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(73) Patenthaver: **OilQuick Deutschland KG, Bürgermeister-Schauer-Straße 1, 82297 Steindorf, Tyskland**

(72) Opfinder: **STÖSSL, Martin, Figurstraße 40, 85132 Rupertsbuch Schernfeld, Tyskland**
Kollmann, Michael, Badstraße 12, 86492 Egling an der Paar, Tyskland

(74) Fuldmægtig i Danmark: **Patrade A/S, Ceresbyen 75, 6., 8000 Århus C, Danmark**

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Loading crane changer

The present invention relates to a device for changing work tools on a loading crane according to the preamble of claim 1.

Loading cranes are used, among other things, to move loads onto transport vehicles or trailers. Such cranes can be stationary or mobile loading cranes. Loading cranes are frequently mounted directly on the transport vehicle or trailer.

Crane loading operations may involve, e.g., loading felled logs or tree branch waste in the forestry industry, loading palleted loads or loads stored in sacks, or loading bar stock in the construction or logistics industry. Different loads require work tools customized to the specific load, or, more specifically, load grabbers, e.g., gripper-like, claw-like or fork-like tools with or without a rotary drive (rotator) for aligning the load grabber relative to the load to be picked up. In some cases, this operation requires frequent changes of the work tool or load grabber. To make it easier to change the work tools, a variety of different quick couplers are used.

DE 3 135 150 C1 describes a generic quick coupler for coupling work tools to sticks of hydraulic excavators. The prior art quick coupler comprises a substantially rotation-symmetrical coupling member on the loading crane side, said coupling member being retracted via a pin-shaped guide member into a complementary cup-shaped receiving element on the work tool side and interlockingly retained by means of a hydraulically actuated locking mechanism. To lock or interlockingly retain the coupling members, a bolt-shaped locking element, which is movably disposed on the coupling member on the work tool side, is retracted into a receiving element in the form of a transverse bore in the pin-shaped guide member of the coupling member on the loading crane side.

Quick couplers of this type ensure a quick change of work tools, whereby the user requires the most direct possible transmission of force and backlash-free connection between the loading crane and the work tool.

Thus, the problem to be solved is that of making available a suitable device, by means of which the transmission of force and the connection between the loading crane and the work tool can be improved.

This problem is solved by a device for changing work tools on a loading crane having the features of claim 1. Useful embodiments and further advanced modifications of the invention are described in the dependent claims.

The inventive device for changing work tools on a loading crane comprises a first coupling member on the work tool side or on the loading crane side having a receiving opening and a second coupling member on the loading crane side or on the work tool side, respectively, having a guide member which extends along a longitudinal axis and which can be made to engage in the receiving opening of the first coupling member by moving the first coupling member and the second coupling member toward each other in the direction of the longitudinal axis. The first coupling member has a support surface for axially abutting the second coupling member, and the second coupling member has a bearing surface complementary to the support surface and at least one locking element which can be moved by means of a drive transversely to the longitudinal axis of the second coupling member between a disengaged position and a retaining position. The locking element has a clamping surface for frictionally abutting the first coupling member. The first coupling member has an abutment surface complementary to the clamping surface for backlash-free axial clamping of the first coupling member and the second coupling member. The interaction between the clamping surface and the abutment surface ensures axial clamping and a direct transmission of force so that the second coupling member can be coupled with zero play to or by the first coupling member and be moved with said first coupling member. This allows precise movements of the work tool to be executed and ensures a high positioning accuracy of the work tool. Furthermore, the vibration-induced wear and tear or abrasion of the contacting surfaces on the first and

second coupling member can be reduced. In addition, because of axial clamping, a unique load capacity for torques is achieved since torques can be frictionally transmitted via the support surface and the abutment surface, thus ensuring that the locking elements in particular do not have to transmit any torques.

Preferably, the first coupling member is disposed on the work tool, and the second coupling member is disposed on the loading crane. However, in the context of the present invention, the loading crane side and the work tool side are considered to be interchangeable. The first coupling member could also be disposed on the loading crane and the second coupling member on the work tool.

In a particularly preferred embodiment, the clamping surface on the locking element and the abutment surface on the first coupling member are designed as mutually corresponding inclined surfaces having a mutual angle of inclination. This makes it possible to achieve an especially good wedge effect for generating an axial pull-in force. The locking element can also have an additional clamping surface as a reserve clamping surface. This reserve clamping surface can be utilized by rotating the locking element about its longitudinal axis.

The support surface on the first coupling member and the associated bearing surface on the second coupling member are preferably designed as conical surfaces. This makes it possible to obtain an optimum bearing surface and to precisely align and center the two coupling members when connecting them. The support surface and the bearing surface can be inclined, e.g., at an angle of 20° to 50°, preferably at an angle of 30°, relative to the central axis of the first coupling member or the longitudinal axis of the second coupling member. However, the support surface and the bearing surface can also be designed as plane surfaces.

Pairing of the clamping surface on the locking element and the abutment surface on the first coupling member can preferably be designed so to ensure the self-locking fixation of the locking element in the retaining position. This prevents the locking element from being disengaged by itself when the two coupling members are in the coupled and locked

position. Self-locking can be achieved by ensuring that the clamping surface and the abutment surface have a suitable inclination. In a potential embodiment of the invention, the clamping surface can be inclined at an angle β of approximately 30° relative to the longitudinal axis of the locking element. The abutment surface on the first coupling member complementary to the clamping surface can also be inclined at an angle of 30° relative to an axis at right angles to the central axis of the first coupling member.

In an advantageous embodiment of the invention, the first coupling member has a cup-shaped main body with a central axis and a circular receiving opening concentric with the central axis. The second coupling member can have a disk-shaped upper part and a cylindrical guide member extending along the longitudinal axis for engaging in the receiving opening of the first coupling member.

Preferably, at least one positioning and aligning element for positioning the angle of the two coupling members is disposed on the guide member of the second coupling member and on the receiving opening of the first coupling member. In this manner, a defined angular position for engaging the guide member in the receiving opening of the first coupling member is predetermined. Thus, it can be ensured that the plug-in connectors disposed on the first coupling member are correctly coupled to the respective mating connectors on the second coupling member. This also provides protection against an unwanted rotation of the first and the second coupling member.

Preferably, two diametrically opposed locking elements are disposed on the second coupling member. This ensures clamping in the center and a uniform force distribution. However, it is also possible to provide only one locking element or more than two locking elements. Using a plurality of locking elements can reduce the relative load on a locking element as compared to an embodiment having only one locking element. It also makes more uniform force distribution possible.

A further advantage can be obtained by disposing suitable damping elements on the first or the second coupling member for the purpose of damping shocks when the two coupling members are being coupled to each other. Using the damping elements, shock-induced

damage can be avoided. The damping elements, which are advantageously disposed between the first and the second coupling member, can be, e.g., elastically deformable elastomer blocks. It is also possible to use springs or differently designed damping elements.

The drive for moving the at least one locking element can preferably be a hydraulic drive with a piston which moves inside a piston chamber. However, it is also possible to use a pneumatic, electric or other drive. The piston, which can preferably be actuated from both ends, and a through-opening inside the guide member for axially guiding the piston, can advantageously have a noncircular cross section. A noncircular cross section allows an angular position of the locking element in the guide member to be uniquely defined and protected against rotation. This is an easy way of ensuring that the clamping surface on the locking element is always correctly positioned. The cross section can be, e.g., slightly elliptical or polygonal, e.g., in the form of a hexagon or octahedron. Other means of preventing rotation are also possible.

It is particularly advantageous if the locking element is integrally formed in one piece with the piston. In this manner, it is possible to simplify the drive.

In a further advantageous embodiment, a visual display for monitoring the correct locking position can be disposed on the first coupling member or on the second coupling member.

Mating supply ports, particularly in the form of a power supply coupler or a hydraulic quick coupler, can be disposed on the first coupling member and the second coupling member. This enables the work tool in particular to be supplied with a hydraulic fluid and/or current. As an alternative or in addition thereto, it is also possible to connect hydraulic actuators or energy consumers in or on the second coupling member, e.g., in the form of a rotary drive (rotator) attached to the second coupling member or integrated into the second coupling member, by means of which rotary drive a work tool can be rotated relative to the coupler axis. The hydraulic actuator or energy consumer can also be, for example, a locking element additionally integrated into the second coupling

member so as to create an interlocking or friction-locked connection between the first and the second coupling member.

Additional features and advantages of the invention will become apparent from the following description of a preferred illustrative embodiment, with reference to the drawings. The drawings show:

Fig. 1 a perspective view of two coupling members of a device for changing work tools in a not yet coupled state;

Fig. 2 a sectional view of the two coupling members in a not yet coupled state;

Fig. 3 a sectional view of the two coupling members in the coupled state;

Fig. 4 a perspective view of a piston with an integrated locking element;

Fig. 5 a lateral view of the piston shown in Figure 4, and

Fig. 6 a front view of the piston shown in Figure 4.

Figures 1 and 2, respectively, show a perspective view and a sectional view of an inventive device for changing work tools on a loading crane, comprising a first coupling member 1 on the work tool side and a second coupling member 2 on the loading crane side in a not yet coupled state.

The first coupling member 1 to be attached to a work tool has a cup-shaped main body with a central axis 3 and a circular receiving opening 4 concentric with the central axis 3. In the configuration shown, the cup-shaped main body consists of a disk-shaped lower member 6 having flange-like connecting members 5 and a ring-shaped upper member 7 which delimits the circular receiving opening 3. The ring-shaped upper member 7 is attached to the disk-shaped lower member 6 by means of screws 8. The disk-shaped lower member 5 can be mounted on a shovel, a fork or other work tool via bores 9 in the

connecting members 5. The ring-shaped upper member has a ring-shaped upper face surface 10 and, in the upper area of the receiving opening 3, a here conically designed support surface 11 for bearing the second coupling member 2.

As can be seen in particular from Figure 2, two diametrically opposed recesses 12 with a downwardly directed, inclined abutment surface 13 are arranged on the inside surface of the ring-shaped upper member 7. Inwardly projecting actuation bolts 16 biased inwardly by a spring are guided so as to be able to move radially inside two guide sleeves 15, which are screwed into transverse bores 14 disposed in the recesses 12. An inspection bolt 17, which moves inside the guide sleeve 15, is disposed at the end of the actuation bolts 16, which projects outwardly relative to the upper member 7. The two radially movable actuation bolts 16 with the inspection bolts 17 provide a visual display for monitoring the correct locking position. Further, on the inside of the ring-shaped upper member 7, a positioning element 18 is disposed, as seen in Figure 1, and is in the form of a longitudinal groove with a rectangular cross section. In the circumferential direction of the upper member, the positioning element 18 in the form of a longitudinal groove is offset by 90° relative to the recesses 12 and serves as a positioning aid for correctly inserting the second coupling member 2. On the disk-shaped lower member 6 of the first coupling member 1, plug-in connectors 19 are arranged, which project into the receiving opening 3 for connection to the respective mating connectors on the second coupling member 2. In this manner, it is possible to supply the work tools, e.g., with hydraulic fluid or another energy source. The coupling connectors 19 can also be designed to transmit electrical energy or electrical signals for monitoring or control purposes.

The second coupling member 2, which can be coupled to the first coupling member 1, comprises a stepped cylindrical main body with a longitudinal axis 20. In the configuration shown, the main body of the second coupling member 2 comprises a disk-shaped upper member 21 and a cylindrical guide member 22 extending along the longitudinal axis 20 and having two oppositely disposed covers 23 for engaging in the receiving opening 3 of the first coupling member 1. The disk-shaped upper member 21 and the cylindrical guide member 22 can be integrally formed in one piece. However,

they can also be designed as separate components that are tightly connected to each other, e.g., by means of screws.

In the upper member 21 of the second coupling member 2, designed here in the form of a circular disk, bores 24 for mounting on a loading crane or a rotary drive are disposed. In addition, the upper member 21 comprises a plurality of connectors 25 and 26 for the supply of hydraulic fluid or the like. In the upper member 21, other connectors for the supply of electrical energy or for the transmission of control signals can be disposed as well.

The guide member 22, which is designed here in the form of a cylinder, is adapted in shape and dimensions to those of the receiving opening 3 of the first coupling member 1. The guide member 22 and the covers 23 have a conical bearing surface 27 shown in Figure 2 for abutting the conical support surface 11 of the first coupling member 1. The conical bearing surface 27 on the second coupling member 2 and the associated support surface 11 on the first coupling member 1 have the same inclination and, in the embodiment shown, and are inclined at an angle α of 30° relative to the longitudinal axes 3 and 20. Thus, during assembly, centering, on the one hand, and connecting the coupling members 1 and 2 in a centered and accurate position, on the other hand, can be ensured. In addition, disposed on the outside of the guide member 22 is an aligning element (not shown in the drawing) in the form of a projecting piece, for engaging in the positioning element 18 of the first coupling member 1, which is designed here in the form of a longitudinal groove. The projecting piece on the guide member 22 and the associated longitudinal groove predetermine a defined inserting position for engaging the guide member 22 in the receiving opening 4 of the first coupling member 1. In this manner, it is possible to ensure that the plug-in connectors 19 disposed on the first coupling member 1 are correctly coupled to the associated mating connectors on the second coupling member 2. Additional receiving means 28 for a plurality of damping elements 29 are located on the lower surface of the guide member 22, as shown in Figure 3.

In a through-opening 30 extending at right angles relative to the longitudinal axis 20 in the guide member 22, two pistons 31, shown separately in Figures 4 to 6, are movably

guided transversely to the longitudinal axis 20. A bolt-shaped locking element 32 for engaging in the recesses 12 of the first coupling element 1 is molded onto the two ends of the pistons 31 facing away from each other. As indicated in Figure 4, the pistons 31 and the bolt-shaped locking elements 32 have a common longitudinal axis 33. The through-opening 30 and the two lateral covers 23 delimit a piston chamber in which the two pistons 31 can be hydraulically moved between a retracted position shown in Figure 2 and an extended position shown in Figure 3. The piston chamber delimited by the through-opening 30 and the two covers 23 and the two pistons 31 with the associated fluid inlets create a drive, designed here in the form of a hydraulic piston drive, by means of which the two locking elements 32 can be moved between a retracted disengaged position shown in Figure 2 and an extended retaining position shown in Figure 3. However, electromechanical, pneumatic or any other types of drives could also be used to move the locking elements 32.

In the embodiment shown, two diametrically opposed locking elements 32 are disposed on the guide member 22. As a result, uniform and centered clamping can be achieved. However, it would also be possible to use only one locking element or more than two locking elements. In the illustrative embodiment, the longitudinal axes 32 of the pistons 31 with the integrated locking elements 32 are disposed at right angles relative to the longitudinal axis 20 of the second coupling member 2 and coaxially relative to each other. However, in alternative embodiments, the pistons 31 and the locking elements 32 could also be moved at an angle not equal to 90° relative to the longitudinal axis 20 of the second coupling member 2. Thus, a movement of the locking element 32 transversely to the longitudinal axis 20 of the second coupling member 2 is not only to be understood as a movement at a right angle relative to the longitudinal axis. In addition to a radial movement component, the locking element 32 could also have an axial movement component.

In the illustrative embodiment shown, the pistons 31 are disposed with coaxial longitudinal axes 33 inside the guide member 22. However, it is also conceivable and possible to dispose one or a plurality of locking elements 32 in a different configuration, for example, instead of diametrically opposed pairs, laterally offset relative to the

longitudinal axis 20 and/or at identical or opposite angles of inclination relative to the longitudinal axis 20.

Figures 4 to 6 show different views of a piston 31 with the integrated bolt-shaped locking element 32. The free ends of the bolt-shaped locking element 32 have a clamping surface 34, here in the form of an inclined surface, for abutting the abutment surface 13 of the first coupling member 1. As indicated in Figure 2, the clamping surface is inclined at an angle β of 30° relative to the longitudinal axis 33. The abutment surface 13 complementary to the clamping surface 34 also inclines at the angle β. The piston 31 and the associated through-opening 30 have a slightly noncircular cross section, which prevents rotation of the piston 31. This ensures that the clamping surface 34 is always in the correct position. In the embodiment shown, the pistons 31 and the associated through-opening 30 have a slightly elliptical cross section. On the side diametrically opposed to the clamping surface 34, an additional clamping surface 35 can be provided on the free front end of the bolt-shaped locking element 32. This additional clamping surface 35 serves as a reserve clamping surface and can be utilized by rotating the piston 31 by 180° in the event of wear and tear.

The working principle of the system described above will be explained below:

For coupling, the two coupling members 1 and 2 are first aligned in such a way that the longitudinal axis 20 of the second coupling member 2 and the center axis 3 of the first coupling member 1 are aligned coaxially relative to each other. In addition, the second coupling member 2, which is disposed, e.g., on a boom of the crane or on a rotary drive, is rotated about its longitudinal axis 20 in such a way that the aligning element disposed on the second coupling member is in alignment with the positioning element 18, which here has the form of a longitudinal groove. Next, the second coupling member 2 can be moved along the longitudinal axis 20, with the cylindrical guide member 22 engaging in the receiving opening 4, toward the first guide member 1 until the lower bearing surface 27 of the second coupling member 2 comes to rest on the support surface 11 of the first coupling member 1. Due to the conical design of the support surface 11 and the bearing surface 27, a precise radial and axial alignment with a defined coupling position is

ensured. Shocks potentially arising during the coupling of the two coupling members 1 and 2 can be damped or absorbed by the damping elements 29 disposed on the lower surface of the second coupling member 2.

When the lower bearing surface 27 of the second coupling member 2 rests on the support surface 11 of the first guide member 1, the two pistons 31 can be moved out of the position shown in Figure 2 by applying appropriate pressure so that the two locking elements 32 are moved radially outward out of the retracted disengaged position shown in Figure 2 into an extended retaining position shown in Figure 3. This causes the upper clamping surfaces 34 of the locking elements 32 disposed in the second coupling member 2 to abut the lower abutment surfaces 13 of the first coupling member 1. Due to the design of the clamping surfaces 34 and abutment surfaces 13 in the form of inclined surfaces an axial force is generated when the locking elements 32 are being extended, by means of which the first coupling member 1 is drawn toward the coupling member 2.

When the locking elements 32 are extended into the retaining position, the actuation bolts 16 disposed in the first coupling member 1 are pushed radially outward, as shown in Figure 3, which also causes the inspection bolts 17 to be pushed radially outward relative to the guide sleeve 15. This signals to the operator that the locking element 32 has been correctly extended and that the coupling procedure has been successfully performed.

To disengage the locking mechanism, the two pistons 31 are again driven toward each other by applying appropriate pressure. This also disengages the locking elements 32 from the recesses 12 of the first coupling member 1 and retracts them into the cylindrical guide member 22. In this manner, the coupling between the first and second coupling members 1 and 2 can be disengaged.

List of reference numbers

1	First coupling member
2	Second coupling member
3	Central axis
4	Receiving opening
5	Connecting member
6	Lower member
7	Upper member
8	Screws
9	Bore
10	Face surface
11	Support surface
12	Recess
13	Abutment surface
14	Transverse bore
15	Guide sleeve
16	Actuation bolts
17	Inspection bolt
18	Positioning element
19	Coupling connector
20	Longitudinal axis
21	Upper member
22	Guide member
23	Cover
24	Bore
25	Connector
26	Connector
27	Bearing surface
28	Receiving means
29	Damping element
30	Through-opening

31 Piston

32 Locking element

33 Longitudinal axis of the piston

34 Clamping surface

35 Additional clamping surface

Patentkrav

1. Anordning til udskiftning af arbejdsapparater på en læssekran, som indeholder en første koblingsdel (1) med en optagsåbning (4) på arbejdsapparatsiden eller læssekransiden og en anden koblingsdel (2) på læssekransiden eller arbejdsapparatsiden med en føringsdel (22), som strækker sig langs en længdeakse (20), og som ved at bevæge den første koblingsdel (1) og den anden koblingsdel (2) mod hinanden i længdeaksen (20) kan bringes i indgreb med optagsåbningen (4) i den første koblingsdel (1), hvor den første koblingsdel (1) har en støtteflade (11) til aksialt anslag af den anden koblingsdel (2), og den anden koblingsdel (2) en kontaktflade (27), der korresponderer med støttefladen (11), og mindst et låseelement (32), som ved hjælp af et drev (23, 30, 31) kan bevæges på tværs af den anden koblingsdels (2) længdeakse (20) mellem en frigørelsesposition og en holdeposition, **kendetegnet ved, at** låseelementet (32) har en spændeflade (34) til kraftsluttende anslag på den første koblingsdel (1), og at den første koblingsdel (1) har en anslagsflade (13), der korresponderer med spændefladen (34), til slørfri, aksial sammenspænding af den første koblingsdel (1) og den anden koblingsdel (2).

2. Anordning ifølge krav 1, **kendetegnet ved, at** spændefladen (34) på låseelementet (32) og anslagsfladen (13) på den første koblingsdel (1) er udformet som indbyrdes korresponderende skrå flader med en indbyrdes korresponderende hældningsvinkel.

3. Anordning ifølge krav 1 eller 2, **kendetegnet ved, at** støttefladen (11) på den første koblingsdel (1) og den tilhørende kontaktflade (27) på den anden koblingsdel (2) er udført som koniske flader.

4. Anordning ifølge et af kravene 1 til 3, **kendetegnet ved, at** parringen af spændefladen (34) på låseelementet (32) og anslagsfladen (13) på den første koblingsdel (1) er udformet til selvlåsende fiksering af låseelementet (32) i holdepositionen.

5. Anordning ifølge et af kravene 1 til 4, **kendetegnet ved, at** den første koblingsdel (1) har et potteformet basislegeme med en midterakse (3) og en cirkelrund optagsåbning (4), som er koncentrisk i forhold til midteraksen (3).

6. Anordning ifølge et af kravene 1 til 5, **kendetegnet ved, at** den anden koblingsdel (2) har en skiveformet overdel (21) og en cylindrisk føringsdel (22), der

strækker sig langs længdeaksen (20), til indgreb i den første koblingsdels (1) optagsåbning (4).

7. Anordning ifølge et af kravene 1 til 6, **kendetegnet ved, at** der på føringsdelen (22) af den anden koblingsdel (2) og på optagsåbningen (4) af den første koblingsdel (1) er anbragt mindst et positionerings- og justeringselement til vinkelpositionering af de to koblingsdele (1, 2).

8. Anordning ifølge et af kravene 1 til 7, **kendetegnet ved, at** der på den anden koblingsdel (2) er anbragt låseelementer (32), som ligger diametralt modsat hinanden.

9. Anordning ifølge et af kravene 1 til 8, **kendetegnet ved, at** der på den første eller den anden koblingsdel (1, 2) er anbragt dæmpningselementer (29) til dæmpning af stød, når de to koblingsdele (1, 2) sættes sammen.

10. Anordning ifølge et af kravene 1 til 9, **kendetegnet ved, at** drevet (23, 30, 31) til forskydning af det mindst ene låseelement (32) er udformet som hydraulisk drev med et stempel (31), der kan forskydes i et stempelkammer (23, 30).

11. Anordning ifølge krav 10, **kendetegnet ved, at** stempelkammeret (23, 30) begrænses af en gennemgangsåbning (30) og to laterale afdækninger (23) på føringsdelen (22).

12. Anordning ifølge krav 11, **kendetegnet ved, at** gennemgangsåbningen (30) og stemplet (31), der kan forskydes aksialt heri, har et ikke-cirkulært tværsnit.

13. Anordning ifølge et af kravene 10 til 12,
kendetegnet ved, at låseelementet (32) er udført integreret med stemplet (31).

14. Anordning ifølge et af kravene 1 til 13, **kendetegnet ved, at** der på den første koblingsdel (1) eller den anden koblingsdel (2) er anbragt en visuel indikator (15, 16, 17) til overvågning af korrekt låsning.

Fig. 1

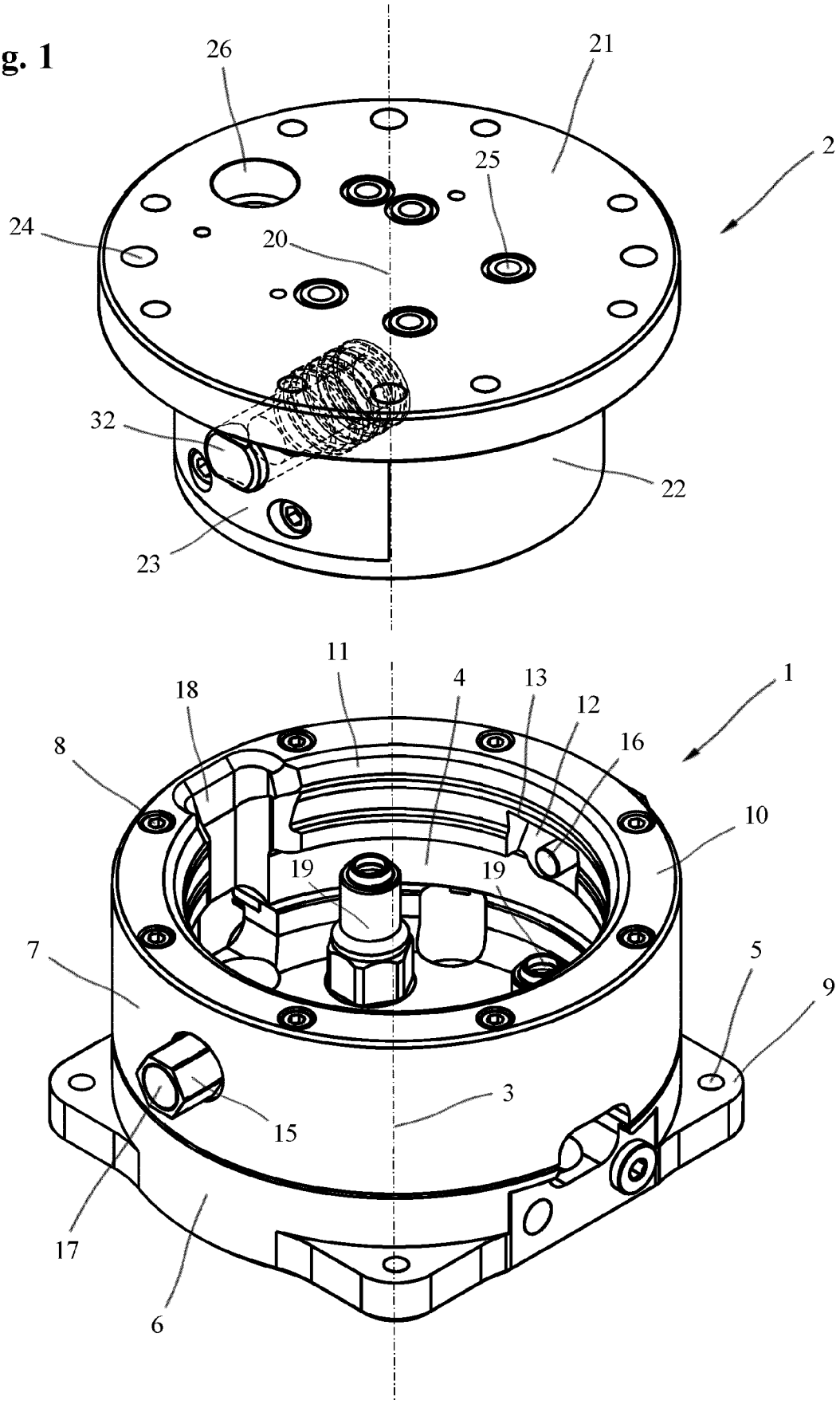

Fig. 2

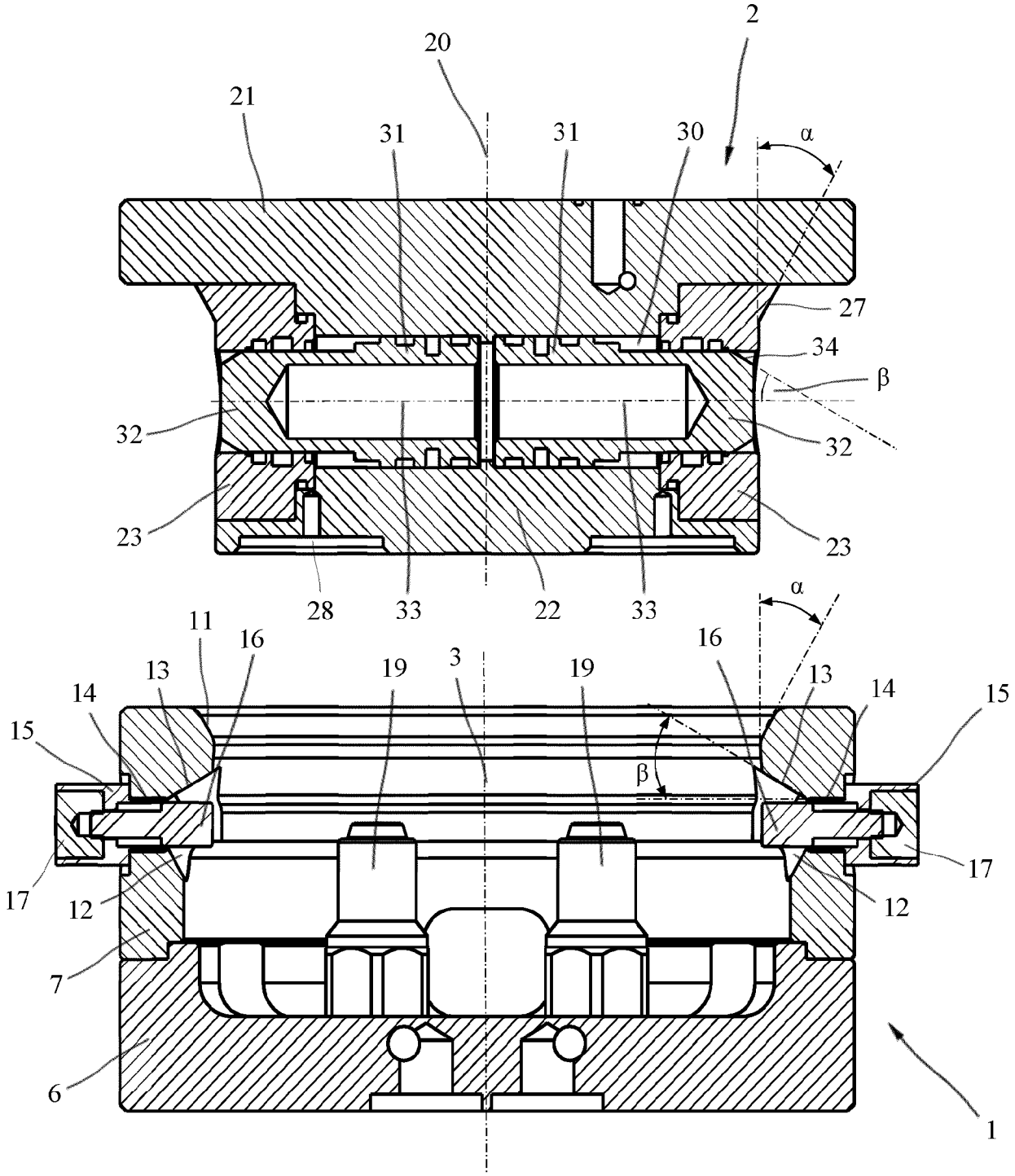
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Fig. 3

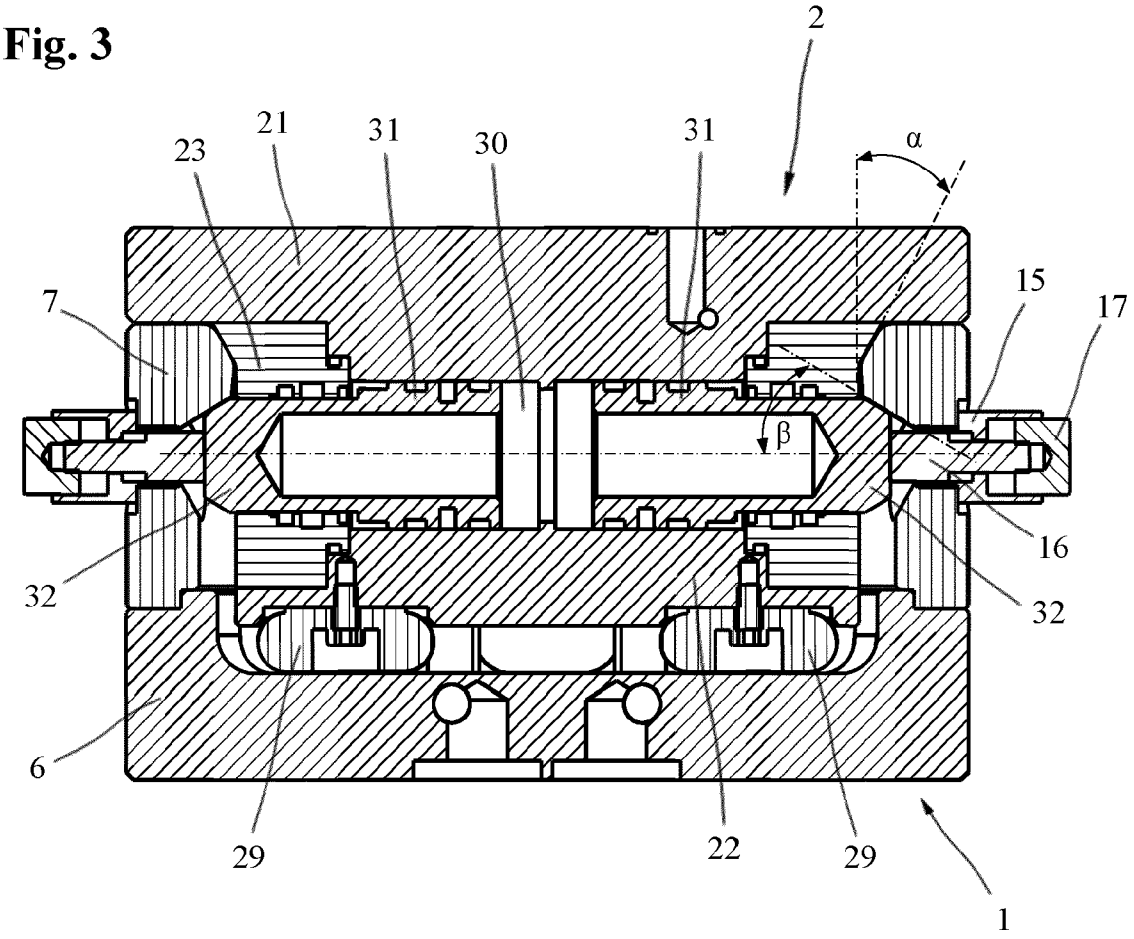

Fig. 5

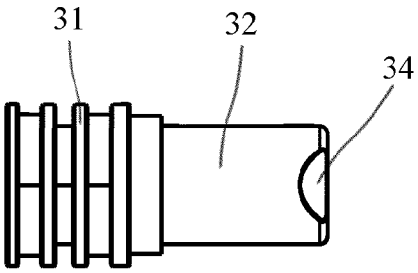

Fig. 4

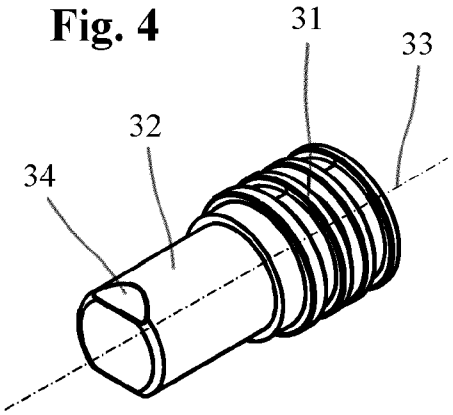

Fig. 6