

Pivoting device for a component

The invention relates to a pivoting device for a component, in particular of a flow machine, which has a suspension device which can be moved along a leveling axis and is intended for
5 arranging the pivoting device on a holding device, and which has a receiving device which can be rotated about a pivoting axis and can be connected to the component along a receiving axis, wherein the pivoting axis forms a first angle with the leveling axis and a second angle with the receiving axis, and wherein the suspension device can be moved along the leveling axis as a function of the center of gravity of the component which can be connected to the receiving
10 device. The invention also relates to a system for pivoting a component, in particular of a flow machine, and to a method for moving a component, in particular of a flow machine, by means of a pivoting device.

For maintenance and, in particular for assembly and disassembly work on flow machines, the
15 machines are typically received and raised by means of crane and associated lifting devices in order to be kept ready in a horizontal position. Individual components or modules of the flow machine can be accommodated, in particular with the aid of various adapter devices, and moved towards or away from the flow machine. In this case, the individual components are typically pivoted in order to be able to be brought from a horizontal assembly position into a vertical
20 transport position or vice versa.

In this case, it is in particular crucial for safe disassembly of the flow machine that the load be transferred from the flow machine to be disassembled to the crane device without jumps, i.e. that any crane preloading, for example, before connections such as screw connections are loosened,
25 can be detected and can be neutralized by means of suitable load compensation, and that the parallel alignment of component axes to one another is possible. With conventional lifting devices, the lifting of the crane device must always be corrected manually for this purpose, since only in the rarest of cases can a shift in center of gravity before and after the loading of the crane device be avoided structurally. In addition, the rotation of the received component by 90° is
30 typically necessary in order to be able to put it down and/or position it for assembly.

Proceeding from this, it is an object of the present invention to propose an improved pivoting device for components, in particular for components of a flow machine, a system for pivoting

such a component and a method for moving a component, in particular of a flow machine, which permits flexibility in its use. This is achieved according to the invention through the subject matter of the independent claims. Advantageous embodiments of the invention are the subject of the subclaims.

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To achieve the object, a pivoting device for a component, in particular of a flow machine, is proposed, which has a suspension device which can be moved along a leveling axis and is intended for arranging the pivoting device on a holding device, and which has a receiving device which can be rotated about a pivoting axis and can be connected to the component along a receiving axis, wherein the pivoting axis forms a first angle with the leveling axis and the pivoting axis forms a second angle with the receiving axis, and wherein the suspension device can be moved along the leveling axis as a function of the center of gravity of the component which can be connected to the receiving device.

15 The pivoting device is designed to receive the component in a suspended manner in order to be able to provide the necessary degrees of freedom for pivoting the component from an initial position to an end position. Due to the fact that the pivot axis and the leveling axis form a first angle and the pivot axis and the receiving axis form a second angle and are in particular arranged in a plane, the rotation of the component in space can be achieved by a rotational or pivoting movement about the pivot axis. The ability to move or shift the suspension device along the leveling axis allows for the compensation or balancing of any shift in the center of gravity of the component and/or the pivoting device that may be caused by pivoting around the pivot axis. The center of gravity of the component is understood in particular as its center of mass, i.e. the mass-weighted average of the positions of all the mass points of the component, its horizontal position being particularly relevant.

In the context of the present invention, the term "component" denotes the totality of a part, a subassembly or a larger unit such as, for example, a module, in particular a flow machine, which is transported as a unit, in particular being disassembled from a flow machine or assembled on the latter. The starting position or the end position of the component can be either a storage position in which the component can be stored for transport and/or maintenance or from which it can be taken, or an assembly position in which the component can be assembled or disassembled, depending on whether assembly or disassembly is carried out.

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The pivoting device can be used for various transport tasks, for example in the context of assembly and disassembly work; the following discussion will focus mainly on a disassembly process, that is to say the transfer of a component from an assembly position to a storage position. Of course, identical and/or similar effects or advantages can also be achieved in an assembly process in the opposite direction, even if they are not explicitly specified or explained. The use of the device is explained below using the example of disassembling components of a flow machine. Of course, the proposed pivoting device, the system proposed herein and/or the method proposed herein can also be used for pivoting and/or moving parts or components of other assembled devices.

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The pivoting device can be used to pivot the components of the flow machine between an assembly position and a storage position, or vice versa. In this case, the assembly position can be a horizontally aligned position of the rotational axis of the component or can be designated as such, since a flow machine which is held or mounted on a mounting support, for example, is typically positioned such that its main axis or rotational axis is aligned, in particular horizontally. Thus, typically, the axis of symmetry of the component is also aligned horizontally and is aligned with the axis of rotation of the flow machine. The storage position of a component can be, for example, a vertically aligned position of the axis of rotation of the component, the axis of the component which is horizontal in the assembly position being pivoted into a vertical position by the pivoting movement. In this case, the axis of the component is arranged parallel to the receiving axis of the pivoting device or can coincide with the latter in order to rotate or pivot the component in space. As a result, for example, a typically larger and/or essentially radially arranged (outer) geometry of the component can be used as a storage structure in order to be able to store and/or transport the component in a stable position.

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The pivoting device can be arranged or fastened via its suspension device, which can have, for example, an eye or crane eye, on a holding device, such as, for example, a carrying device and/or crane device, and is fastened in particular to the latter during operation. In this case, the holding or crane device can be configured to carry out an independent movement, in particular a horizontal and/or a vertical movement, in order to be able to move the pivoting device and/or to be able to apply a holding force which is directed in particular counter to gravity.

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The suspension device can be moved or shifted along the leveling axis of the pivoting device, which is aligned in particular horizontally during the operation of the pivoting device. In the

assembly position, the leveling axis is aligned in particular parallel to a main axis or rotational axis of the flow machine. The suspension device can, for example, be movable or mounted on a carriage, in particular by means of a spindle, motorized and/or automated along the leveling axis, or it can be handled or moved. In the case of a shift of the center of gravity due to a pivoting
5 and/or rotational movement of the component, this enables the leveling or correction of the alignment of the pivoting device and/or of the component, in particular in a longitudinal direction or the direction of the leveling axis.

The receiving device of the pivoting device or the receiving axis which is fixed at the second
10 angle to the pivoting axis can be rotated about the pivoting axis in order to be able to effect the movement or rotation of the component which is received or connected. Of course, the receiving device can also be constructed in two or more parts, wherein the two or more parts can also be spaced apart from one another in order to make possible a suitable mounting or connection with the component.

15 In one embodiment, the sum of the first angle and the second angle is 90° , the two angles lying in particular in one plane. As a result, a component is rotated through 90° in space about the pivot axis during a rotation of 180° and is pivoted from an assembly position into a storage position or the component is pivoted from a horizontal position into a vertical position or vice
20 versa. In this case, the receiving axis or the direction in which the component can be received and/or fastened on the receiving device is aligned or arranged parallel or perpendicular to the leveling axis and thus in particular horizontally or vertically.

In one embodiment, the first angle α and the second angle β are each 45° . As a result, the
25 leveling axis and the receiving axis can be aligned parallel to one another. The center of gravity of the component can lie close to or in particular on the pivot axis, whereby the torque necessary for rotation can be minimized. The component can thus be turned, pivoted or rotated in or very close to its center of gravity, as a result of which a lever arm can be reduced, in particular as a function of the distance of the center of gravity from the pivot axis, so that energy can be saved
30 by reducing the lever arm. As a result, for example, a gear for rotary movement about the pivot axis can be designed with a smaller dimension, as a result of which, furthermore, the dimensions of the pivoting device can also be reduced.

In one embodiment, the pivoting device has a weight sensor for detecting the weight received on the receiving device 15. The weight sensor can be arranged in particular in the area of the suspension device or crane eye. The weight sensor can be used to measure or detect the load on the eye or the weight of the received component, and in particular to store or transmit it for further processing. The detected weight can be displayed, for example, as information via a display device or can be provided in the form of data for the corresponding operation of the holding device and can be used, in particular, for the vertical positioning or for counterbalancing of the pivoting device as a function of the load or component being held during operation. Load transfer, in particular by the holding device on which the pivoting device is arranged, can thus be improved. The use of an additional crane balance, for example on the holding device, can thus be dispensed with.

For example, when a specific component is first picked up, the weight of said component can be detected and stored, as a result of which the calibration of the pivoting device can be carried out in order, when this specific component is detected, to be able to carry out the movement or alignment of the component or of the pivoting device in an automated manner, in particular without further calculations.

In one embodiment, the pivoting device has a leveling sensor, which is arranged in particular in the area of the suspension device and is set up in particular for aligning the leveling axis in the horizontal direction, in particular during operation of the pivoting device and/or during the pick-up or pivoting of the component. The leveling sensor can detect a shift of the load center of gravity of the component and/or a resulting offset of the leveling axis with respect to the horizontal. On the basis of this information, the position of the receiving device or crane eye can be adjusted in order to bring the leveling axis or the leveling arm to horizontal.

In one embodiment, the receiving device is arranged at a distance from the leveling axis. In this case, in particular during operation, a vertical distance is provided between the receiving device and the leveling axis or the suspension device, so that the movement or shift of the suspension device can take place independently of and/or at a distance from the pivoting movement of the receiving device. In this way, leveling or balancing of the pivoting device and/or of the component fastened thereto can be carried out in an improved manner. In particular, an L-shaped basic shape can be provided for the pivoting device, wherein a leveling arm extending along the leveling axis is aligned in particular horizontally for guiding the suspension device during

operation. A functional arm arranged on the leveling arm, in particular at right angles, can be aligned vertically during operation, the receiving device being positioned on this functional arm, in particular at an angle of 45°.

5 In one embodiment, the receiving device has a reading device and/or a reading/writing device for data transmission. This device can be designed, for example, as an RFID reading device and/or a reading/writing device and can be set up for reading and/or writing data of an RFID chip or of a memory device. Such a readable chip can be arranged, for example, on the component, and the latter's parameters or information such as weight, center of gravity or center of gravity position
10 can have stored information, in particular in the form of data. As a result, for example, data can be read and/or written or stored from a component and used for further processing and/or control of the pivoting device and/or the holding device.

In one embodiment, the pivoting device has a control device which is configured to control the
15 rotation of the receiving device about the pivot axis and the linear displacement of the suspension device along the leveling axis. In this case, the control device is in particular configured to control the holding device and/or the suspension device in an automated manner and as a function of the detected or read data or information of the component to be held or being held, such as, for example, weight or center of gravity position. In addition, it can be provided
20 that the control device is in communication with the holding device in order to enable control of the latter. This eliminates manual readjustment and thus reduces personnel requirements.

In one embodiment, the pivoting device has an energy storage device for operating the pivoting device. By means of the proposed design of the pivoting device, the component can be rotated or
25 turned close to or at its center of gravity, as a result of which the energy requirement can be reduced, so that the pivoting device can be supplied with energy using an energy storage device and in particular autonomously, for example in the form of a 48V battery. In this case, the battery or the energy storage device can be arranged so as to be replaceable, in particular in or on the functional arm or vertical strut of the pivoting device.

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In one embodiment, the pivoting device has a display device for displaying information available on the pivoting device. Such information can be, for example, information or data which is detected by means of the weight sensor or the leveling sensor of the pivoting device and/or data read via the data interface. Furthermore, the display device can be designed as a touch display in

order to permit manual operation of the pivoting device. For example, the actuation of the receiving device and/or of the receiving device can be effected in this way. Additionally or alternatively, a remote control can be provided for manual operation of the pivoting device, wherein it can be connected wirelessly or by wire to the pivoting device or its control unit.

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In a further aspect of the invention, in order to achieve the object, a system for pivoting a component, in particular of a flow machine, is specified, having the pivoting device which is described therein and has a receiving device and a coupling device which can be connected to the receiving device, wherein the coupling device can be connected to the component. In this case, the coupling device can be designed in such a way that a positive-locking connection to the receiving device can be produced therewith. Positive-locking connections are used to transmit high forces. Since the components, in particular of a flow machine, typically have a high weight, this weight can be reliably transferred to the pivoting device and/or the holding device connected to the pivoting device via a correspondingly dimensioned positive-locking connection. In addition, positive-locking connections can be quickly produced and released in the working sequence. In this case, the coupling device is designed, for example, as a coupling pin which can be received by the correspondingly designed receiving device.

Such a coupling device can, for example, be connected to the component via suitable connecting device or be arranged integrally on the latter in order to be able to form a load-bearing or loadable mount for the component with the pivoting device. If the coupling device is designed as a coupling pin, then the axis of the coupling pin, in particular in the received state, can be aligned parallel to the axis of the component and/or the horizontal or the leveling axis of the pivoting device. As a result, the pivoting device can compensate movement sequences which are carried out by means of the pivoting device and the resultant shifts in the center of gravity in an improved manner.

In one embodiment, the system has an adapter device which can be arranged on the component and/or on the coupling device; in particular, it can be connected to the latter or can be designed in one piece. In this case, the adapter device is in particular configured to be arranged on the respective component or to be detachably connected to the latter in order to form a movable unit. Accordingly, according to the invention, the term center of gravity of the component can also be understood as a center of gravity of the unit comprising the component and the adapter device and/or the coupling device.

In some embodiments, it can be provided that the adapter device has the coupling device or the coupling device is provided integrally on the adapter device. It can be provided that each component is or can be assigned an adapter device tailored to it, the coupling device always
5 being of the same design. In this case, the coupling device is arranged, in particular, on the side of the adapter device opposite the side receiving the component, so that a connection to the pivoting device is made possible. As a result, a large number of different components can be received and pivoted by means of the pivoting device.

10 In one embodiment, the adapter device or the coupling device has a readable or readable/writable memory unit, and the receiving device has a reading device or reading/writing device for reading or reading/writing to the memory unit of the adapter device or of the coupling device.
Information in the form of data can be stored in or by means of the memory unit of the adapter device or of the coupling device and can be read by the reading device or reading/writing device
15 of the receiving device. Such information can be, for example, the device number of the component, the weight of the component or of the adapter device with and/or without a component arranged thereon, the position of the center of gravity of the coupling device and/or of the adapter device with and/or without a component arranged thereon. These data can be used for in particular for the automated operation of the pivoting device and/or can be displayed, for
20 example, via the display device of the pivoting device.

In one embodiment, the receiving device has a closure control to check that the coupling device or the adapter device and/or component is securely received on the receiving device. For example, if the coupling device is designed as a coupling pin, this coupling pin can be secured in
25 a receiving opening of the receiving device by means of a setting pin. This securing device can, for example, trigger a signal which can permit the actuation of the pivoting device in order to ensure that the component is securely fastened to the pivoting device as the basis for the operation of the pivoting device.

30 In a further aspect of the invention, a method for moving a component, in particular of a flow machine, by means of a pivoting device is proposed in order to achieve the object. The method comprises the following steps: receiving the component to be moved on the receiving device of the pivoting device along the receiving axis; moving the suspension device of the pivoting device along the leveling axis in order to horizontally align the leveling axis of the pivoting

device as a function of the center of gravity of the component; and pivoting the received component about the pivoting axis of the receiving device, said pivoting axis forming the first angle with the leveling axis and the second angle with the receiving axis, said angles lying in particular in a plane. The suspension device can be moved in particular before, during and/or
5 after the pivoting of the component in order to level the pivoting device and/or the component.

The terms used in the description of the method for devices and equipment and their functions and use correspond to those of the preceding description, which relates in particular to the proposed pivoting device. The individual process steps are therefore to be understood in
10 particular in connection with the preceding description.

When the component is picked up, it is arranged on the receiving axis, in particular in a direction along the latter, and is detachably connected to the receiving device via a positive-locking connection in order to be able to raise and pivot the latter. The use of the suspension device
15 permits the center of gravity of the component or the common center of gravity of the pivoting device and the component to be taken into account, so that the pivoting device can be level or the leveling axis can be horizontal. This makes it possible to avoid the rocking or unfavorable loading of the pivoting device when the component is lifted. In addition, a balanced pivoting movement can be made possible in order to be able to position the component on the flow
20 machine and/or to be able to position it after disassembly from the flow machine.

When the received component is pivoted, it is rotated in space so that it can be either positioned on the corresponding surface or positioned on a device or flow machine and be fastened to the latter. In addition, it can be provided that, if the position of the center of gravity of the
25 component changes when the component is pivoted, the suspension device is moved as a function of the position of the center of gravity or of the center of gravity. In this case, the stepwise and/or continuous movement of the suspension device can in particular also be provided in an automated manner.

30 In one embodiment, the sum of the first angle and the second angle is 90° . In particular, the first angle and the second angle can each be 45° . The pivot axis forms an angle of 45° with the leveling axis and with the receiving axis. As a result, compensating movements, such as, for example, the movement of the suspension device, which are carried out by the pivoting device, can be reduced. By tilting the pivot axis at an angle to the horizontal, the component, especially

if it is symmetrically designed, can be rotated at or around its center of gravity, thereby reducing the lever arm and the leverage force required. This makes it possible to save energy when moving the component.

5 In one embodiment, the component is pivoted through an angle of approximately 90° in space. In this case, the component has an axis which can be pivoted or rotated from a horizontal position, in particular into a vertical position, or vice versa. As a result, the component can be brought in particular from a storage position into an assembly position in which the axis of the component is aligned with the axis of the device or flow machine or vice versa.

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In one embodiment, the method has the further step of connecting a coupling device arranged on the component with the receiving device of the pivoting device, which connection can be carried out, in particular, when receiving the component to be moved. The use of a coupling device allows the receiving device to be connected to various components without having to make
15 significant changes to the pivoting device or receiving device. In addition, the coupling device can be designed for positive-locking connection to the receiving device in order to be able to provide a favorable force transmission for the secure receipt of the component by the pivoting device.

20 In one embodiment, the method has a further step of arranging an adapter device on a component, in particular the coupling device that is or will be arranged on the adapter device. By using an adapter device, a component of the flow machine can be structurally stabilized, for example, so that deformation and/or damage can be avoided when the component is released from the flow machine during a lifting and/or pivoting movement. The coupling device can be
25 formed in a single piece on the adapter device or can be fastened to it by suitable fastening means. In this case, the coupling device can in particular be arranged in such a way that, when the component is received by means of the pivoting device, the center of gravity of the component or of the adapter device with the received component is positioned as close as possible to or on the pivoting axis of the receiving device. This makes it possible to reduce the
30 lever arm for the rotary or pivoting movement and thus to create an energy-saving potential.

In one embodiment, the method has the further step of reading stored information from the memory unit arranged on the coupling device, the pivoting device being operated as a function of the read information. The term "operation of the pivoting device" is understood here to mean,

in particular, the movement of the suspension device along the leveling axis and/or the pivoting of the received component. The data can include the information already described herein in order to be able to carry out the control of the pivoting device or pivoting movement and/or compensating movement(s), which is as targeted and/or automated as possible.

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In one embodiment, the method has the further steps of applying a predetermined holding force to the pivoting device and releasing the component, in particular from the flow machine or a device. The predetermined holding force can be determined, for example, as a function of the weight of the component and can be provided via the suspension device or by a holding, lifting
10 or carrying device fastened thereto. As a result, the component for releasing any fastening device, such as screw connections, can be "raised" with the flow machine. In this way, the acting weight forces can be balanced, whereby the component is prevented from jumping and/or falling, in particular when the fastening device is released, in order to reduce the probability of damage to the component and the pivoting device.

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Further features, advantages and possible applications of the invention will become apparent from the following description in conjunction with the Figures. Shown are:

- Fig. 1 a schematic representation of an exemplary embodiment of a pivoting device
20 according to the invention with a component arranged thereon in an assembly position;
- Fig. 2 a schematic representation of the pivoting device of Fig. 1 in a storage position;
- 25 Fig. 3 a schematic representation of an exemplary embodiment of a system according to the invention for pivoting a component;
- Fig. 4 a schematic representation of an exemplary method according to the invention for moving a component, in particular of a flow machine, by means of a pivoting device
30 for moving when carrying out the disassembly of the flow machine; and
- Fig. 5 A schematic representation of an exemplary method according to the invention for moving a component, in particular of a flow machine, by means of a pivoting device for moving when carrying out the assembly of the flow machine.

Fig. 1 shows a schematic representation of an exemplary embodiment of a pivoting device 10 according to the invention with a component 11 arranged thereon. The pivoting device 10 is shown in an assembly position in which the component 11 is arranged or aligned for assembly or
5 disassembly on a device 1, here by way of example on a flow machine.

The pivoting device 10 has a leveling arm 12 and a functional arm 13 arranged perpendicularly thereto. A suspension device 14 is arranged on the leveling arm 12, by means of which the pivoting device 10 can be arranged or is arranged on a holding device 20. The holding device 20
10 can be designed to move the pivoting device 10 and/or to apply a holding force directed counter to gravity. The suspension device 14 can be moved along a leveling axis N and in particular along the leveling arm 12, as a result of which the leveling axis N can be or is aligned horizontally, in particular during the operation of the pivoting device 10. The suspension device 14 can have an eye 24 for attachment to the holding device 20, a weight sensor 34 and a leveling
15 sensor 44. In this case, the leveling sensor 44 can be used to align the leveling axis N in the horizontal plane and the weight sensor 34 can be used to detect or determine the absorbed load or weight of the component 11. This weight information can be used, for example, to adjust the holding force of the holding device 20 and/or to position the pivoting device 10 vertically by means of the holding device 20.

20 The receiving device 15 is arranged on the functional arm 13 at a vertical distance from the leveling axis N, which receiving device can be connected to the component 11 along the receiving axis A or is connected to the latter in the representation of Fig. 1. A component axis K, in this case by way of example an axis of symmetry, of the component 11 is aligned parallel to
25 the leveling axis N and to the receiving axis A in the assembly position shown.

The receiving device 15 and thus the receiving axis A can be rotated about a pivot axis S of the pivot device 10. This pivot axis S forms a first angle α with the leveling axis N, which is 45° in the exemplary embodiment shown. With the receiving axis A, the pivot axis S forms a second
30 angle β , which is likewise 45° in the exemplary embodiment shown. Thus, a sum of the first angle α and the second angle β is 90° . This arrangement of the axes A, N and S allows a 180° rotation of the receiving device 15 around the pivot axis S to enable a 90° rotation of the component 11 or of the receiving axis A in space from a horizontal to a vertical orientation or vice versa.

With such a rotation of the component 11 about the pivot axis S, the position of a center of gravity of the component 11 relative to the pivot device 10 can shift, which can change the position of the pivoting device 10 or result in an offset of the leveling axis N to the horizontal. In order to avoid or compensate for this, the suspension device 14 can be moved along the leveling axis N in space as a function of the center of gravity of the component 11 connected to the receiving device 15 or of a change in position of the center of gravity.

In the embodiment shown, the component 11 is connected to an adapter device 21 which has a coupling device 22 which is connected fixedly or detachably to the adapter device 21. In the embodiment shown, the coupling device 22 is designed as a coupling pin which can be received by the receiving device 15 along the receiving axis A or is received in the representation in Fig. 1. The receiving device 15 can have a closure control 25 which is designed to control the secure receipt of the coupling device 22 on the receiving device 15. As a closure control 25, the receiving device 15 and the coupling pin 22 can have, for example, recesses which are aligned with one another in the secure receiving position and can be secured by means of at least one setting pin. The closure control 25 can generate a signal, for example, which can enable the use of the pivot device 10.

The pivot device 10 can have a control device 43 which is configured to control the rotation of the receiving device 15 about the pivot axis S and the linear movement of the suspension device 14 along the leveling axis N. In this case, the control of the pivoting device 10 can be automated and/or be a function of detected or read information about the received component 11. To provide such information, a reading device 35 or a reading/writing device 35 can be provided, for example, on the receiving device 15, which reading/writing device can be coupled to the memory unit 55 of the adapter device 21 and/or of the coupling device 22 for data transmission. In this case, for example, the adapter device 21 and/or the coupling device 22 can have a readable or readable/writable memory unit 55, and the receiving device 15 can have a reading device 35 and/or a reading/writing device 35 for reading or reading/writing to the memory unit 55.

An energy storage device 33 for supplying energy to the pivoting device 10 and a display device 23 for displaying information available on the pivoting device 10 are arranged on the functional arm 13. Such information can be, for example, the data or information read from the memory

unit 55, data or information detected by means of the sensors 34 and 44 and/or data or information provided in some other way, for example by means of the control device 43.

Fig. 2 shows a schematic representation of the exemplary embodiment of a pivoting device 10 according to the invention with a component 11 from Fig. 1 arranged thereon in a storage position.

In the storage position, the component 11 is or can be placed and/or is or can be received by means of the pivoting device 10, for example on a transport or maintenance device 50. In this storage position, the component 11, in comparison with the representation in Fig. 1, is pivoted 90° in space and the receiving axis A and the component axis K of the component 11 are thus aligned vertically. The receiving device 14 is moved along the leveling axis N as a function of the center of gravity of the component 11 or the change in position of the center of gravity of the component 11 in space caused by the rotation about the pivot axis S, in order to align the leveling axis N in the horizontal and thus to level the pivoting device 10 and the component 11. Within the scope of the disclosure, the center of gravity of the component 11 is understood to be the center of gravity of the component 11 or the common center of gravity of the component 11 and of the adapter device 21 and/or coupling device 22 arranged thereon. It can be seen in the illustration that the first angle α and the second angle β are unchanged at 45° , with the angle β formed by the receiving axis A and the pivot axis S and thus the receiving axis A and the component axis K being rotated through 90° about the pivot axis S by the rotation through 180° .

Fig. 3 shows a schematic representation of the exemplary embodiment of a system 70 according to the invention for pivoting a component 11, in particular of a flow machine 1.

The system 70 has a pivoting device 10 with a receiving device 15, described here, for example, in connection with Figs. 1 and 2. Also shown is the coupling device 22 which can be connected to the receiving device 15 along the receiving axis A. This coupling device 22 can be configured to be connected directly or indirectly or by means of an adapter device 21 to the component 11. In some exemplary embodiments, not shown, the coupling device 22 can also be constructed in a single piece with the component 11.

The adapter device 21 is designed to be arranged on the component 11 and to be connected thereto, in particular in order to be able to receive the component 11 in an improved manner. In

this case, the coupling device 22 can be arranged on the adapter device 21 or can be formed integrally on or with the latter.

In the exemplary embodiment shown, the coupling device 22 has a readable or readable/writable memory unit 55, and the receiving device 15 of the pivoting device 10 has a reading device 35 or a reading/writing device 35 for reading or reading/writing to the memory unit 55 of the coupling device 22. In some exemplary embodiments, the memory unit 55 can also be arranged on the adapter device 21 or the component 11. In addition, the receiving device 15 can have a closure control 25 for controlling the secure receipt of the coupling device 22 on the receiving device 15.

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Fig. 4 shows a schematic flowchart of an exemplary method 100 according to the invention for moving a component 11 of a flow machine 1 by means of the exemplary pivoting device 11 from Fig. 1 and Fig. 2 during the disassembly of the flow machine 1. In this case, the component 11, which is fastened to the flow machine 1, is brought from an assembly position to a storage position rotated 90° in space.

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In a first step a0, not shown separately, the pivoting device 10 can be arranged on a holding device 20 by means of its suspension device 14. In a further step a, an adapter device 21 can be arranged on the component 11 which is fastened to the flow machine 1 and fastened thereto. In this case, a coupling device 22 can be provided in a single piece on the adapter device 21 or can be arranged on or fastened to the latter. In some exemplary embodiments, the coupling device 22 can also be arranged on or fastened directly to the component 11.

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In a step b, the component 11 to be moved is received on a receiving device 15 of the pivoting device 10 along the receiving axis A. In this case, in a step b1, the coupling device 22 arranged on the component 11 can be connected to the receiving device 15 of the pivoting device 10. In addition, a closure control 25 for controlling the secure receipt of the coupling device 22 on the receiving device 15 can be closed in order, for example, to permit load reception by the pivoting device 10 and/or the holding device 20.

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In a step c, information which is stored in the memory unit 55 arranged on the coupling device 22 can be read, and the pivoting device 10 and/or the holding device 20 can be operated as a function of the information read. According to the invention, operation is understood to mean, in particular, the movement of the suspension device 14 and/or the pivoting of the received

component 11 by means of the receiving device 15 and the application of a holding force to the pivoting device 10 by means of the holding device 20. A reading device 35 and/or a reading/writing device 35 provided on the receiving device 15 can be used for reading, for example. Depending on this information, the suspension device 14 of the pivoting device 10 can
5 be moved in a step f1 along its leveling axis N to level the pivoting device 10 as a function of the center of gravity of the component 11.

In particular, taking into account the read information in a step d, the pivoting device 10 can be acted upon by means of the holding device 20 with a holding force, in particular a predetermined
10 holding force, in order to raise the component 11. This can take place, for example, as a function of the weight of the component 11 or of the total weight of the component 11, adapter device 21 and/or coupling device 22. In a step e, the component 11 can be detached from the flow machine 1. In this case, for example, a fastening device by which the component 11 is fastened to the flow machine 1 or is connected to the latter can be released. By the application of the predetermined
15 holding force to the component 11, the load can be transferred in the fastened state, so that the release of the fastening device can be simplified and any jumping or falling of the component 11 during the release can be avoided.

After the component 11 has been released, it can be moved by means of the holding device 20 in
20 order to provide sufficient space for pivoting the component 11. In a further step g, the received component 11 is rotated 90° in space by the 180° rotation about the pivot axis S. This is made possible in particular by the fact that the pivot axis S forms a first angle α with the leveling axis N and a second angle β with the receiving axis A, which together form 90°. As a result, the component 11 can be brought from the assembly position into the storage position, in which it
25 can be placed, for example, on the transport device 50.

Before, during, and/or after the pivoting in step g, in a step f the suspension device 14 of the pivoting device 10 is moved along its leveling axis N to level the pivoting device 10 as a function of the center of gravity of the component 11, the position of which is changed or can
30 change during the pivoting operation, in order to level the leveling axis N, the component 11 and/or the pivoting device 10. As already mentioned, this can take place in particular as a function of detected and/or read information.

After the component 11 has been placed, the application of force by means of the holding device 20 can be ended and the receiving device 15 can be released from the coupling device 22. In a further step h, the adapter device 21 and/or the coupling device 22 can be separated from the component 11.

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Fig. 5 shows a schematic flowchart of an exemplary method 100 according to the invention for moving a component 11, in particular of a flow machine 1, by means of the exemplary pivoting device 11 from Fig. 1 and Fig. 2 for carrying out an assembly of the flow machine 1.

10 The exemplary embodiment described below is essentially similar to the exemplary embodiment illustrated in Fig. 4, in which case, in principle, the reverse sequence of the pivoting movement, in particular from the storage position into the assembly position, is carried out for the assembly of the component 11 on the flow machine 1. In the following, only the differences in comparison with the method shown in Fig. 4 will be discussed, whereby the effects and advantages already
15 shown can also be present here.

In a step a, the adapter device 21 can be arranged on the component 11 provided, for example, on the transport device 50 and can be fastened to the latter. In a step b, the component 11 to be moved is received on the receiving device 15 of the pivoting device 10.

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The steps b1, f1, c and d can be carried out optionally and/or in a different sequence within the scope of step b in a manner similar to the procedure described above, the component 11 being raised by the application of the predetermined holding force in step d. Even before the lifting of the component 11, the pivoting device can be leveled in step f1 by moving the suspension device
25 14 of the pivoting device 10 along its leveling axis N. This takes place in particular as a function of information detected and/or read in step c.

In step g, the received component 11 is rotated or pivoted 90° about the pivot axis S by a 180° rotation. Here too, in particular before, during and/or after pivoting, in step f the suspension
30 device 14 of the pivoting device 10 is moved along its leveling axis N in order to level the pivoting device 10 as a function of the center of gravity of the component 11. As a result, the component 11 can be brought from the storage position into the assembly position, in which it can be positioned relative to the flow machine 1 in order to be arranged on or fastened to the latter.

After the component 11 has been fastened to the flow machine 1, the application of force by means of the holding device 20 can be ended and, in a step h, the pivoting device 10 can be released from the component 11, in particular by releasing the receiving device 15 from the
5 coupling device 22. In a further step, the adapter device 21 and/or the coupling device 22 can then be separated from the component 11.

LIST OF REFERENCE SYMBOLS

	1	flow machine
5	10	pivoting device
	11	component
	12	leveling arm
	13	functional arm
	14	suspension device
10	15	receiving device
	20	holding device
	21	adapter device
	22	coupling device
	23	display device
15	24	eye
	25	closure control
	33	energy storage device
	34	weight sensor
	35	reading device, reading/writing device, interface
20	43	control device
	44	leveling sensor
	50	transport or maintenance device
	55	memory unit
	100	procedure
25		
	a - h	steps
	A	receiving axis
	K	component axis
	S	pivot axis
30	N	leveling axis
	α	angle between pivot axis and leveling axis
	β	angle between pivot axis and receiving axis

CLAIMS

1. Pivoting device (10) for a component (11), in particular of a flow machine (1), having a suspension device (14), which can be moved along a leveling axis (N), for arranging the pivoting device (10) on a holding device (20), and a receiving device (15), which can be rotated about a pivoting axis (S) and can be connected to the component (11) along a receiving axis (A), wherein the pivoting axis (S) forms a first angle (α) with the leveling axis (N) and the pivoting axis (S) forms a second angle (β) with the receiving axis (A), and wherein the suspension device (14) can be moved along the leveling axis (N) as a function of a center of gravity of the component (11), which can be connected to the receiving device (15).
2. The pivoting device (10) according to claim 1, wherein a sum of the first angle (α) and the second angle (β) is 90° .
3. A pivoting device (10) according to at least one of the preceding claims, wherein the first angle (α) and the second angle (β) are each 45° .
4. A pivoting device (10) according to at least one of the preceding claims, wherein the pivoting device (10) has a weight sensor (34) for detecting the weight received at the receiving device (15).
5. A pivoting device (10) according to at least one of the preceding claims, wherein the pivoting device (10) includes a leveling sensor (44) for horizontally aligning the leveling axis.
6. A pivoting device (10) according to at least one of the preceding claims, wherein the receiving device (15) has a reading device (35) and/or a reading/writing device (35) for data transmission.
7. A pivoting device (10) according to at least one of the preceding claims, including a control device (43) which is set up to control the rotation of the receiving device (15)

about the pivoting axis (S) and a linear movement of the suspension device (14) along the leveling axis (N).

- 5 8. A pivoting device (10) according to at least one of the preceding claims, wherein the pivoting device (10) has an energy storage device (33) for operating the pivoting device (10).
9. A pivoting device (10) according to at least one of the preceding claims, wherein the pivoting device (10) includes a display device (23) for displaying information available
10 on the pivoting device (10).
10. System (70) for pivoting a component (11), in particular of a flow machine (1), having a pivoting device (10) according to at least one of the preceding claims with a receiving device (15) and a coupling device (22) which can be connected to the receiving device
15 (15), wherein the coupling device (22) can be connected to the component (11).
11. A system (70) according to claim 10, wherein the system includes adapter device (21) that can be arranged on the component (11) and on which the coupling device (22) is arranged or formed.
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12. System (70) according to at least one of claims 10 or 11, wherein the coupling device (22) or the adapter device (21) has a readable or readable/writable memory unit (55), and the pivoting device (10) has, in particular on the receiving device (15), a reading device (35) and/or a reading/writing device (35) for reading or reading and writing to the
25 memory unit (35) of the coupling device (22) or the adapter device (21).
13. A system (70) according to at least one of claims 10 to 12, wherein the receiving device (15) includes a closure control (25) for controlling the secure attachment of the coupling device (22) on the receiving device (15).
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14. A method (100) for moving a component, in particular of a flow machine, by means of a pivoting device (10), having the following steps:
 - b) Attaching the component (11) to be moved on the receiving device (15) of the pivoting device (10) along the receiving axis (A),

- f) Moving a suspension device (14) of the pivoting device (10) along a leveling axis (N) for horizontally aligning the leveling axis of the pivoting device (10) as a function of the center of gravity of the component (11),
- g) Pivoting the received component (11) about the pivot axis (S) of the receiving device (15), which forms a first angle (α) with the leveling axis (N) and a second angle (β) with the receiving axis (A).
15. The method (100) according to claim 14, wherein the sum of the first angle (α) and the second angle (β) is 90° .
16. The method (100) according to at least one of claims 14 or 15, wherein the component (11) is pivoted about the pivot axis through an angle of 90° in space.
17. The method (100) according to at least one of claims 14 to 16, wherein in step b) the coupling device (22) connected to the component (11) is connected to the receiving device (15) of the pivoting device (10).
18. The method (100) of at least one of claims 14 to 17, including the further step:
(a) Arranging the adapter device (21) on the component (11), whereby the coupling device (22) is arranged or will be arranged on the adapter device (21).
19. The method (100) of at least one of claims 14 to 18, including the further step of:
c) Reading stored information from the memory unit (55) arranged on the coupling device (22) or adapter device (21), whereby the pivoting device (10) is operated according to the information read.
20. The method (100) of at least one of claims 14 to 19, including the further steps of:
d) Applying a predetermined holding force to the pivoting device (10), and
e) Detaching the component (11) in particular from the flow machine (1).