Sweden

(12) Patent specification (10) SE 546 540 C2

(21) Patent application number:	2130194-0	(51) Int.Cl.:	
(45) Grant of patent:	2024-11-26	***E02F 3/36***	(2006.01)
(41) Available to the public:	2023-01-10	***E02F 9/26***	(2006.01)
(22) Filing date:	2021-07-09	***F15B 15/28***	(2006.01)
(24) Effective date:	2021-07-09		
(30) Priority data:	---		

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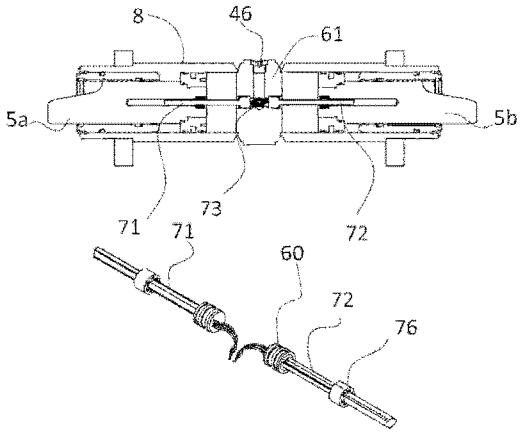
(54) Title: QUICK COUPLING DEVICE COMPRISING POSITION SENSORS AND A CONTROL UNIT ARRANGED TO CONTROL LOCKING AND MAINTENANCE OF THE DEVICE

(56) Cited documents: US 2006104789 A1 · US 6231296 B1 · US 2011313625 A1 · US 2005081710 A1

(57) Abstract:

The present invention relates to a device for quick coupling of an implement to an operating arm of a working machine. A first and second locking pins are arranged to be engage with a pair of front coupler hooks of the implement for mechanically locking of a longitudinal position thereof during engagement. A first and a second electric position sensor are disposed within a hydraulic cylinder housing and configured to generate position signals indicative of the position of a first and second hydraulic locking piston relative to the hydraulic cylinder housing. Based on the received position signals, a control unit is configured to generate signals indicative of the quick coupling device being in an unlocked mode, a locked mode or a maintenance mode relative to an engageable implement.



ABSTRACT

The present invention relates to a device for quick coupling of an implement to an operating arm of a working machine. A first and second locking pins are arranged to be engage with a pair of front coupler hooks of the implement for mechanically locking of a longitudinal position thereof during engagement. A first and a second electric position sensor are disposed within a hydraulic cylinder housing and configured to generate position signals indicative of the position of a first and second hydraulic locking piston relative to the hydraulic cylinder housing. Based on the received position signals, a control unit is configured to generate signals indicative of the quick coupling device being in an unlocked mode, a locked mode or a maintenance mode relative to an engageable implement.

QUICK COUPLING DEVICE COMPRISING POSITION SENSORS AND A CONTROL UNIT ARRANGED TO CONTROL LOCKING AND MAINTENANCE OF THE DEVICE

FIELD OF THE INVENTION

[0001] The present invention relates to the field of quick coupling of an implement, e.g. a bucket and other working tools, to an operating arm of a working machine such as an excavator operating arm and excavator. In particular, the invention relates to a quick coupling arrangement and method having a sensor system for ensuring a correct and safe coupling.

BACKGROUND

[0002] With the development of quick-coupling arrangement and methods to ensure correct coupling of the implement to the excavator operating arm, electronic and sensor solutions have become more attractive to monitor and ensure that the implement has been correctly attached to the excavator operating arm. For example, electronic and sensor solutions are now being used to ensure correct locking position of the bucket relative to the excavator operating arm or to the quick coupling arrangement. In case the quick coupling arrangement is provided with locking pistons, i.e. hydraulically movable cylinders for locking the implement to the quick coupling arrangement, the locking position of the locking piston is controlled by electronics and sensors.

[0003] One example of a sensor solution is disclosed in US 2018171576 A1. A quick coupler with two cylinders extending transversely and that are provided with inductive sensors placed on the locking cylinders.

[0004] In DE 20215590 U1 a quick coupler having one locking cylinder is provided with a proximity sensor that can be used to indicate correct locking.

[0005] Yet another example of a quick coupling arrangement is disclosed in US 2006104789 A1 that uses an inductive sensor placed outside the locking cylinder.

[0006] Another example of a sensor solution is disclosed in US 2011313625 A1. A quick coupler with a sensor placed within or upon the hydraulic ram, wherein the sensor detects hydraulic pressure and/or hydraulic ram extension status.

[0007] There are also sensor solutions that are used to detect wear in connection with the quick coupling process. In US 2016237656 A1 an alternative quick coupling arrangement is disclosed related to a jaw type coupler wherein sensors are used to detect wear of a fixed attachment pins. In addition, in US 2018066418 A1 a visual indicator is used to visually indicate that a wedge and/or rear pin is worn and in need of repair/replacement.

[0008] However, there are problems related to the prior art mentioned above. The arrangements and methods disclosed do not provide a controlled and robust quick coupling arrangement and method to ensure a safe and correct coupling in a reliable and dynamic way.

SUMMARY OF THE INVENTION

[0009] It is an object of the present invention to mitigate the above problems and to provide a quick coupling device and working machine comprising a quick coupling device having a more reliable and dynamic way to ensure a safe and correct coupling.

[0010] This and other objects are achieved by providing a quick coupling device and working machine having the features defined in the independent claims. Preferred embodiments are defined in the dependent claims.

[0011] According to a first aspect of the present invention, there is provided a quick coupling device for quick coupling of an implement to an operating arm of a working machine, wherein the device comprises a frame having a first shaft and a second shaft, and wherein each shaft is able to be connected to the operating arm. Each of the first and second shafts extends along a transverse shaft axis that are parallel. It is understood that the quick coupling device may be operationally connected to various types of working machines with various types of operating arms. The quick coupling device further comprises a first locking pin and a second locking pin extending outwards from the frame along a common transverse axis, i.e. the first locking pin and the second locking pin extend in opposite directions and outwards from the frame in a transverse direction along a common first transverse axis. The first transverse axis is parallel to that of the first and second shaft axis. The first and second locking pins are arranged to be engaged with a pair of front coupler hooks of the implement for mechanically locking of a longitudinal position thereof during engagement, i.e. the first and second locking pins are arranged to engage with the implement for partial mechanical locking of the implement to the quick coupling device and thus the operating arm of the working machine. It is understood that the quick coupling device may be connected to various types of implements.

[0012] The quick coupling device according to the first aspect of the present invention is further provided with a first hydraulic locking piston and a second hydraulic locking piston outwardly movable in opposite directions from a cylinder housing along an axis parallel with said transverse axis, i.e. the first hydraulic locking piston and the second hydraulic locking piston are arranged to be movable along a common second transverse axis which is parallel to that of the first transverse axis. The first and second locking pistons are arranged to translationally move, i.e. arranged for translational movement, along the second transverse axis colinear with that of the hydraulic cylinder housing. In other words, the first and second locking piston are extendable from the cylinder housing in opposite directions along the second transverse axis, wherein the first and second locking piston are movable between a retracted position and an extended position. Each of the first and second locking pistons is provided with a locking end, i.e. an extending end of each of the locking pistons, wherein the locking end is provided with a locking wedge surface configured to engage with a corresponding wedge surface of a pair of rear locking brackets of the implement in order to mechanically lock the implement to the quick coupling device. It is

understood that the locking pistons may be locked to various types of implements having various types of locking brackets with corresponding wedge surfaces.

[0013] The quick coupling device according to the first aspect further comprises a pair of electric position sensors, i.e. a first position sensor and a second position sensor, which are disposed within the hydraulic cylinder housing. Thus, the pair of electric position sensors are of the electric type. The first position sensor is configured to generate a first position signal indicating the position of the first hydraulic locking piston relative to the hydraulic cylinder housing. Analogously, the second position sensor is configured to generate a second position signal indicating the position of the second hydraulic locking piston relative to the hydraulic cylinder housing. In other words, the first position sensor is configured to generate the first position signal corresponding to the transverse position or extended position of the first hydraulic locking piston relative to the hydraulic cylinder housing. Analogously, the second position sensor is configured to generate the second position signal corresponding to the transverse position or extended position of the second hydraulic locking piston relative to the hydraulic cylinder housing. Each of the position sensors of the pair of position sensors is thus configured to generate a position signal indicative of an extension of the locking piston, i.e. indicative of a locking piston position, relative to the hydraulic cylinder housing. In other words, the first position sensor is configured to generate a first position signal value indicative of the position of the first locking piston relative to the hydraulic cylinder housing, i.e. the first position signal value indicates the position of the first locking piston relative to the hydraulic cylinder housing. Similarly, the second position sensor is configured to generate a second position signal value indicative of the position of the second locking piston relative to the hydraulic cylinder housing, i.e. the second position signal value indicates the position of the second locking piston relative to the hydraulic cylinder housing.

[0014] The quick coupling device according to the first aspect further comprises a control unit being configured to receive the first position signal and the second position signal. The control unit is further configured to generate at least one unlocked mode signal, at least one locking mode signal, and at least one maintenance mode signal based on the first position signal and second position signal. Thus, the control unit is configured to receive the first position signal and the second position signal and, based on first and second position signals, the control unit is further configured to generate at least one unlocked mode signal, at least one locking mode signal, and at least one maintenance mode signal. The at least one unlocked mode signal is indicative of the quick coupling device being in an unlocked mode relative to the engageable implement, i.e. the quick coupling device is in an unlocked mode when the quick coupling device is not locked to the implement. In other words, the unlocked mode corresponds to when the locking piston is in an unlocked position relative to locking bracket of the implement, in short, when implement is not locked to the quick coupling device. Similarly, the at least one locked mode signal is indicative of the quick coupling device being in a locked mode relative to an engageable implement, i.e. the quick coupling device is in a locked mode when the quick coupling device is locked to the implement. In other words, the locked mode corresponds to when the locking piston is in a locked position relative to locking bracket of the implement, in short,

when implement is locked to the quick coupling device. Also, the at least one maintenance mode signal is indicative of the quick coupling device being in a maintenance mode relative to an engageable implement, i.e. the maintenance mode corresponds to when the locking piston is in a maintenance position relative to locking bracket of the implement, in short, when there is a need of maintenance of the locking bracket and/or locking piston of the quick coupling device.

[0015] There is an insight that by arranging a pair of position sensors within the hydraulic cylinder housing and operationally connecting them to the movement of the respective locking piston an improved quick coupling device and arrangement is achieved. Surprisingly, by arranging the first and second electric position sensor within, i.e. inside, the hydraulic cylinder housing and operationally connecting them to the locking pistons, three different locking piston modes can be measured and determined by means of one single position sensor device, thereby achieving both an improved sensor functionality in general and a more accurate position sensor signal, and thereby achieving a safer and more reliable quick coupling device. Another advantage is that since the sensors are positioned inside the hydraulic cylinder housing, and thus inside the quick coupling device, the sensors are protected from wear, dirt and other parameters which not only may damage the sensor but also influence the accuracy of the sensor signals.

[0016] Consequently, from a sustainability perspective, a more durable sensor function is achieved with a longer lifecycle, and which is subject to less maintenance. Also, from a working machine user perspective, a more reliable and accurate sensor function is achieved, which in turn, provides a safer and more reliable quick coupling process and thus a safer and more reliable operation of the working machine in general.

[0017] In an embodiment, the first and second position sensors are centrally arranged within the hydraulic cylinder housing. Firstly, by arranging the sensors centrally within the locking pistons, a more accurate measurement of the position of the locking piston relative to the hydraulic cylinder housing, and thus the frame, is achieved. Secondly and in combination, a more accurate position of the locking piston relative to the corresponding locking bracket, when being engaged thereto, is also achieved.

[0018] In an embodiment, the control unit is further configured to generate at least: a first unlocked mode signal based on the first position signal, a first locked mode signal based on the first position signal, a first maintenance mode signal based on the first position signal, a second unlocked mode signal based on the second position signal, a second locked mode signal based on the second position signal, and a second maintenance mode signal based on the second position signal. Thus, based on the first position signal, a first unlocked mode signal is generated when the first locking piston is in an unlocked position relative to the implement. In addition, based on the first position signal, a first locked mode signal is generated when the first locking piston is in a locked position relative to the implement. Based on the first position signal, a first maintenance mode signal is generated when the first locking piston is in a maintenance position relative to the implement. Analogously, based on the second position signal, a second unlocked mode signal is generated when the second locking piston is in an unlocked position relative to the

implement. In addition, based on the second position signal, a second locked mode signal is generated when the second locking piston is in a locked position relative to the implement. And finally, based on the second position signal, a second maintenance mode signal is generated when the second locking piston is in a maintenance position relative to the implement.

[0019] In an embodiment, the first hydraulic locking piston is provided with an axially elongated first sensor cavity for translational movement of at least a part of the first position sensor; and the second hydraulic locking piston is provided with an axially elongated second sensor cavity for translational movement of at least a part of the second position sensor. Thus, each of the first and second hydraulic locking pistons are provided with a centrally elongated hole, e.g. a bore, having an opening facing the inside of the hydraulic cylinder housing, thereby fluidly connecting the respective elongated sensor cavity with its respective hydraulic chamber space of the hydraulic cylinder housing.

[0020] In an embodiment, the first position sensor and the second position sensor (72) are of an inductive type.

[0021] In an embodiment, the first position sensor comprises a first elongated sensor element and a first hollow sensor element, wherein the first elongated sensor element is attached to the hydraulic cylinder housing, and is arranged to translationally move, i.e. arranged for translational movement, inside the first hollow sensor element which is attached to an inner surface of the first sensor cavity, thereby measuring the position of the first locking piston relative to the hydraulic cylinder housing. Furthermore, the second position sensor comprises a second elongated sensor element and a second hollow sensor element, wherein the second elongated sensor element is attached to the hydraulic cylinder housing, and is arranged to translationally move inside the second hollow sensor element which is attached to an inner surface of the second sensor cavity, thereby measuring the position of the second locking piston relative to the hydraulic cylinder housing. Thus, each of the first and second pair of elongated sensor elements and hollow sensor elements are arranged to mutually translate relative to each other to provide a translational signal indicative of the relative movement between the locking piston and the hydraulic cylinder housing. Each of the first and second hollow sensor elements is coaxially attached to the respective inner surface of the sensor cavities.

[0022] In an embodiment, the control unit is configured to continuously receive the position signals. Thus, the control unit is configured to continuously generate at least one unlocked mode signal, at least one locking mode signal, and at least one maintenance mode signal based on the first position signal and second position signal. In an embodiment, the control unit is configured to continuously generate: the first unlocked mode signal based on the first position signal, the first locked mode signal based on the first position signal, the first maintenance mode signal based on the first position signal, the second unlocked mode signal based on the second position signal, the second locked mode signal based on the second position signal, and the second maintenance mode signal based on the second position signal.

[0023] In an embodiment, the first fixed locking pin is attached to the first shaft, and wherein the second fixed locking pin is attached to the second shaft. In an embodiment, the first and second locking pin are fixedly attached to the shaft.

[0024] In an embodiment, the first locking piston and second locking piston are independently movable relative to each other.

[0025] In an embodiment, a hydraulic oil is supplied to a respective hydraulic chamber of each locking piston via a non-centralized oil channel. Thus, hydraulic oil is supplied to the respective hydraulic chambers via openings positioned radially outside the respective position sensors.

[0026] In an embodiment, the control unit is further configured to receive at least one calibration signal from a calibration device which is operationally connected thereto, and based on the at least one calibration signal the control unit is configured to: define a first range of locking values indicative of the first locking piston being in a correct locking position when being engaged with a pair of rear locking brackets of the implement, and define a second range of locking values indicative of the second locking piston being in a correct locking position when being engaged with a pair of rear locking brackets of the implement. Thus, in response to at least one calibration signal, the control unit is configured to determine a correct locking position value of the first and second locking piston relative to the rear locking brackets of the implement when being in engagement with the rear locking brackets of the implement. Based on the correct locking position value, the control unit is further configured to determine a range of correct locking values corresponding to when the respective locking piston is in the correct locking position with the rear locking brackets when the locking piston is in engagement thereto.

[0027] In an embodiment and based on the range of correct locking values, the control unit is configured to define: a first range of unlocked position values indicative of the first locking piston being in an unlocked position when being engaged with a pair of rear locking brackets of the implement, and a first range of maintenance position values indicative of the first locking piston being in a maintenance position when being engaged with a pair of rear locking brackets of the implement. Based on the range of correct locking values, the control unit is configured to define: a second range of unlocked position values indicative of the second locking piston being in an unlocked position when being engaged with a pair of rear locking brackets of the implement, and a second range of maintenance position values indicative of the second locking piston being in a maintenance position when being engaged with a pair of rear locking brackets of the implement. It is understood that the at least one calibration signal comprises signals from both the first and second locking piston.

[0028] In an embodiment, the control unit is further configured to perform a first comparison of the first position signal and the first range of locking values when being engaged with a pair of rear locking brackets of the implement, and based on the first comparison, the control unit is configured to generate: a first unlocked mode signal indicative of a first position value of the first position signal is below the first range of values, a first locked mode signal indicative of a first

position value of the first position signal within the first range of values, a first maintenance mode signal indicative of a first position value of the first position signal is above the first range of values.

Thus, when the quick coupling device is about to be engaged or is in engagement with the pair of rear locking brackets of the implement, the control unit is configured to perform a first comparison of a value of the first position signal with the first range of locking values, and based on the first comparison, the control unit is further configured to generate one of a first unlocked mode signal indicative of a first position value of the first position signal is below the first range of values, a first locked mode signal indicative of a first position value of the first position signal within the first range of values, or a first maintenance mode signal indicative of a first position value of the first position signal is above the first range of values.

Furthermore, the control unit is further configured to perform a second comparison of the second position signal and the second range of locking values when being engaged with a pair of rear locking brackets of the implement, and based on the second comparison, the control unit is configured to generate: a second unlocked mode signal indicative of a second position value of the second position signal is below the second range of values, a second locked mode signal indicative of a second position value of the second position signal within the second range of values, a second maintenance mode signal indicative of a second position value of the second position signal is above the second range of values.

Thus, when the quick coupling device is about to be engaged or is in engagement with the pair of rear locking brackets of the implement, the control unit is further configured to perform a second comparison of a value of the second position signal with the second range of locking values, and based on the second comparison, the control unit is further configured to generate one of a second unlocked mode signal indicative of a second position value of the second position signal is below the second range of values, a second locked mode signal indicative of a second position value of the second position signal within the second range of values, or a second maintenance mode signal indicative of a second position value of the second position signal is above the second range of values.

[0029] According to a second aspect of the present invention, a working machine comprises a quick coupling device according to present invention, an implement and operating arm.

[0030] In an embodiment of the invention of the second aspect, the working machine further comprises a pair of support heels, wherein an upper surface of the support heel is configured to abut a lower surface of the quick coupling device.

BRIEF DESCRIPTION OF DRAWINGS

[0031] These and other aspects of the present invention will now be described in more detail, with reference to the appended drawings showing a currently preferred embodiment of the invention, wherein:

Fig. 1A illustrates a perspective view of the quick coupling device according to the invention, wherein the locking piston is in an unlocked mode.

Fig. 1B illustrates a perspective view of the quick coupling device according to the invention, wherein the locking piston is in a locked mode.

Fig. 1C illustrates a perspective view of the quick coupling device according to the invention, wherein the locking piston is in maintenance mode.

Fig. 1D illustrates a perspective view of the quick coupling device according to the invention, wherein the locking piston is in maintenance mode.

Fig. 1E illustrates a perspective view of the quick coupling device according to the invention.

Fig. 2A illustrates a detailed view of Fig. 1A.

Fig. 2B illustrates a detailed view of Fig. 1B.

Fig. 2C and Fig. 2.1c illustrate detailed views of Fig. 1C.

Fig. 2D illustrates a detailed view of Fig. 1D.

Fig. 3 illustrates a perspective view of an implement.

Fig. 4 illustrates a detailed view of a heel with shims.

Fig. 5 illustrates a cross-sectional view of the heel with shims as shown in Fig. 4

Fig. 6 illustrates a perspective view of a hydraulic cylinder housing with locking pistons according to prior art.

Fig. 7 illustrates a cross-sectional view of a hydraulic cylinder housing with locking pistons according to prior art.

Fig. 8a and 8b illustrate cross-sectional views of a central connection portion of a hydraulic cylinder housing according to prior art.

Fig. 9 illustrates a perspective view of a central connection portion of a hydraulic cylinder housing according to prior art.

Fig. 10 illustrates a perspective view of a hydraulic cylinder housing with locking pistons according to an embodiment of the present invention.

Fig. 11a illustrates a cross-sectional view of a hydraulic cylinder housing with locking pistons according to the present invention.

Fig. 11b illustrates a perspective view of a hydraulic cylinder housing with locking pistons according to the present invention.

Fig. 12 illustrates a perspective view of a central connection portion of a hydraulic cylinder housing according to an embodiment of the present invention.

Fig. 13 illustrates a view of a central connection portion of a hydraulic cylinder housing according to an embodiment of the present invention.

Fig. 14 illustrates a cross-sectional view of a central connection portion of a hydraulic cylinder housing according to an embodiment of the present invention.

Fig. 15 illustrates a cross-sectional view of a central connection portion of a hydraulic cylinder housing according to an embodiment of the present invention.

Fig. 16a, 16b, 16c, 16d illustrate views of a cylinder housing according to an embodiment of the present invention.

Fig. 17-19 illustrate perspective views of a cylinder housing according to an embodiment of the present invention showing different extensions of the locking piston.

Fig. 20 illustrates a perspective view of a quick coupling device according to an embodiment of the present invention, and an operating arm connected thereto.

Fig. 21A and Fig. 21B illustrate views of the sensor arrangement according to an embodiment of the present invention.

Fig. 22A and Fig. 22B illustrates views of the sensor arrangement according to an embodiment of the present invention.

Fig. 23 shows a schematical overview of the electrical connection of the quick coupling device.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0032] In the following description, the present invention will now be described in more detail, with reference to the appended drawings.

[0033] In Fig. 1a and Fig. 2a a hydraulic quick coupling device 1 according to an embodiment is shown, wherein a first locking piston 5a is in an unlocked mode. The quick coupling device 1 is moving into an engagement position with the implement, i.e. the locking piston 5a is about to engage with one locking bracket hook of the pair of rear locking brackets 4b. The locking piston 5a is in its retracted position or retracted state, and will remain in its retracted position until the quick coupling device has been moved into its locking position with an implement 3 or working tool, which in this case is a bucket.

[0034] In Fig. 1a-1e the quick coupling device 1 is provided with a frame 40 having a first shaft 15a and a second shaft 15b, wherein each shaft is connected to an operating arm 2. It is understood that the quick coupling device can be connected to different operating arms of different working machines. Consequently, the quick coupling device 1 is connectable to difference types of operating arm. Furthermore, the quick coupling device 1 is provided with a first locking pin 14a and a second locking pin 14b. The first and second locking pins are fixed relative to the frame 40 of the quick coupling device. The first and second locking pins furthermore extend outwardly from the frame in opposite directions relative to each other and along a common transverse axis, i.e. transversely protruding in opposite directions. The pair of locking pins are configured to engage with a pair of front coupler hooks 4a of the implement 3 for mechanically locking of a longitudinal position thereof during engagement. In a quick coupling method of coupling the quick coupling device 1 to the implement 3, an operator of the working machine, e.g. an excavator operator, first controls and moves the operating arm 2 with its thereto connected quick coupling device 1 such that the pair of locking pins engage with the pair of front coupler hooks 4a of the implement 3 in order to first mechanically lock the movement of the implement in its longitudinal direction.

[0035] Secondly, the operator continues to control and move the operating arm 2 such that the pair of locking pistons 5a and 5b, i.e. the locking ends of the locking pistons, face the corresponding locking bracket hooks of the pair of rear locking brackets 4b. Thereafter the locking pistons are configured to move outwards in the transverse direction in order to mechanically lock the implement to the quick coupling device 1.

[0036] It is understood that the first locking pins 14a and the second locking pins 14b may have different shapes and lengths depending on the type of implement that the quick coupling device 1 is configured to connect with. It is also further understood that the first and second locking pistons may have different shapes depending on the implement the quick coupling device is configured to be connected with, i.e. the shape of the locking pistons are adapted to be engageable with the locking bracket hocks that may vary depending on the type of implement.

[0037] Fig. 1b shows the quick coupling device according to the present invention, wherein of the first locking pistons 5a is in a locking position, i.e. the quick coupling device is in a locked mode. The locking piston 5a has moved from its extracted position, outwardly from the hydraulic cylinder housing 8, until it has mechanically locked with one locking bracket hook of the of pair rear locking brackets 4b. The locking piston is provided with a locking end of the locking piston, i.e. the

end that moves outwardly in the transverse direction from the cylinder housing 8, and thus from the quick coupling device, towards the locking bracket of the implement 3. The locking end, i.e. the extending end, of the first locking piston 5a is provided with a wedge shaped end portion, i.e. a first wedge locking surface 9 which is configured to engage with a corresponding locking surface of the implement to be connected. In Fig. 2b, the first locking piston 5a extends from the hydraulic cylinder housing 8 and has moved outwardly in a transverse direction of the quick coupling device until the first wedge locking surface 9 has mechanically locked with a corresponding locking surface, i.e. bracket locking surface 7, of the implement.

[0038] Although not shown, but on the other side of the quick coupling device, a second locking piston 5b has also extended from the hydraulic cylinder housing 8 and has moved outwardly in a transverse direction of the quick coupling device until a second wedge locking surface has mechanically locked with a second corresponding locking surface, i.e. a second bracket locking surface 7, of the implement. The second locking piston 5b is thus in its locking position. Consequently, the first locking piston 5a and second locking piston 5b are configured to transversely move out from the quick coupling device in opposite directions along a common transverse direction. A first locking end of the first locking piston 5a and a second locking end of the second locking piston 5b are thus configured to outwardly extend in opposite direction such that the respective wedge locking surface 9 engage with corresponding bracket locking surfaces of the implement 3 in order to mechanically lock the implement 3 to the quick coupling device and thus to interconnect the implement 3 with the operating arm.

[0039] It is understood that the first locking piston and second locking piston are each movable back and forth along one transverse axis that is common to them both, i.e. that the first and second locking pistons are configured to be movable between a retracted position and an extended position in order to lock and unlock the implement.

[0040] Fig. 1C and 1D, and Fig. 2C, 2.1C and 2D shows a quick coupling device according to the present invention, wherein the first locking pistons 5a has moved beyond the locked mode and into a maintenance mode which shall alert the operator that maintenance or service is needed. The first locking pistons 5a has thus extended beyond the position where it is regarded as being correctly locked. That is an indication that for example the locking bracket surface, and thus the locking bracket hooks, may have been worn and that they need to be replace with a pair of new rear locking brackets. Alternatively, it may also be an indication that a shims plate 11 or that a shims 12a and 12b in the stack of shims needs to be replaced or changed.

[0041] In Fig. 1E a quick coupling device 1 according to the present invention is shown without engageable operating arm or implement.

[0042] Fig. 3 is a perspective view of the implement showing the pair of front coupler hooks 4a and the of pair rear locking brackets 4b, including the pair of locking bracket hooks. Furthermore, a pair of support heels 10 are shown having a stack of shims 12a and 12b and a shims plate 11 on top of a heel base 10, see also Fig. 4 and Fig. 5 showing detailed views of the support heels

10, wherein the shims plate and stack of shims 12a and 12b are fixed to a heel base with a pair of screws 13. When maintenance is needed, the screws are untightened such that the shims plate 11 can be replaced or such that more shims may be added to increase the hight of the shims plate 11, i.e. to raise the upper surface of the shims plate 11, which then affects the position of the quick coupling device. When the quick coupling device 1 is connected to the implement 3, the upper surface of the support heel abuts a lower surface 39 of the frame 40 of the of the quick coupling device 1. Consequently, an increase of the height of the support heel increases frame of the quick coupling device 1 relative to the implement 3, which then, in turn, lowers the pair of rear locking brackets 4b such that the locking ends of the respective locking piston may engage correctly with the locking bracket surfaces of the rear locking bracket, and thus achieve a locking mode. It is understood that the operator may need to adjust the stack of shims in order to achieve the wanted locking mode, i.e. that the operator may need to repeat the steps of adding shims 12a/12b until a correct locking mode has been achieved.

[0043] Fig. 6 and 7, Fig 8a, 8b and Fig. 9 show a hydraulic cylinder housing with locking pistons 95a and 95b according to prior art. The hydraulic cylinder housing is provided with support brackets 16 and is provided with a hydraulic oil input connection 18 and 21 to supply the hydraulic chambers, via a centrally positioned oil locking channel 22, with hydraulic oil to increase a hydraulic pressure and thus to create force against the locking pistons 95a and 95b in order to cause the piston to move outwards towards an engagement with a pair of rear locking brackets. In addition, the hydraulic cylinder housing is further provided with a hydraulic oil output connection 17 and 20 to discharge and release oil from the chambers via a non-central oil discharge channel 23, and thus reduce the hydraulic pressure and thus to cause the pistons to move inwards towards a retracted state in order to achieve a unlocked mode of the quick coupling device. The prior art cylinder housing is furthermore provided with a plugged oil channel 19 and a check valve 25.

[0044] In Fig. 10 to 12 a hydraulic cylinder housing 8 with locking pistons 5a och 5b according to an embodiment of the present invention is shown. On the upper surface of a central connection portion of the hydraulic cylinder housing 8, a mounting channel 46 extends radially towards the centre of the hydraulic cylinder housing 8. The mounting channel hole 46 is used during the mounting of electric sensors 71 and 72 and their sensor cables 73, see Fig. 11b. After the mounting the mounting channel hole 46 is then closed with a screw.

[0045] Furthermore, a hydraulic oil input connection 52 to supply the hydraulic chambers, via a non- central oil locking channel 47, with hydraulic oil to increase a hydraulic pressure and thus to create force against the locking pistons 5a and 5b in order to cause the piston to move outwards towards an engagement with a pair of rear locking bracket. In addition, the hydraulic cylinder housing is further provided with a hydraulic oil output connection 51 to discharge and release oil to reduce the hydraulic pressure and thus to cause the pistons to move inwards towards a retracted state in order to achieve an unlocked mode of the quick coupling device. A check valve 48 is further arranged in a lower part of the central connection portion. The electric sensors 71

and 72 are inductive type sensors and are electrically connectable via sensor connections 53 and 54. Two cylindrical sensor base spaces 57 extends centrally within the hydraulic cylinder housing 8 along a central axis thereof. The sensor base spaces are configured to receive and hold a sensor head element 60 of each sensor 71 and 72 relative to the cylinder housing 8. On the rear side of the cylinder housing 8, a pair of sensor fasteners 55 and 56 are arranged which fix the sensor heads 60 to the sensor base spaces and thus fixing the sensor head elements and the elongated sensor elements 59, as shown in Fig. 21A and 21B, to the hydraulic cylinder housing 8.

[0046] In Fig. 11, the first hydraulic locking piston 5a and the second hydraulic locking piston 5b are shown and are being outwardly movable from two opposite ends of a cylinder housing 8 in opposite directions along a common axis coinciding with that of the hydraulic cylinder housing 8. Each locking piston is provided with a centrally disposed space, i.e. a sensor channel, configured to allow a movement an elongated sensor element 59, as shown in Fig. 21A and 21B, fixed to the cylinder housing 8. That is, during a reciprocal movement of the locking piston, the elongated sensor element 59 moves back and forth into the sensor channel. In addition, each sensor 71 and 72 are provided with a hollow sensor element 76 that is fixed to a respective locking piston. The hollow sensor element 76 is arranged to receive the elongated sensor element 59 for measuring the position of elongated sensor element 59 relative to hollow sensor element 76 in order to measure the position of locking piston relative to the hydraulic cylinder housing (8). As a result, the centrally positioned sensor within the locking piston enables an accurate and continuous monitoring and measurement of the movement or displacement of the locking piston relative to the quick coupling device in order to determine if the locking piston is in an unlocked mode, locked mode or in a maintenance mode when the locking piston has move too far.

[0047] Each locking piston is provided with one inductive position sensor. It is understood that the locking pistons may move independently of each other, and that each sensor is configured to measure the position of the respective locking piston individually.

[0048] In Fig. 17 to Fig. 19 the hydraulic cylinder housing 8 is presented with three different extensions of the locking end, i.e. three different positions of the locking piston 5b is shown. That is, the locking piston has moved outwards three different lengths out from the cylinder housing 8. In Fig. 17 the locking end 81 and the locking piston 5b is in a retracted position or locked state, i.e. that the quick coupling device is in an unlocked mode. In Fig. 18 the locking end 82 and the locking piston 82 is in a locked position or locked state, i.e. that the quick coupling device is in locked mode. Although not shown, it is understood that the locking wedge surface 9 is mechanically locked to the corresponding locking bracket surface. In Fig. 19 the locking end 83 and locking piston are in a maintenance position or maintenance state, i.e. the quick coupling device is in a maintenance mode.

[0049] Fig. 20 illustrate a perspective view of a quick coupling device connected to the operating arm 2, showing an electric sensor connection 41 and a hydraulic connection 42 to the hydraulic cylinder housing 8.

[0050] In Fig. 21A, Fig. 2B, Fig. 22A and Fig. 22B a sensor arrangement of the present invention is shown. The hydraulic locking piston is provided with an axially elongated sensor cavity for translational movement of an elongated sensor element 59. The position sensor comprises an elongated sensor element 59 and a first hollow sensor element 76. The elongated sensor element 59 is attached to the hydraulic cylinder housing 8 at an inner opening facing a hydraulic chamber (not shown). The elongated sensor element 59 is arranged for translational movement, i.e. to translationally move, inside the first hollow sensor element 76 and the elongated sensor cavity within the locking piston. When the elongated sensor element 59 moves relative to the hollow sensor element 76, a position signal is generated. The elongated sensor element 59 is attached to the hydraulic cylinder housing (8), and is arranged for translational movement, i.e. to translationally, move inside the second hollow sensor element (76) and the sensor cavity within the locking piston. The hollow sensor element 76 is attached to an inner surface of the second sensor cavity. Thereby, a movement of the locking piston causes a displacement of the hollow sensor element relative to the fixed elongated sensor element which, in turn, induces a position signal of the locking piston.

[0051] Fig. 23 shows a schematical overview of the electrical connection of the quick coupling device. A visual display 100 is provided with six symbols A1 to A3 and B1 to B3, three symbols for each set of three sensor signals. A1 symbol 101 indicates that a first sensor is in an unlocked mode, and thus that the first locking piston is in an unlocked state. B1 symbol 106 indicates that a second sensors is in an unlocked mode, and thus that the second locking piston is in an unlocked state. A2 symbol 102 indicates that a first sensors is in a locked mode, and thus that the first locking piston is in a locked state. B2 symbol 105 indicates that a second sensor is in a locked mode, and thus that the second locking piston is in a locked state. A3 symbol 103 indicates that a first sensor is in a maintenance mode, and thus that the first locking piston is in a maintenance state. B3 symbol 104 indicates that a second sensor is in a maintenance mode, and thus that the second locking piston is in a maintenance state. The display 100 is electrically connected to a control unit 107 via electrical wiring 110. The hydraulic cylinder housing 8 is connected to the control unit via electrical wirings 109, at least one wiring for each sensor. The control unit is also connected to calibration device 112 having a button to be pushed according to predetermined calibration process. 4. The control unit is configured to continuously receive the position signals from the sensors 71 and 72.

[0052] Before the first time of using a new quick coupling device or with a new implement, the working machine operator needs to perform a calibration of the quick coupling device. The operator then needs to lock the first locking piston 5a and second locking pistons 5b with pair of rear locking brackets, and to visually identify and determine when the first and second locking pistons are in a calibration position, i.e. a threshold position from when the locking piston is regarded as being in a correct position. The control unit is then able to calculate a range or interval during which the first and second locking pistons are considered as being correctly locked with the pair of rear locking brackets of the implement. After the operator has defined the calibration position, the operator then pushes the button of the calibration device 112 in

accordance with a predetermined calibration process. At least one calibration signal is then received by the control unit 107, and based on the at least one calibration signal, the control unit 107 then determines and defines a first range of first locking values indicative of the first locking piston being in a correct locking position when being engaged with a pair of rear locking brackets 4b of the implement 3. The control unit also defines a second range of second locking values indicative of the second locking piston being in a correct locking position when being engaged with a pair of rear locking brackets 4b of the implement 3. Thus, the control unit 107 calculates the first and second range of locking values based on the values of the at least one calibration signal.

[0053] Preferably, the calibration position is set to 2/3 of the thickness of the rear locking bracket, i.e. when each of the first and second locking pistons have penetrated 2/3 of the body thickness of the rear locking bracket.

CLAIMS

1. A quick coupling device (1) for quick coupling of an implement (3) to an operating arm (2) of a working machine, said device comprising:

a frame (40) having a first shaft (15a) and a second shaft (15b), each shaft being connectable to the operating arm (2);

a first locking pin (14a) and a second locking pin (14b) extending outwards from the frame along a common transverse axis, each locking pin being engageable with a pair of front coupler hooks (4a) of the implement (3) for mechanically locking of a longitudinal position thereof during engagement;

a first hydraulic locking piston (5a) and a second hydraulic locking piston (5b) outwardly movable in opposite directions from a cylinder housing (8) along an axis parallel with said transverse axis, wherein each locking piston (5a, 5b) is provided with a locking end (81, 82, 83) having a locking wedge surface (9) which is configured to engage and mechanically lock with a locking bracket surface (7) being a corresponding locking surface of a pair of rear locking brackets (4b) of the implement (3) for mechanically locking the longitudinal position thereof during engagement.

Characterized in that the device further comprises

a lower surface (39) of the frame (40) of the quick coupling device (1) wherein when the quick coupling device (1) is connected to the implement (3), an upper surface of a support heel of the implement (3) abuts the lower surface (39) of the frame (40) of the of the quick coupling device (1), the support heel having a stack of shims (12a, 12b) and a shims plate (11);

a first electric position sensor (71) being disposed within the hydraulic cylinder housing (8), and being configured to generate a first position signal indicative of the position of the first hydraulic locking piston (5a) relative to the hydraulic cylinder housing (8);

a second electric position sensor (72) being disposed within the hydraulic cylinder housing (8), and being configured to generate a second position signal indicative of the position of the second hydraulic locking piston (5b) relative to the hydraulic cylinder housing (8); and

a control unit being configured to receive the first position signal and the second position signal, and based on the first position signal and second position signal the control unit is configured to generate:

at least one unlocked mode signal when the locking piston (5a, 5b) is in a retracted position and until the quick coupling device has been moved into a locking position with

the implement 3, indicative of the quick coupling device being in an unlocked mode relative to an engageable implement,

at least one locked mode signal when the locking piston (5a, 5b) has moved from its extracted position, outwardly from the hydraulic cylinder housing (8), until the first wedge locking surface (9) has mechanically locked with the bracket locking surface (7) of the implement, indicative of the quick coupling device being in a locked mode relative to an engageable implement, and

at least one maintenance mode signal indicative of the quick coupling device being in a maintenance mode relative to an engageable implement, wherein the locking piston (5a, 5b) has moved beyond the locked mode and into the maintenance mode which shall alert an operator that maintenance or service is needed which is an indication that the locking bracket surface (7) may have been worn, or alternatively that the shims plate (11) or that the shims (12a, 12b) in the stack of shims needs to be replaced or changed.

2. The device according to claim 1, wherein the control unit is further configured to generate at least:

a first unlocked mode signal based on the first position signal,

a first locked mode signal based on the first position signal,

a first maintenance mode signal based on the first position signal,

a second unlocked mode signal based on the second position signal,

a second locked mode signal based on the second position signal, and

a second maintenance mode signal based on the second position signal.

3. The device according to any one of the preceding claims, wherein the first and second position sensors are centrally arranged within the hydraulic cylinder housing (8).

4. The device according to any one of the preceding claims, wherein

the first hydraulic locking piston (5a) is provided with an axially elongated first sensor cavity for translational movement of at least a part of the first position sensor (71); and

the second hydraulic locking piston (5b) is provided with an axially elongated second sensor cavity for translational movement of at least a part of the second position sensor (72).

5. The device according to any one of the preceding claims, wherein the first position sensor (71) and the second position sensor (72) are of an inductive type.

6. The device according to any one of the preceding claims, wherein

the first position sensor comprises a first elongated sensor element (59) and a first hollow sensor element (76), wherein the first elongated sensor element (59) is attached to the hydraulic cylinder housing (8), and is arranged to translationally move inside the first hollow sensor element (76) which is attached to an inner surface of the first sensor cavity, thereby measuring the position of the first locking piston relative to the hydraulic cylinder housing (8); and

the second position sensor comprises a second elongated sensor element (59) and a second hollow sensor element (76), wherein the second elongated sensor element (59) is attached to the hydraulic cylinder housing (8), and is arranged to translationally move inside the second hollow sensor element (76) which is attached to an inner surface of the second sensor cavity, thereby measuring the position of the second locking piston relative to the hydraulic cylinder housing (8).

7. The device according to any one of the preceding claims, wherein the control unit is configured to continuously receive the position signals.

8. The device according to any one of the preceding claims, wherein the first locking pin (14a) is attached to the first shaft (15a), and wherein the second locking pin (14b) is attached to the first shaft (15a).

9. The device according to any of the preceding claims, wherein the first locking piston (5a) and second locking piston (5b) are independently movable relative to each other.

10. The device according to any one of the preceding claims, wherein a hydraulic oil is supplied to a respective hydraulic chamber of each locking piston via a non-centralized oil channel.

11. The device according to any one of the preceding claims, wherein the control unit is further configured to receive at least one calibration signal from a calibration device (112) which is operationally connected thereto, and based on the at least one calibration signal the control unit is configured to:

define a first range of locking values indicative of the first locking piston being in a correct locking position when being engaged with a pair of rear locking brackets (4b) of the implement (3), and

define a second range of locking values indicative of the second locking piston being in a correct locking position when being engaged with a pair of rear locking brackets (4b) of the implement (3).

12. The device according to claim 11, the control unit is further configured to determine a range of correct locking values corresponding to when the respective locking piston is in the correct locking position with the rear locking brackets when the locking piston is in engagement thereto, and based on the range of correct locking values, the control unit is configured to define:

a first range of unlocked position values indicative of the first locking piston being in an unlocked position when being engaged with a pair of rear locking brackets of the implement, and

a first range of maintenance position values indicative of the first locking piston being in a maintenance position when being engaged with a pair of rear locking brackets of the implement;

a second range of unlocked position values indicative of the second locking piston being in an unlocked position when being engaged with a pair of rear locking brackets of the implement, and

a second range of maintenance position values indicative of the second locking piston being in a maintenance position when being engaged with a pair of rear locking brackets of the implement.

13. The device according to claim 11, wherein the control unit is further configured to perform a first comparison of the first position signal and the first range of locking values when being engaged with a pair of rear locking brackets (4b) of the implement (3), and based on the first comparison, the control unit is configured to generate:

a first unlocked mode signal indicative of a first position value of the first position signal is below the first range of values,

a first locked mode signal indicative of a first position value of the first position signal within the first range of values,

a first maintenance mode signal indicative of a first position value of the first position signal is above the first range of values; and

wherein the control unit is further configured to perform a second comparison of the second position signal and the second range of locking values when being engaged with a pair of rear locking brackets (4b) of the implement (3), and based on the second comparison, the control unit is configured to generate:

a second unlocked mode signal indicative of a second position value of the second position signal is below the second range of values,

a second locked mode signal indicative of a second position value of the second position signal within the second range of values,

a second maintenance mode signal indicative of a second position value of the second position signal is above the second range of values.

14. A working machine comprising a quick coupling device according to any one of the preceding claims; an implement (3) and operating arm (2).

15. The working machine according to claim 14, wherein the machine further comprises a pair support heels (10), wherein an upper surface of the support heel is configured to abut a lower surface of the quick coupling device.

I följande bilaga finns en översättning av patentkraven till svenska. Observera att det är patentkravens lydelse på engelska som gäller.

A Swedish translation of the patent claims is enclosed. Please note that only the English claims have legal effect.

Patentkrav

1. Snabbkopplingsanordning (1) för snabbkoppling av ett redskap (3) till en manöverarm (2) på en arbetsmaskin, varvid nämnda anordning innefattar :

en ram (40) med en första axel (15a) och en andra axel (15b), varvid varje axel kan anslutas till manöverarmen (2);

en första låstapp (14a) och en andra låstapp (14b) som sträcker sig utåt från ramen längs en gemensam tväraxel, varvid varje låstapp kan samverka med ett par främre kopplingshakar (4a) hos redskapet (3) för mekanisk låsning av en längsgående position hos dessa under samverkan;

en första hydraulisk låskolv (5a) och en andra hydraulisk låskolv (5b) som kan röra sig utåt i motsatta riktningar från ett cylinderhus (8) längs en axel som är parallell med nämnda tväraxel, varvid varje låskolv (5a, 5b) är försedd med en låsände (81, 82, 83) med en låskilyta (9) som är konfigurerad för att samverka och mekaniskt låsas med en låshållaryta (7) som är en motsvarande låsyta hos ett par bakre låshållare (4b) hos redskapet (3) för att mekaniskt låsa den längsgående positionen hos detsamma under samverkan,

kännetecknat av att anordningen dessutom innefattar

en nedre yta (39) hos snabbkopplingsanordningens (1) ram (40), varvid när snabbkopplingsanordningen (1) är ansluten till redskapet (3), ligger en övre yta hos en stödklack hos redskapet (3) an mot den nedre ytan (39) hos snabbkopplingsanordningens (1) ram (40), varvid stödklacken uppvisar en stapel av mellanlägg (12a, 12b) och en mellanläggsplatta (11);

en första elektrisk positionsgivare (71) som är placerad inne i hydraulcylinderhuset (8), och som är konfigurerad för att generera en första positionssignal som indikerar läget hos den första hydrauliska låskolven (5a) i förhållande till hydraulcylinderhuset (8);

en andra elektrisk positionsgivare (72) som är placerad i hydraulcylinderhuset (8), och som är konfigurerad för att generera en andra positionssignal som indikerar positionen hos den andra hydrauliska låskolven (5b) i förhållande till hydraulcylinderhuset (8); och

en styrenhet som är konfigurerad för att ta emot den första positionssignalen och den andra positionssignalen, och på basis av den första positionssignalen och den andra positionssignalen är styrenheten är konfigurerad för att generera:

minst en signal för upplåst läge när låskolven (5a, 5b) är i en tillbakadragen position och ända till dess att snabbkopplingsanordningen har förflyttats till en låsposition med redskapet (3), vilket indikerar att snabbkopplingsanordningen är i upplåst läge i förhållande till ett påkopplingsbart redskap,

minst en signal för låst läge när låskolven (5a, 5b) har förflyttats från sin utdragna position, utåt från hydraulcylinderhuset (8), till dess att den första killåsytan (9) har låsts mekaniskt med redskapets hållarlåsyta (7) hos redskapet, vilket indikerar att snabbkopplingsanordningen är i låst läge i förhållande till ett påkopplingsbart redskap, och

minst en signal för underhållsläge som indikerar att snabbkopplingsanordningen är i underhållsläge i förhållande till det påkopplingsbara redskapet, varvid låskolven (5a, 5b) har förflyttats bortom det låsta läget och till underhållsläget som skall varna operatören om att underhåll eller service behövs, vilket är en indikation på att låshållarytan (7) kan vara sliten, eller alternativt att mellanläggsplattan (11) eller mellanläggen (12a, 12b) i stapeln av mellanlägg behöver ersättas eller bytas ut.

2. Anordning enligt krav 1, varvid styrenheten är vidare konfigurerad för att generera åtminstone:

en första signal för upplåst läge på basis av den första positionssignalen,

en första signal för låst läge på basis av den första positionssignalen,

en första signal för underhållsläge på basis av den första positionssignalen,

en andra signal för upplåst läge på basis av den andra positionssignalen;

en andra signal för låst läge på basis av den andra positionssignalen, och

en andra signal för underhållsläge på basis av den andra positionssignalen.

3. Anordning enligt något av föregående krav, varvid de första och andra positionssensorerna är centralt anordnade i hydraulcylinderhuset (8).

4. Anordning enligt något av föregående krav, varvid

den första hydrauliska låskolven (5a) är försedd med en axialt långsträckt första sensorkavitet för translationsrörelse hos åtminstone en del av den första positionssensorn (71); och

den andra hydrauliska låskolven (5b) är försedd med en axialt långsträckt andra sensorkavitet för translationsrörelse hos åtminstone en del av den andra positionssensorn (72).

5. Anordning enligt något av föregående krav, varvid den första positionssensorn (71) och den andra positionssensorn (72) är av induktiv typ.

6. Anordning enligt något av föregående krav, varvid

den första positionssensorn innefattar ett första långsträckt sensorelement (59) och ett första ihåligt sensorelement (76), varvid det första långsträckta sensorelementet (59) är fästat vid hydraulcylinderhuset (8), och är anordnat för att genom translation förflyttas inne i det första ihåliga sensorelementet (76) som är fästat vid en inre yta hos den första sensorkaviteten, för att därigenom mäta positionen hos den första låskolven i förhållande till hydraulcylinderhuset (8); och

den andra positionssensorn innefattar ett andra långsträckt sensorelement (59) och ett andra ihåligt sensorelement (76), varvid det andra långsträckta sensorelementet (59) är fästat vid hydraulcylinderhuset (8), och är anordnat för att genom translation förflyttas inne i det andra ihåliga sensorelementet (76) som är fästat vid en inre yta hos den andra sensorkaviteten, för att därigenom mäta positionen hos den andra låskolven i förhållande till hydraulcylinderhuset (8).

7. Anordning enligt något av föregående krav, varvid styrenheten är konfigurerad för att kontinuerligt ta emot positionssignalerna.

8. Anordning enligt något av föregående krav, varvid den första låstappen (14a) är fästad vid den första axeln (15a), och varvid den andra låstappen (14b) är fästad vid den första axeln (15a).

9. Anordning enligt något av föregående krav, varvid den första låskolven (5a) och den andra låskolven (5b) är oberoende rörliga i förhållande till varandra.

10. Anordning enligt något av föregående krav, varvid en hydraulolja tillförs till en respektive hydraulkammare hos varje låskolv via en icke centraliserad oljekanal.

11. Anordning enligt något av föregående krav, varvid styrenheten är vidare konfigurerad för att ta emot minst en kalibreringssignal från en kalibreringsanordning (112) som är operativt förbunden med densamma, och på basis av minst en kalibreringssignal är styrenheten är konfigurerad för att :

definiera ett första område för låsvärden som indikerar att den första låskolven är i en korrekt låsposition när den samverkar med ett par bakre låshållare (4b) hos redskapet (3), och

definiera ett andra område för låsvärden som indikerar att den andra låskolven är i en korrekt låsposition när den samverkar med ett par bakre låshållare (4b) hos redskapet (3).

12. Anordning enligt krav 11, varvid styrenheten är vidare konfigurerad för att bestämma ett område för korrekta låsvärden som motsvarar när respektive låskolv är i den korrekta låspositionen med de bakre låshållarna när låskolven samverkar med dessa, och på basis av området för korrekta låsvärden är styrenheten konfigurerad för att definiera :

ett första område för värden för olåst position som indikerar att den första låskolven är i en upplåst position när den samverkar med ett par bakre låshållare hos redskapet, och

ett första område för positionsvärden för underhåll som indikerar att den första låskolven är i en underhållsposition när den samverkar med ett par bakre låshållare hos redskapet;

ett andra område för värden för upplåst position som indikerar att den andra låskolven är i en upplåst position när den samverkar med ett par bakre låshållare hos redskapet, och

ett andra område för värden för underhållsposition som indikerar att den andra låskolven är i en underhållsposition när den samverkar med ett par bakre låshållare hos redskapet.

13. Anordning enligt krav 11, varvid styrenheten är vidare konfigurerad för att utföra en första jämförelse mellan den första positionssignalen och det första området för låsvärden när den samverkar med ett par bakre låshållare (4b) hos redskapet (3), och på basis av den första jämförelsen är styrenheten konfigurerad för att generera :

en första signal för upplåst läge som indikerar att ett första positionsvärde hos den första positionssignalen ligger under det första området för värden,

en första signal för låst läge som indikerar att ett första positionsvärde hos den första positionssignalen ligger inom det första området för värden,

en första signal för underhållsläge som indikerar att ett första positionsvärde hos den första positionssignalen ligger över det första området för värden, och

varvid styrenheten är vidare konfigurerad för att utföra en andra jämförelse mellan den andra positionssignalen och det andra området för låsvärden när den samverkar med ett par bakre låshållare (4b) hos redskapet (3), och på basis av den andra jämförelsen är styrenheten konfigurerad för att generera :

en andra signal för upplåst läge som indikerar att ett andra positionsvärde hos den andra positionssignalen ligger under det andra värdeområdet,

en andra signal för låst läge som indikerar att ett andra positionsvärde hos den andra positionssignalen ligger inom det andra värdeområdet,

en andra signal för underhållsläge som indikerar att det andra positionsvärdet hos den andra positionssignalen ligger över det andra värdeområdet.

14. Arbetsmaskin innefattande en snabbkopplingsanordning enligt något av föregående krav; ett redskap (3) och en manöverarm (2).

15. Arbetsmaskin enligt krav 14, varvid maskinen innefattar vidare ett par stödklackar (10), varvid en övre yta hos stödklacken är konfigurerad för att ligga an mot en nedre yta hos snabbkopplingsanordningen.

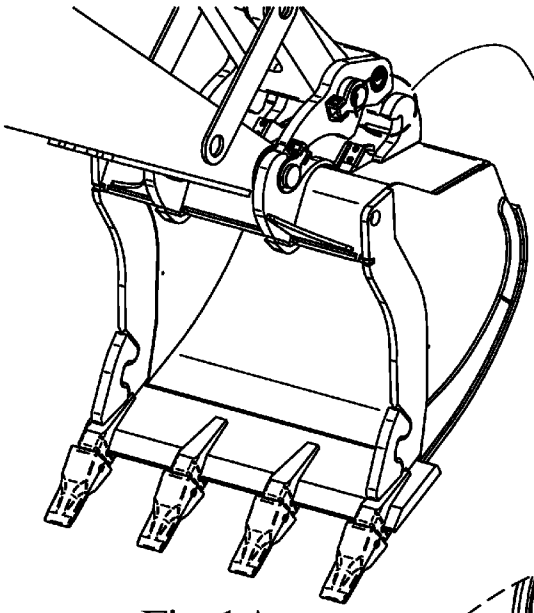


Fig 1A

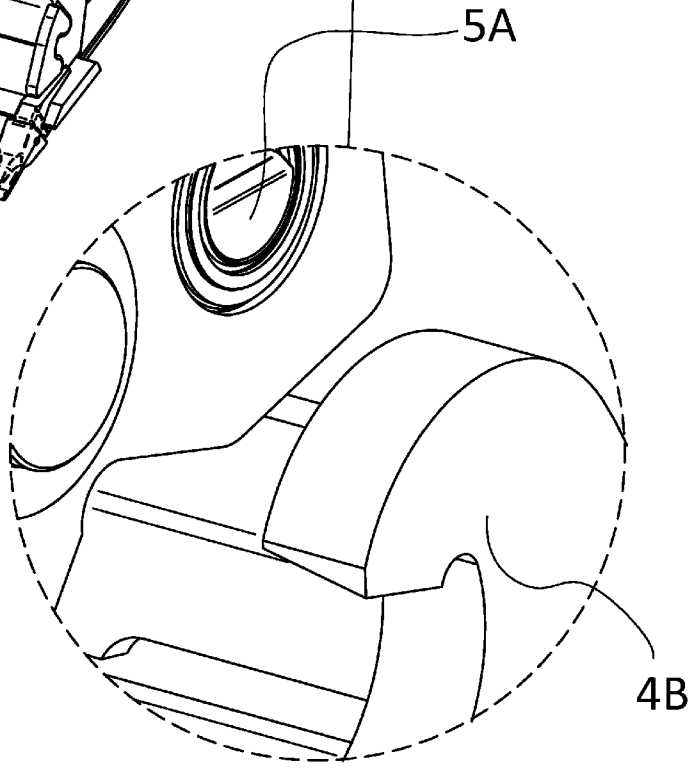


Fig. 2A

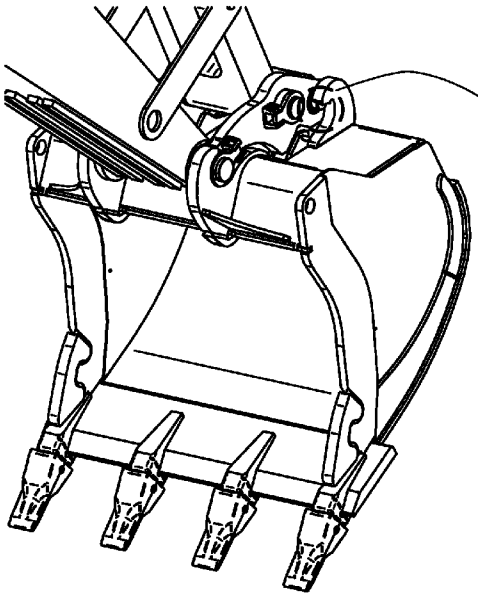


Fig 1B

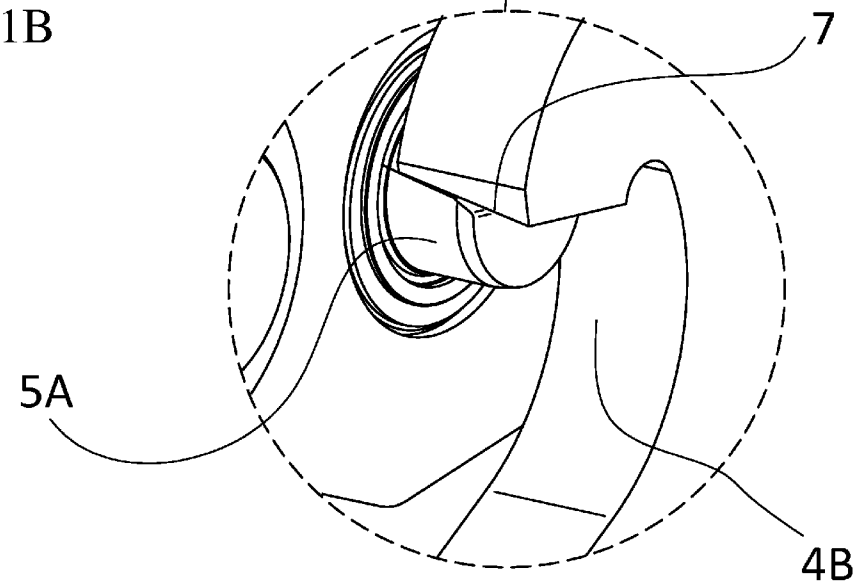


Fig. 2B

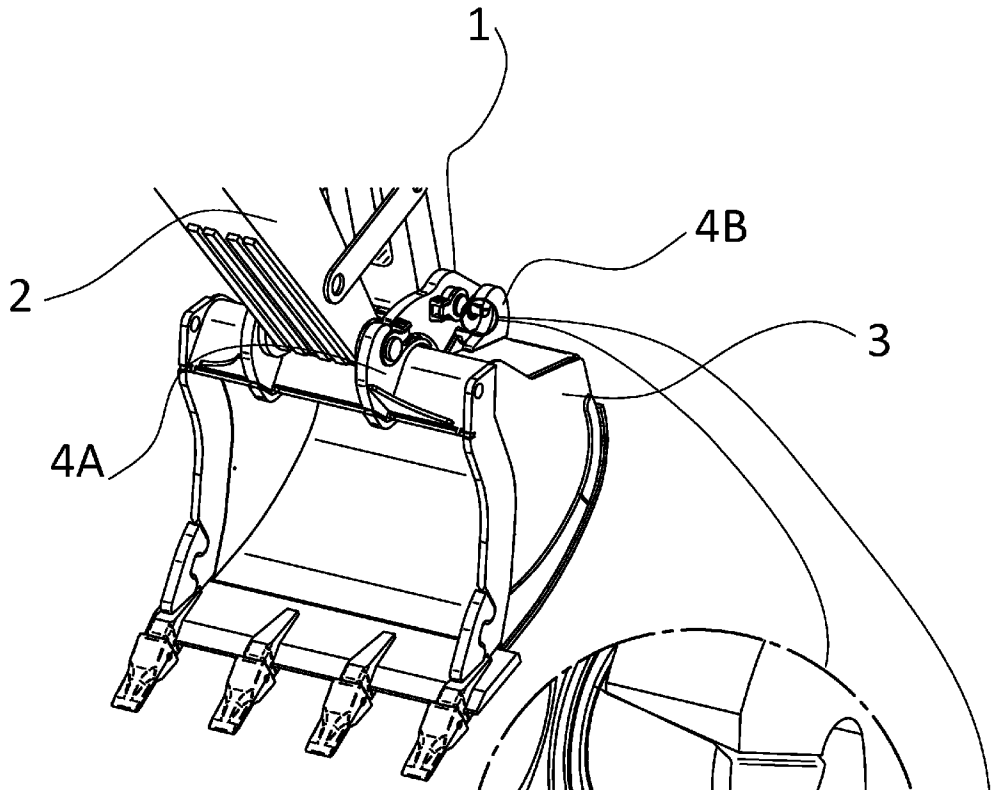


Fig 1C

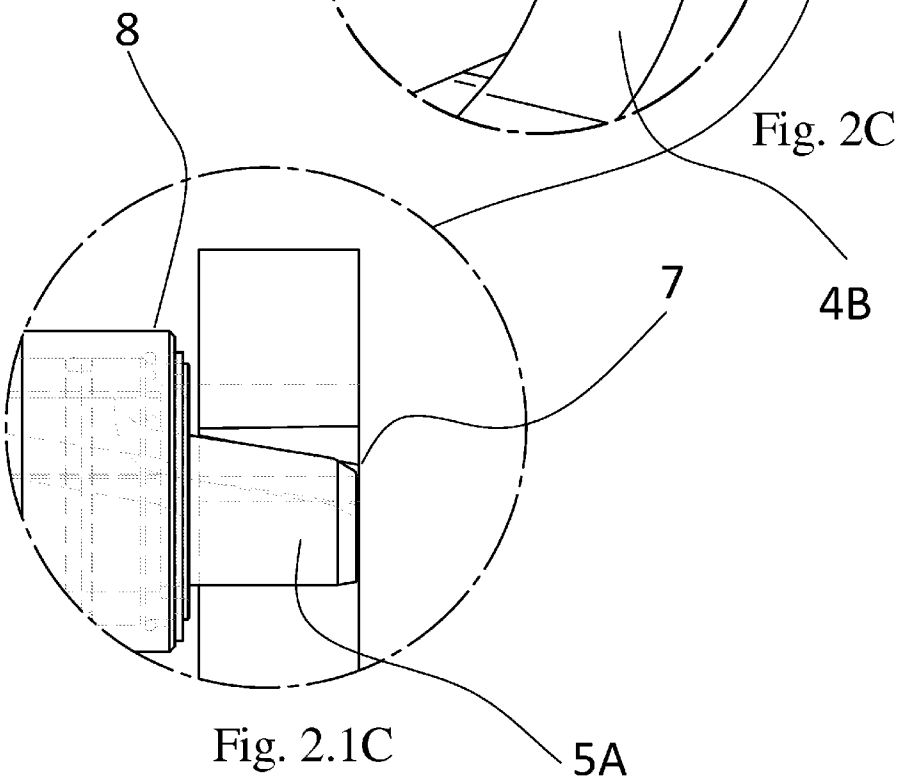


Fig. 2C

Fig. 2.1C

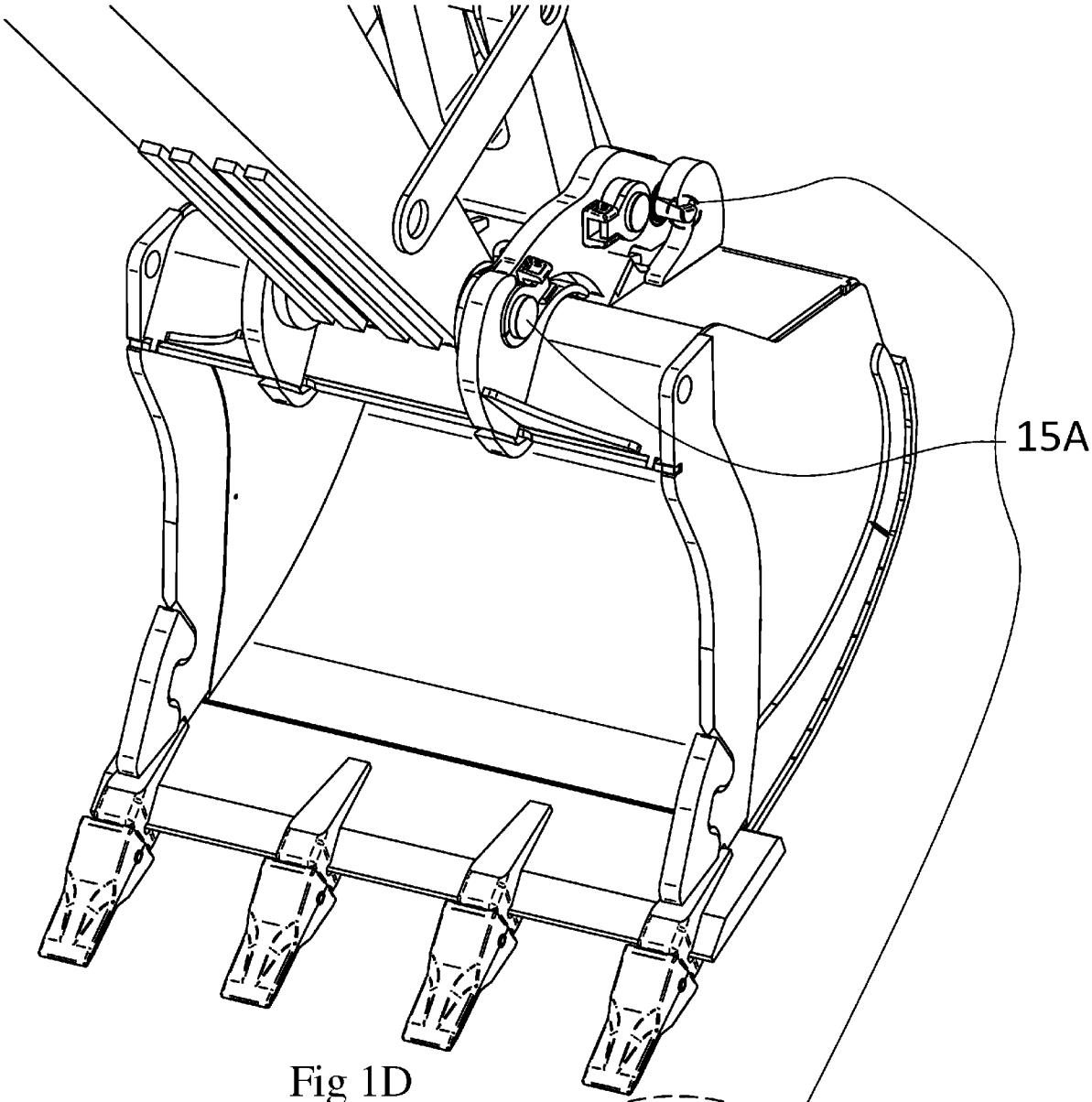


Fig 1D

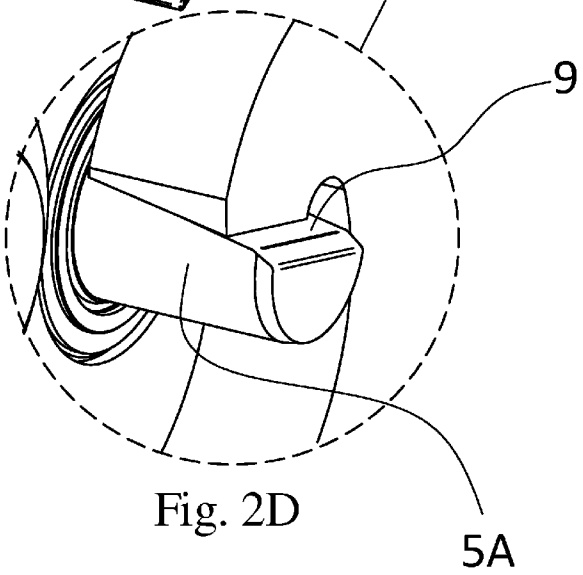


Fig. 2D

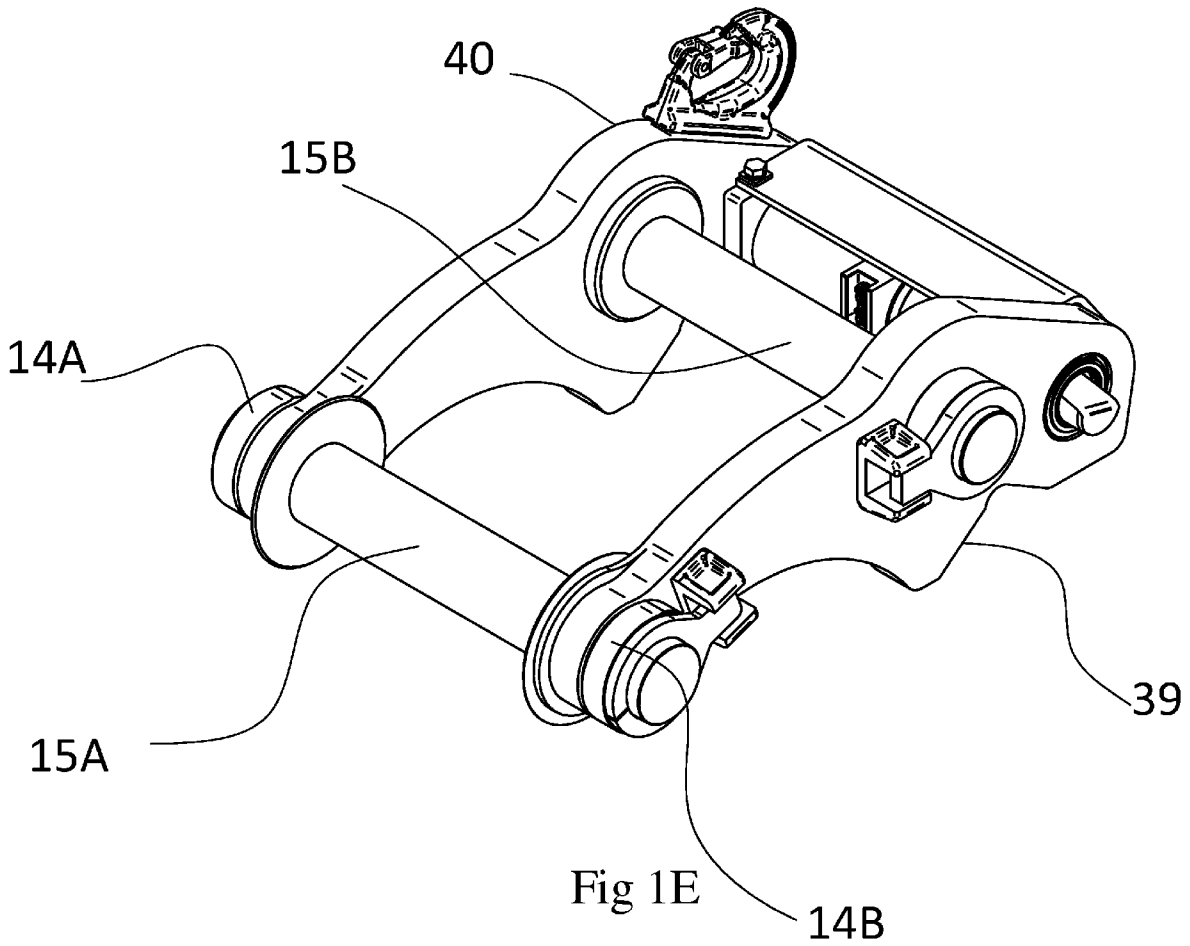


Fig 1E

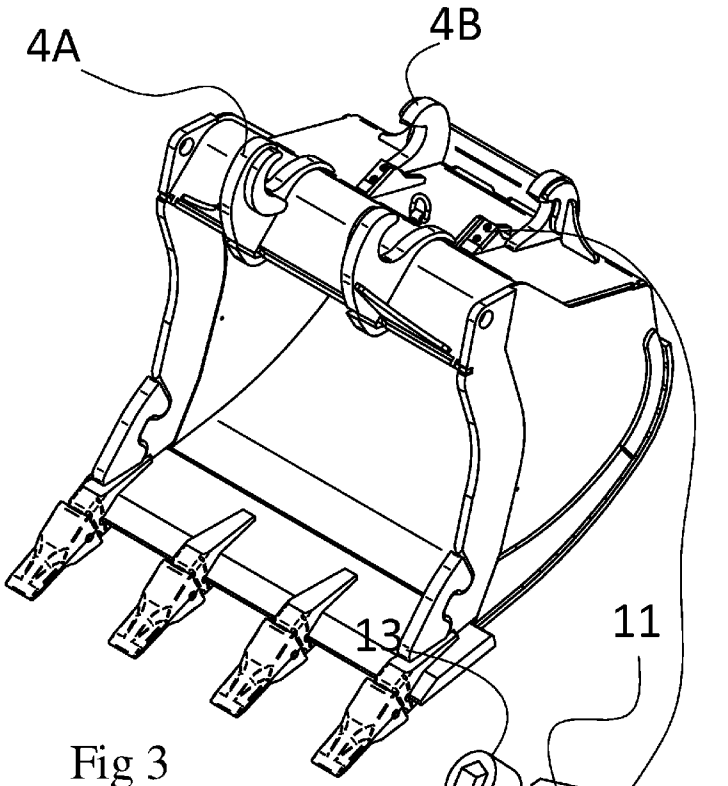


Fig 3

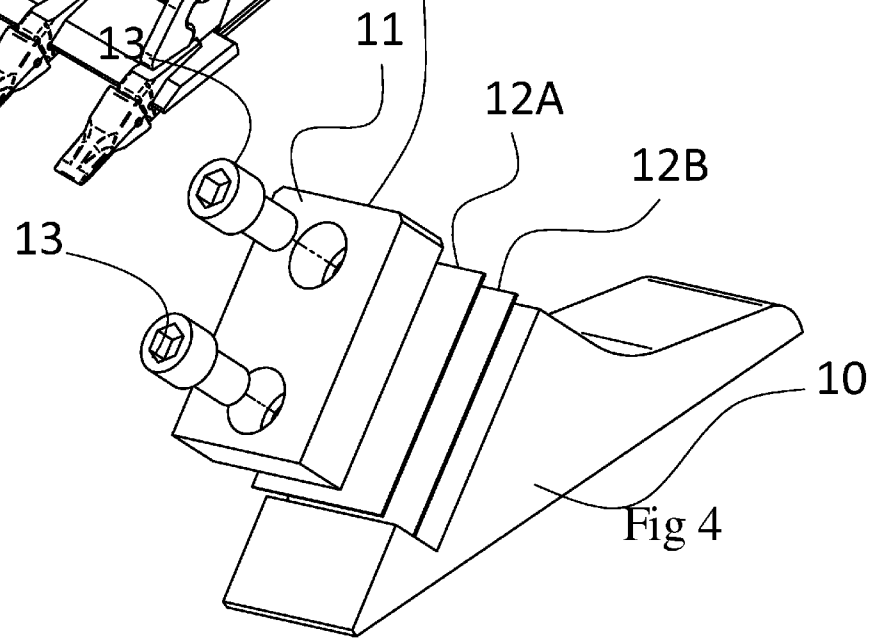


Fig 4

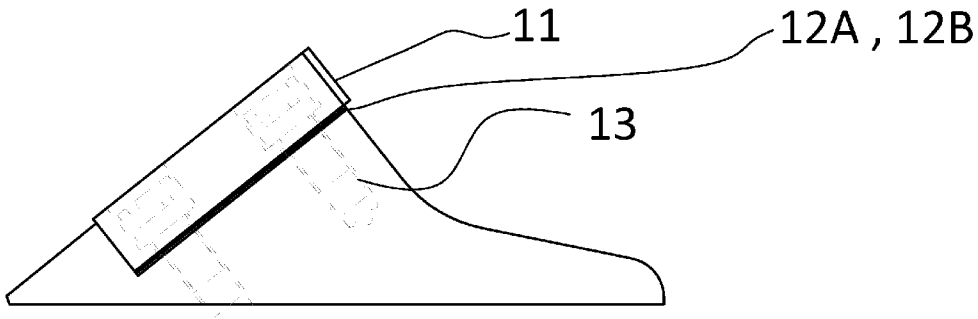


Fig 5

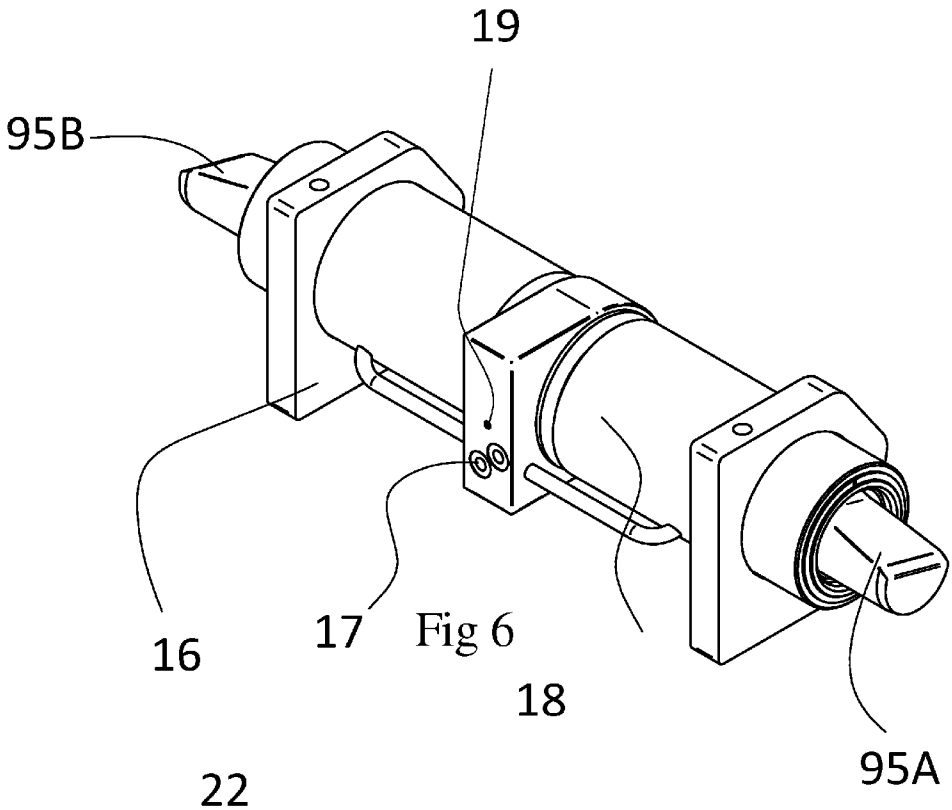


Fig 6

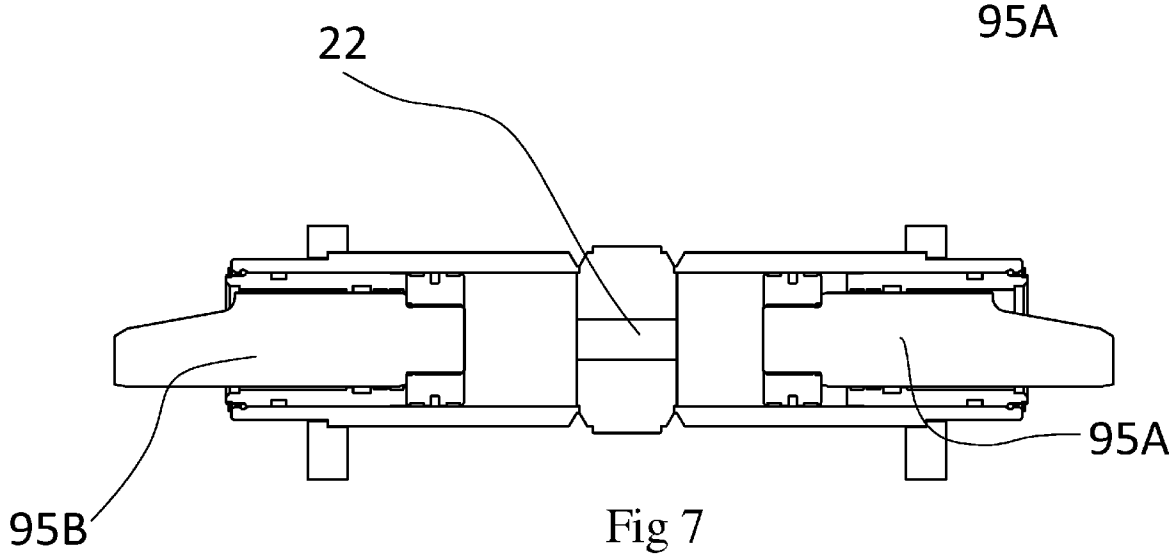


Fig 7

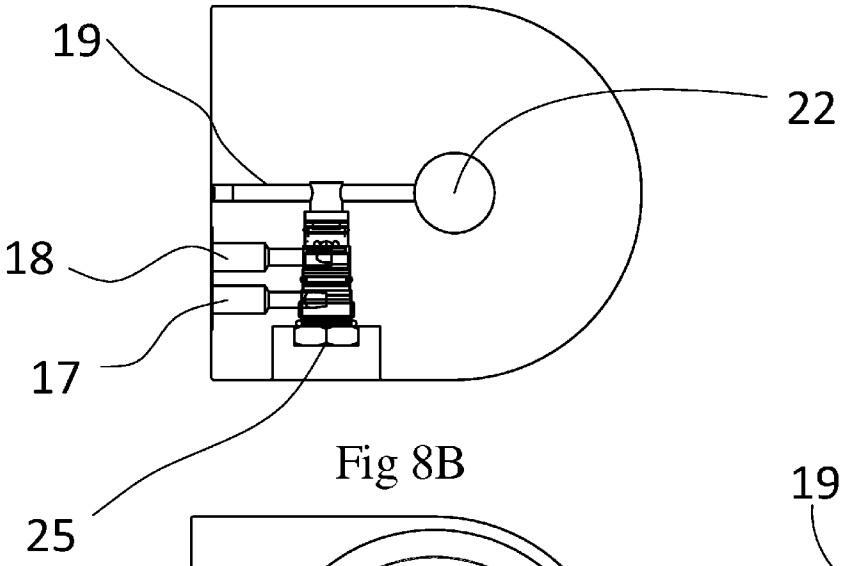


Fig 8B

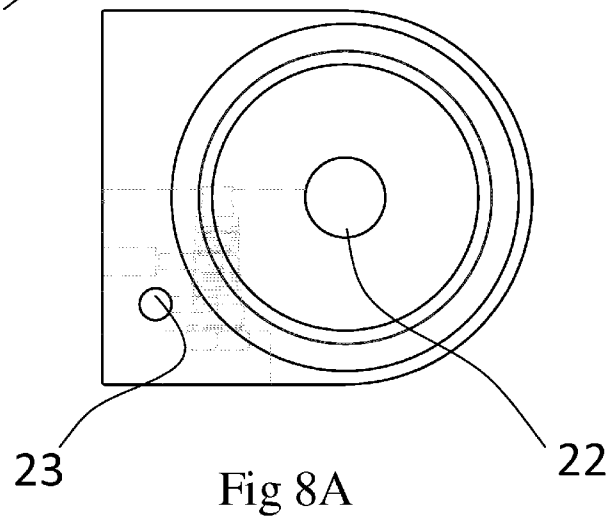


Fig 8A

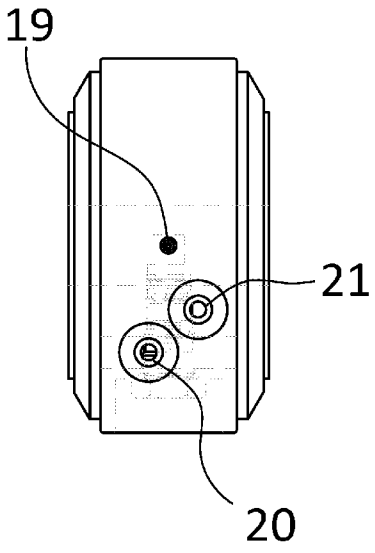


Fig 9

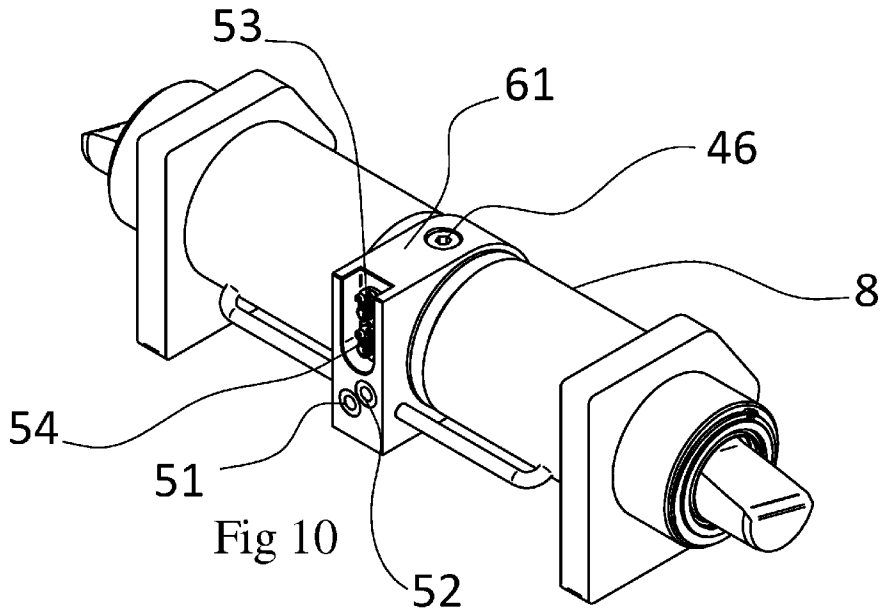


Fig 10

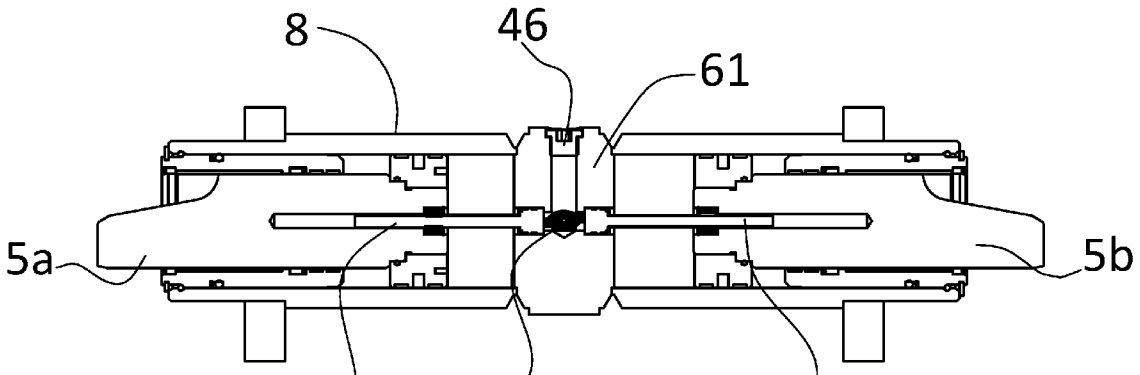


Fig 11A

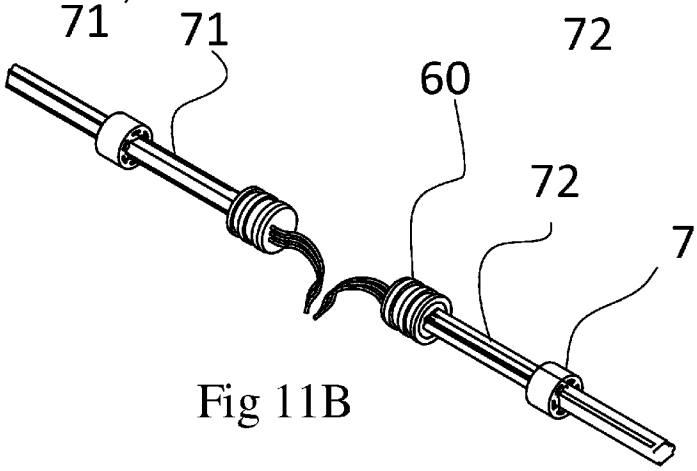


Fig 11B

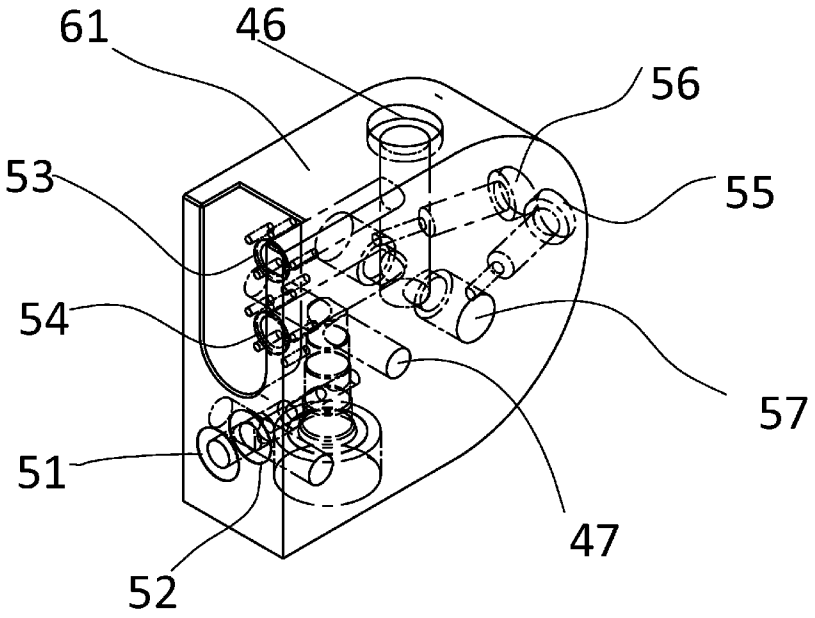


Fig 12

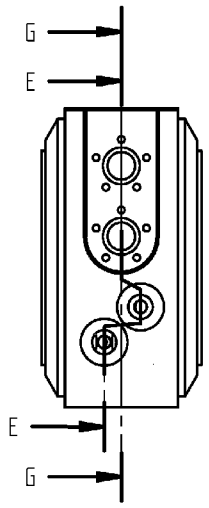


Fig 13

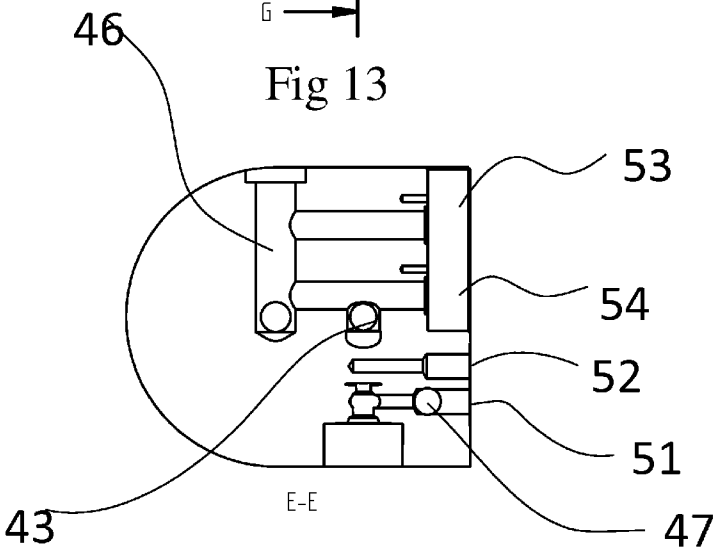


Fig 14

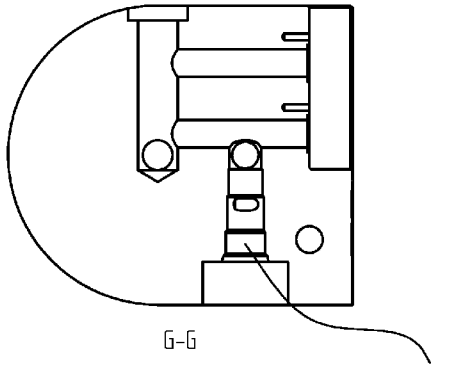


Fig 15

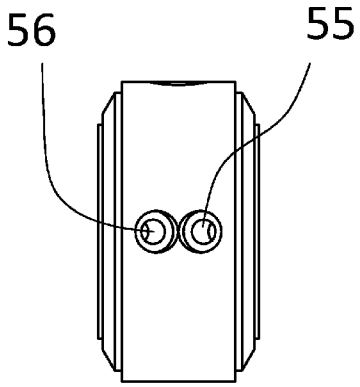


Fig 16A

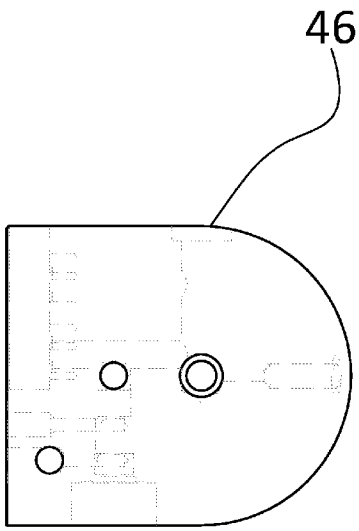


Fig 16B

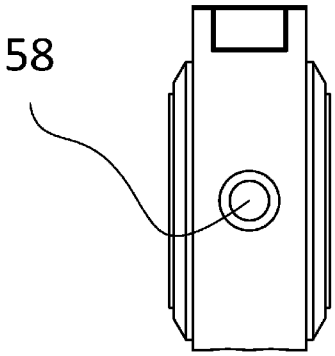


Fig 16C

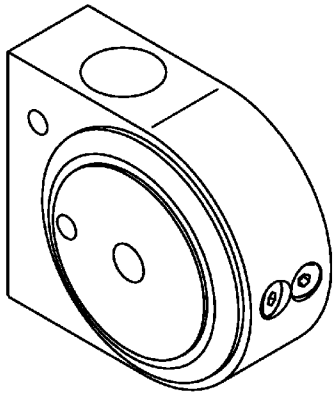


Fig 16D

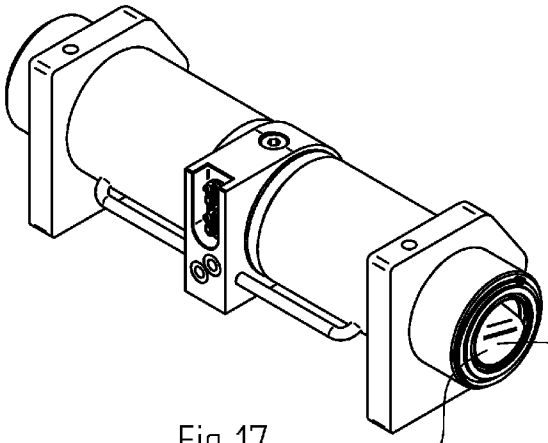


Fig 17

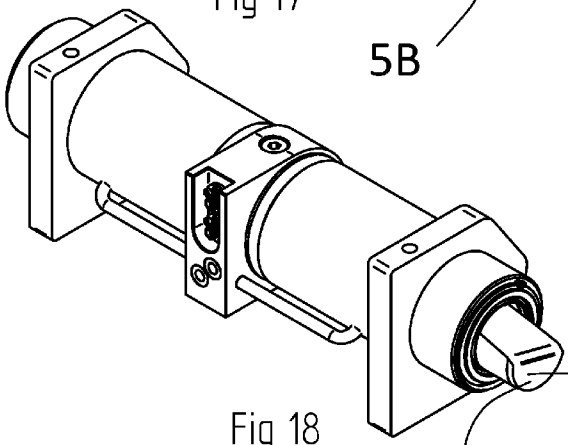


Fig 18

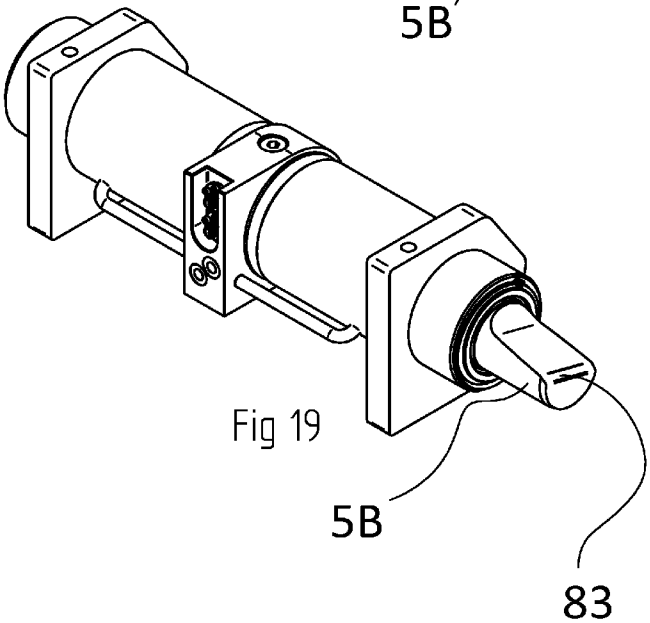


Fig 19

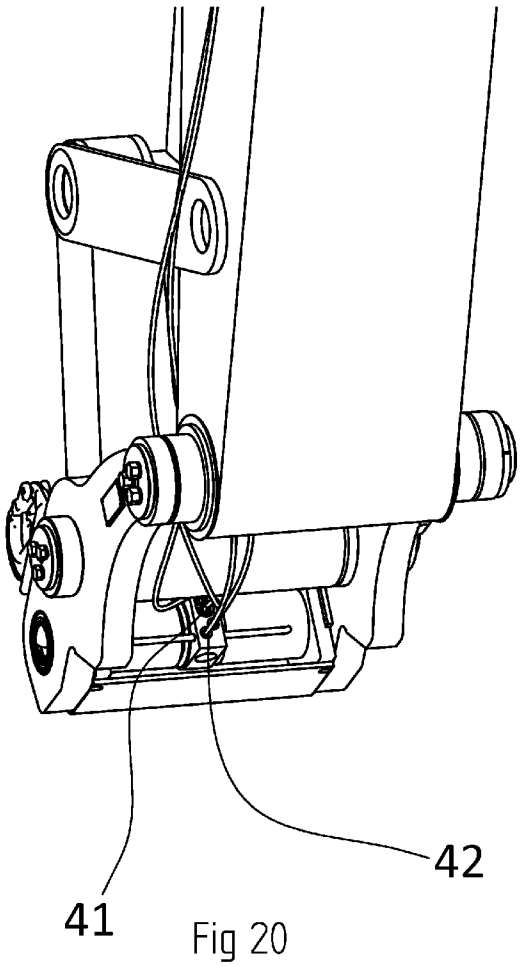


Fig 20

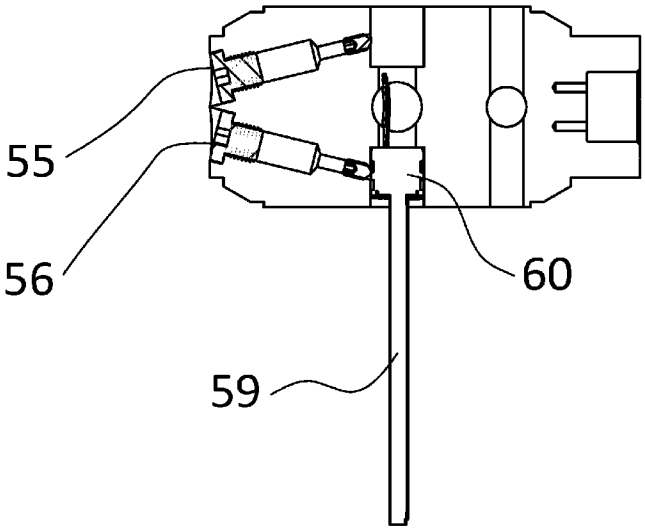


Fig 21A

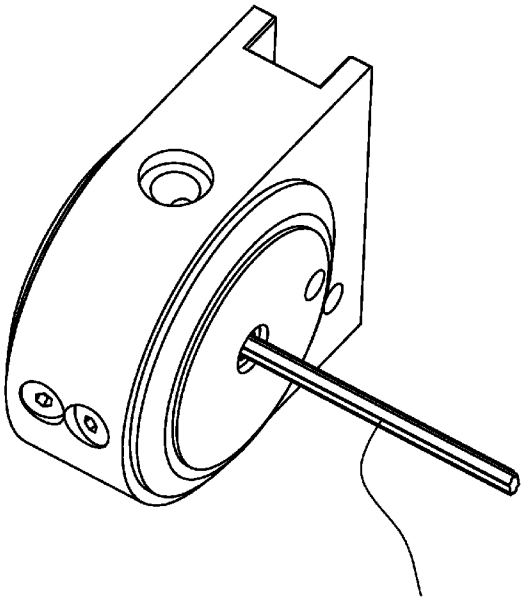


Fig 21B

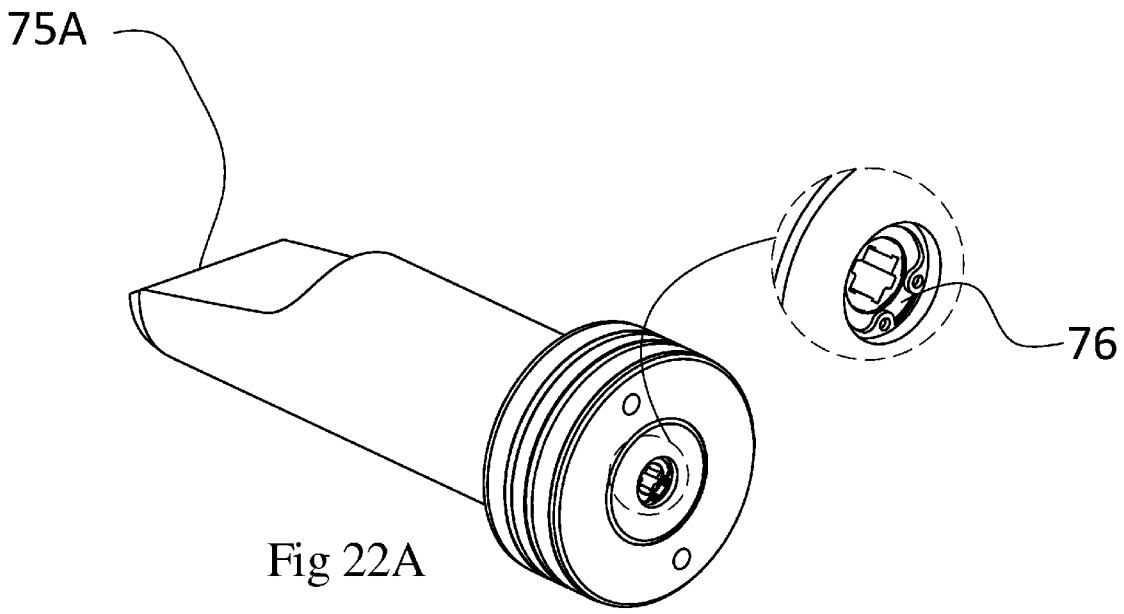


Fig 22A

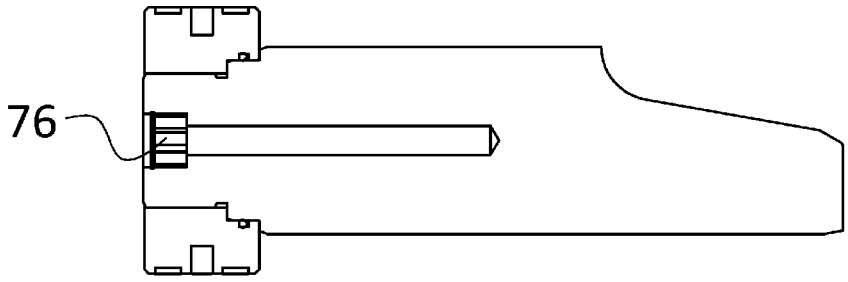


Fig 22B

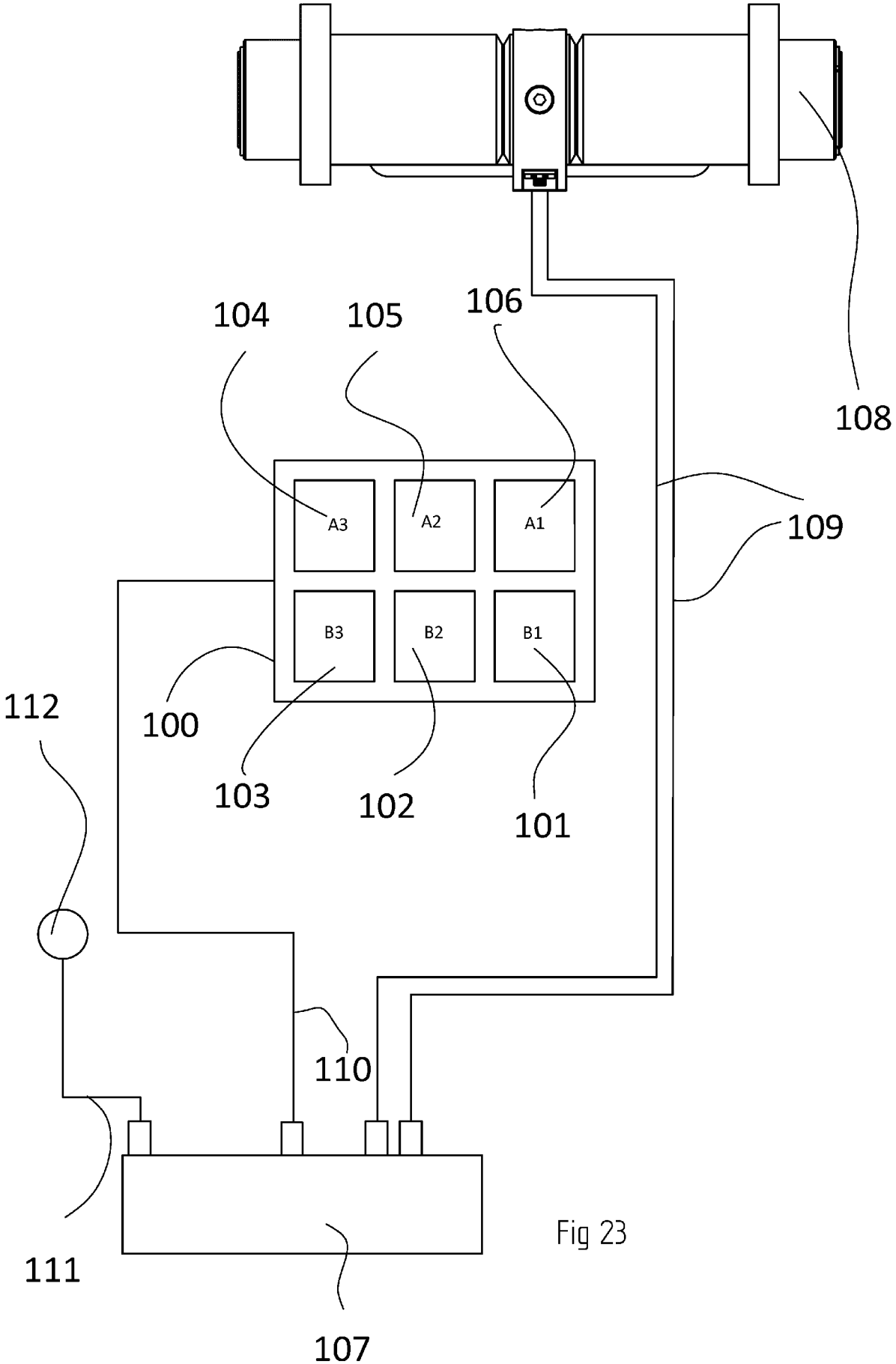

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Fig 23