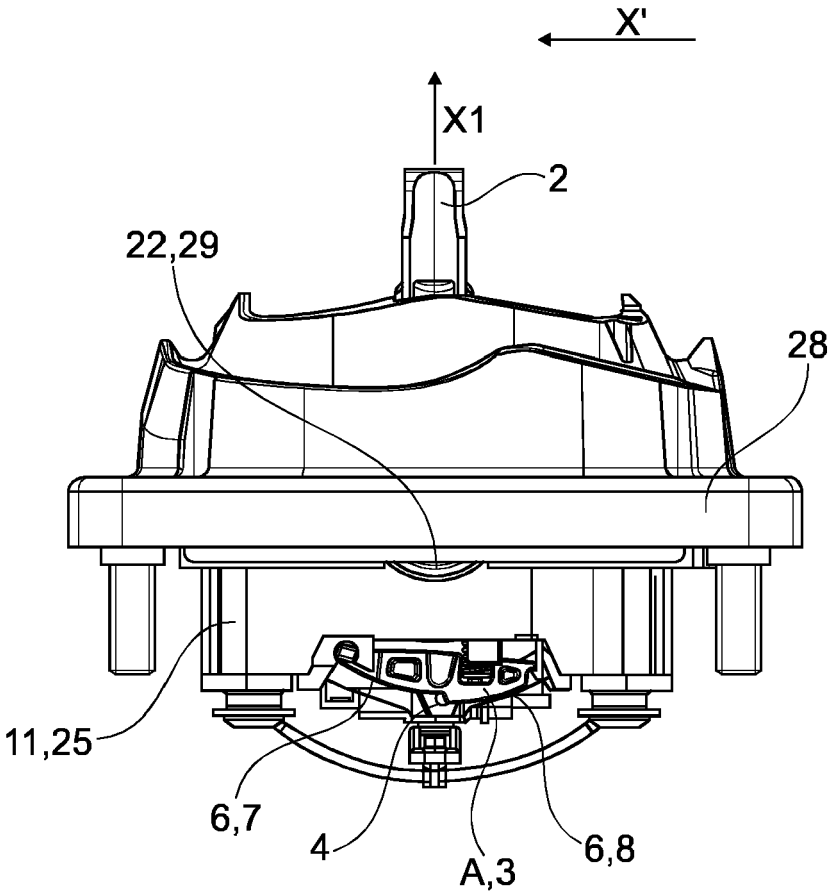

Fig. 3

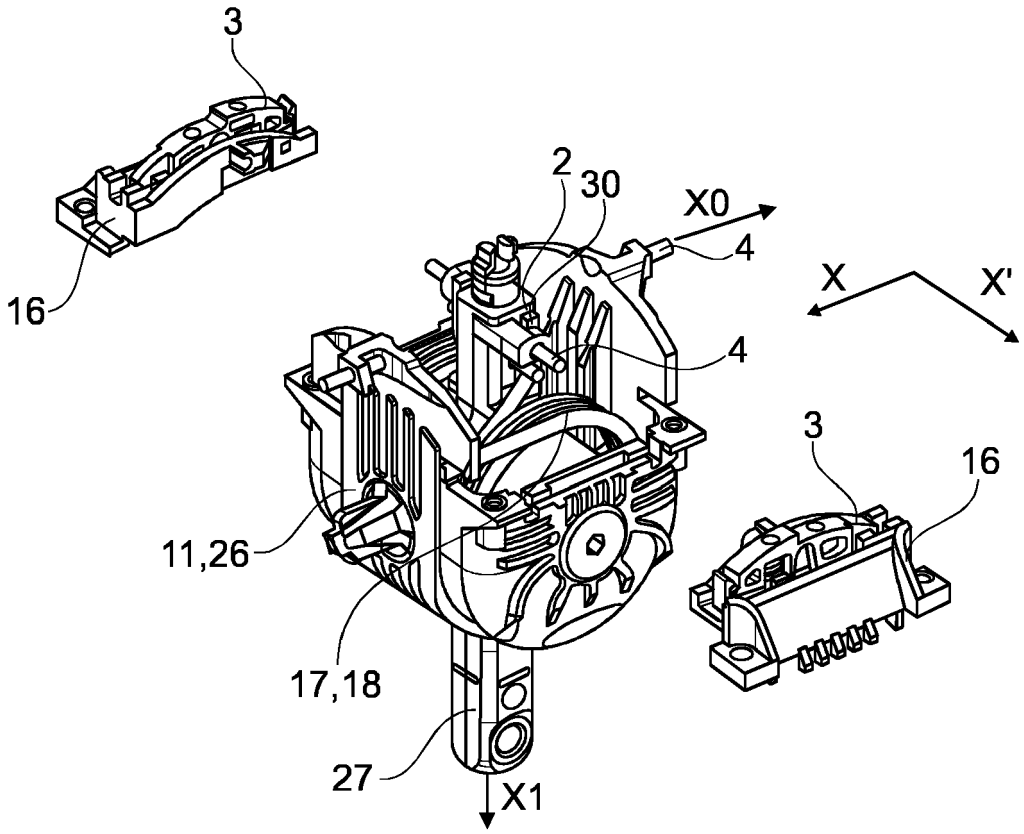

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
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