Valve device for selectively opening and closing conduits in a flow battery, and flow battery with a valve device

Technical Field

The present invention relates to a valve device for selectively opening and closing conduits in a flow battery, such as a liquid flow battery, a semi-solid flow battery, or a solid flow battery; it further relates to a flow battery, such as a liquid battery (e.g., a redox flow battery), a semi-solid flow battery, or a solid flow battery, comprising such a valve device.

State of the Art

Liquid flow batteries (also known as "all-liquid" flow batteries) store electrical energy in liquid electrolytes, a positive electrolyte (anolyte) and a negative electrolyte (catholyte). More specifically, the reactants are present in dissolved form in a solvent. For the sake of simplicity, the solvents, which serve as energy carriers and each contain at least one reactant in dissolved form, are referred to in this document as "liquid electrolytes." The two energy-storing electrolytes are each stored in a tank and circulate in two separate hydraulic flow circuits between their respective tanks and, in each case, a chamber of a galvanic cell connected to the tank via a conduit. Ion exchange takes place across a membrane within the galvanic cell. In the galvanic cell, the dissolved substances are chemically reduced or oxidized, releasing electrical energy that can be tapped via current collectors connected to the electrodes or electrode stacks arranged in the galvanic cell.

An example of a liquid battery can be found in EP 3 580 802 A1.

Semi-solid flow batteries or solid-flow batteries are constructed similarly to liquid flow batteries. In solid-flow batteries, however, the energy is stored in a solid, as in a solid-state battery. As in a liquid flow battery, the energy is transported to the solid via a liquid electrolyte, more specifically, via a fluid that serves as an energy carrier. In one design, energy-storing solid particles may be present as a suspension in the fluid that serves as the energy carrier. The solid particles are transported by the fluid from the tank to the galvanic cell. For simplicity, these suspensions are also referred to as "liquid electrolytes" in this document. Examples of this type

include solid-dispersion-flow batteries. In another design, the energy-storing solids are stationary within the energy storage tanks. To transfer the energy to the galvanic cell, materials are dissolved in the fluids acting as energy carriers, whereby electrochemical reactions take place between the dissolved materials. These fluids are also referred to as "liquid electrolytes." The materials dissolved in the liquid electrolyte are also called "targeting materials." The solids in the tanks can, for example, be chemically oxidized or reduced. Since the solids remain in the tanks, only the liquid electrolyte is pumped. Semi-solid flow batteries are a hybrid of liquid flow batteries and solid flow batteries, in which one liquid electrolyte is configured like that of a liquid flow battery and the other liquid electrolyte is configured like that of a solid flow battery.

To ensure safe and long-lasting operation of the flow battery, on the one hand, the hydraulic circuit between the tank and the chamber connected to it, more specifically, the electrode stack located in the chamber, must be interrupted. This minimizes self-discharge, for example. On the other hand, it must be possible to vary the flow rate through the tank and a bypass connected in parallel. This is achieved by providing a valve between the tank and the chamber.

In conventional flow batteries according to the prior art, a valve, such as a ball valve, is currently used for each electrolyte to interrupt the hydraulic circuit between the tank and the chamber. Each valve can be controlled separately via its own motor.

Description of the Invention

Based on the known prior art, it is an objective of the present invention to provide an improved valve device for selectively opening and closing conduits in a flow battery, such as a liquid flow battery, for example, a redox flow battery, a semi-solid flow battery, or a solid flow battery, as well as an improved flow battery, such as a liquid battery, a redox flow battery, a semi-solid flow battery, or a solid flow battery.

The problem is solved by a valve device for selectively opening and closing two conduits in a flow battery, for example a liquid battery such as a redox flow battery, or a semi-solid flow battery or a solid flow battery, having the features of claim 1. Advantageous embodiments are described in the subclaims, the description, and the figures. In one embodiment, the flow battery relates to a liquid battery, in particular a redox flow battery. In another embodiment, the flow battery relates to a semi-solid flow battery. In a further embodiment, the flow battery relates to a solid-state flow battery.

Accordingly, a valve device for selectively opening and closing two conduits in a flow battery, such as a liquid flow battery, for example, a redox flow battery, or a semi-solid flow battery or solid flow battery, is proposed, comprising two valves, each of which is configured to selectively open and close an electrolyte-carrying conduit.

The valve device comprises a common drive for controlling the valve position of both valves, which is coupled to both valves.

In other words, a valve device is proposed in which the valve positions of two valves can be controlled by a single drive. Thus, using only one drive, the separately circulating hydraulic circuits of the electrolytes, which are each supplied via an electrolyte-carrying conduit, can be shut off and reopened.

Compared to conventional valve arrangements in the prior art with two separate valves, there is no need for the double effort involved in controlling and wiring two motors, nor is it necessary to provide two motors at all. With the proposed solution, it is sufficient to provide a single control system, a single set of wiring, and just the one drive. Accordingly, the proposed valve device offers space-saving advantages over conventional valve arrangements. Furthermore, it has a simpler design.

According to one embodiment, exactly one drive may be provided to control the valve position of both valves.

According to one embodiment, a gearbox may be arranged between the drive and the valves. This allows for a gear ratio, preferably a reduction ratio, between the drive, more specifically a drive shaft and the valves, more specifically an output shaft of the gearbox leading to the valves. Accordingly, one or more output shafts may be provided that provide a connection to the valves. This contrasts with conventional solutions in which, for example, a drive gear is directly coupled to a gear of an drive of the respective valve.

According to one embodiment, the gearbox and the drive may be configured as a gearmotor.

According to one embodiment, the valve device 1 may be configured to position the valves between a closed position and an open position and, optionally, in at least one predetermined intermediate position lying between the two aforementioned positions, wherein the valve

device is optionally configured to adjust the valves continuously or in steps between the closed position and the open position.

According to one embodiment, the gearbox may comprise exactly one output shaft, more specifically a continuous output shaft, that is coupled to both valves, for example, to one valve body of each valve. Preferably, the valves are arranged on opposite sides relative to the output shaft. This enables a particularly compact design; in this configuration, the valves are spaced apart from one another in the longitudinal direction of the output shaft, and the valve bodies and the output shaft extend, for example, in different principal directions. This supports advantageous flexibility with regard to the fluid connection of the valves. This contrasts with conventional solutions in which, for example, a drive gear is aligned in the same plane as a gear of a valve body and is directly coupled to the valve body.

According to one embodiment, the valves may each comprise a valve body that is, for example, configured as a rotary piston.

In one embodiment, the valves may be arranged on opposite sides relative to the drive and/or the gearbox.

According to one embodiment, at least one sensor assembly for detecting the valve position of a valve body of at least one of the valves may be provided.

The sensor assembly may optionally be configured as an angle sensor, for example, an optical angle sensor.

According to one embodiment, the gearbox may be configured as a self-locking gearbox and/or a worm gear, wherein, optionally, a drive shaft is configured as a worm.

According to one embodiment, at least one coupling unit may be provided, by means of which the drive can be selectively coupled to both valves, optionally coupled to only one of the valves, or decoupled from both valves. The coupling unit preferably allows the drive to be coupled to only one of the valves, thereby facilitating separate adjustment of one of the valves. In this way, for example, a flow rate can be adjusted for a single electrolyte circuit. Preferably, the coupling unit may additionally allow the drive to be coupled to both valves, thereby facilitating the adjustment of both electrolyte circuits; advantageously, the adjustment is the same for each circuit.

Each valve may advantageously be configured as a double-valve assembly, each comprising two sub-valves. The valve device may accordingly comprise two double-valve assemblies, each of which comprises two sub-valves. The sub-valves of each double-valve assembly are controlled by a common drive of the respective double-valve assembly to enable the valve position of both sub-valves.

In other words, a double-valve assembly may be provided for each electrolyte conduit; the dual-valve assembly can provide two parallel fluid circuits. For example, one sub-valve of the respective double-valve assembly can provide a fluid connection between a tank and a chamber of a galvanic cell, while the other sub-valve can provide a bypass for the tank and, in particular, a (direct) connection between the chamber's outlet and the inlet. In this way, flexible flow control can advantageously be achieved, such that, for example, a flow of the electrolyte can be routed through the tank only partially, for instance, from 40% to 90% of the total flow, or the flow can be routed entirely through the tank.

Preferably, the sub-valves of each double-valve assembly are firmly connected to one another and/or adjustable exclusively in relation to one another. The sub-valves can preferably be adjusted continuously. Adjusting the sub-valves in relation to one another ensures that a substantially constant flow rate can be maintained, with the sub-valves collectively providing a predetermined total flow rate. For example, opening a sub-valve or increasing its opening angle may be accompanied by a corresponding reduction in the opening angle of the other sub-valve. Compared to a configuration in which the valves or sub-valves are adjustable independently of one another, for example, when the valves are mechanically separated, a variable flow rate can be avoided. Preferably, the sub-valves are firmly connected or coupled to one another by means of an output shaft.

The valves or sub-valves may, in particular, be designed as ball valves. In addition to a particularly compact design, this also enables rapid opening and closing of the valves with a relatively low risk of leakage.

The above-mentioned problem is further solved by a flow battery, such as a liquid flow battery, for example, a redox flow battery, or a semi-solid flow battery or solid flow battery, having the features of Claim 17. Advantageous embodiments are described in the description and illustrated in the figures.

Accordingly, a flow battery, for example a liquid battery, such as a redox flow battery, or a semi-solid flow battery, or a solid flow battery, is proposed comprising a galvanic cell, a first tank connected via a first conduit to a first chamber of the galvanic cell for storing a first electrolyte, and a second tank connected via a second conduit to a second chamber of the galvanic cell for storing a second electrolyte.

The flow battery further comprises a valve device according to one of the embodiments described in this document.

The description provided regarding the valve device also applies to the flow battery, specifically the liquid battery and, more specifically, the redox flow battery. The flow battery allows the advantages and effects described in connection with the valve device to be achieved in a similar manner. Accordingly, to avoid redundancy, the details regarding the valve device described above will not be repeated here.

In a particularly preferred embodiment, the flow battery includes valves, each of which is configured as a double-valve assembly, as described above. A sub-valve of a respective double-valve assembly may be fluidically connected to the respective conduit downstream of the respective tank. The other sub-valve of the respective double-valve assembly may be fluidically connected to the respective conduit upstream of the respective tank and aligned parallel to the respective tank to guide the respective electrolyte.

As described above, a bypass for the respective tank can thus be provided; in particular, a (direct) connection between the outlet of the chamber and its inlet can also be provided in parallel with the fluid flow through the tank. In this way, it can advantageously be achieved that a volumetric flow of the electrolyte can, for example, be routed only partially through the tank or completely through the tank.

Each double-valve assembly may be configured to provide a constant total flow rate of the respective electrolyte. In other words, the double-valve assembly may advantageously be configured such that a flow rate through the respective tank and a flow rate parallel to the respective tank always provide a predetermined total flow rate.

Brief Description of the Figures

Preferred further embodiments of the invention are explained in more detail in the following description of the figures. The figures show:

Figure 1 shows a schematic view of a flow battery;

Figure 2 shows a schematic side view through a valve device of the flow battery from Figure 1;

Figure 3 A schematic cross-sectional view through the valve device shown in Figure 2;

Figure 4 a schematic view showing another cross-section through the valve device shown in Figure 2;

Figure 5 A schematic perspective side view of a gearbox and a drive for the valve device shown in Figure 2;

Figure 6 a schematic perspective side view of the gearbox and drive of the valve device shown in Figure 5; and

Figure 7 a schematic view of a flow battery in which the valves are configured as double-valve assemblies.

Detailed Description of Embodiments

The following describes several advantageous embodiments with reference to the figures. Identical, similar, or functionally equivalent elements in the various figures are designated by identical reference numerals, and repeated descriptions of these elements are omitted in some cases to avoid redundancy.

Figure 1 shows a schematic view of a flow battery 100. In this case, the flow battery 100 is configured as a liquid flow battery 100. However, it may also be configured analogously as a semi-solid flow battery or a solid-state flow battery. The flow battery 100 comprises two tank units 110, each comprising a tank 113 for storing a liquid electrolyte, which is connected via conduits 111 to a chamber 122 of a galvanic cell 120. A pump 112 can be used to generate a hydraulic flow circuit of flowing electrolyte in each of the tank units 110.

The galvanic cell 120 comprises two chambers 122 that are separated from one another by a membrane 121. Ions can be exchanged between the chambers 122 across the membrane 121.

Each chamber 122 contains an electrode 123, which is connected via a current collector to the corresponding battery terminal 130 of the flow battery 100.

In this case, the tank unit 110 shown on the left in Figure 1 is designed to store and circulate an anolyte, and the tank unit 110 shown on the right in Figure 1 is intended to store and circulate a catholyte.

The flow battery 100 stores electrical energy in the liquid electrolytes. As already described in the technical background, this can be achieved either by having energy carriers present in the liquid electrolytes in dissolved form, by having energy carriers present as solids suspended in the liquid electrolytes, and/or by having solid energy carriers present in a stationary state in the tanks, with energy transfer occurring via targeting materials in the liquid electrolytes. When the electrolytes circulate in the two separate flow circuits, ion exchange takes place between the two electrolytes in the galvanic cell 120 via the membrane 121. In the galvanic cell 120, the dissolved substances are chemically reduced or oxidized, releasing electrical energy that can be tapped via current collectors connected to the electrodes 123 arranged in the galvanic cell 120. The flow battery 100 thus constitutes a redox flow battery 100.

Each of the conduits 111, which each provide a hydraulic circuit between an associated tank 113 and an assigned chamber 122, comprises a valve 2 for selectively opening and closing the conduit 111 and thus for enabling and interrupting the hydraulic circuit between tank 113 and chamber 122.

The valves 2 are currently designed as continuously adjustable 2-2-way valves, but they are not limited to this design. The valve position of the valves 2 can be continuously adjusted between a closed position and an open position. Accordingly, not only is it possible to interrupt the hydraulic circuit in the closed position and to enable or open the hydraulic circuit in the open position, but it is also possible to continuously adjust the flow rate of the fluid, more specifically, the electrolyte, flowing through valve 2. The open position represents a fully open position in which the flow rate, that is the volumetric flow, is at its maximum.

Valves 2 are part of a valve device 1. In addition to the two valves 2, each of which is designed to open and close a conduit 111 that provides a hydraulic circuit between a tank 113 and a

chamber 122 of a galvanic cell 120, the valve device 1 comprises a common drive 3 for controlling the valve position of both valves 2. The drive 3 is coupled to both valves 2.

In other words, the valve device 1 comprises exactly one drive 3 that is coupled to the first valve 2 and the second valve 2.

Optionally, the valve device 1, as shown here, includes a gearbox 4 that provides, or, more precisely, forms the coupling between a drive shaft of the drive 3 (not shown here) and the valves 2, specifically the valve bodies of each valve 2 (also not shown here). The gearbox 4 provides a gear ratio between the drive shaft and the valve bodies of the valves 2. In the present embodiment, the gearbox 4 provides a reduction ratio, in other words, a gear ratio that slows down the speed. Alternatively, the drive shaft of the drive 3 may also be directly coupled to the valve bodies of the valves 2.

Furthermore, the drive 3 may also be designed without a drive shaft.

The drive 3 may be configured as an electric drive 3 or, alternatively, as a hydraulic drive 3 or a pneumatic drive 3.

The gearbox 4 may also be designed as a component of the drive 3. In other words, the drive 3 may be designed as a gearmotor. The gearbox 4 is then integrated into the drive 3 or forms a single structural unit with it.

Accordingly, by providing the valve device 1 in the flow battery 100, it is possible to control both valves 2 with just a single drive 3 and thus, using this single drive 3, to open and close both hydraulic circuits, that is, the circuit of the positive electrolyte (the anolyte) and the circuit of the negative electrolyte (the catholyte) and, due to the optional stepless adjustment capability of the valves 2, to optionally control the flow rate as well. For example, the drive 3 may comprise a steplessly adjustable servomotor or be designed as such.

Alternatively or additionally, the valve device 1 may be configured to position the valves 2 between the closed position and the open position, that is, the fully open position, in at least one predetermined intermediate position. In such a configuration, the drive 3 may, for example, be designed as a stepwise (stepped) adjustable servomotor.

Figure 2 schematically shows a side view of the valve device 1 from Figure 1.

The valve device 1 comprises the drive 3, which may optionally be coupled to the optional gearbox 4, as is the case here. The gearbox 4 comprises a gearbox housing 40. An output shaft of the gearbox 4, not shown here, is coupled on two opposite sides to one valve 2 each, more precisely to a valve body 20 of the valves 2. In other words, the gearbox 4 comprises exactly one output shaft that is coupled to both valves 2. Rotational motion of the drive shaft of the drive 3 is transmitted by the gearbox 4 into rotational motion of the valve bodies 20 about their respective axes of rotation 21.

The valve device 1 comprises a housing 5, which in this case consists of two housing parts 50. The housing parts 50 are arranged on both sides of the gearbox 4 and are each connected to, or in other words, secured to the gearbox housing 40.

In the present embodiment, the housing parts 50 are arranged on opposite sides; however, other arrangements are also possible in principle.

Each housing part 50 provides the hydraulic connection interfaces 51 for the electrolyte-carrying conduits 111 of the hydraulic circuits and serves as a bearing for the valve body 20.

Figure 3 shows a schematic cross-sectional view through the valve device 1 from Figure 2.

The valves 2, more specifically their valve bodies 20, are shown in Figure 3 in the open position, i.e., in the (fully) open position.

The valve bodies 20 are each designed as rotary pistons. However, they are not limited to this type of design.

It can also be seen that an optional support plate 52 may be provided to bear each valve body 20, which, for example, can transfer axial bearing forces of the valve body 20 to an optional adapter plate 53.

The adapter plate 53 may be optionally provided, for example, to accommodate an optional printed circuit board 60. It may optionally transmit forces from the support plate 52 to the respective housing part 50. Furthermore, it may be optionally provided for securing the housing part 50 to the gearbox housing 40.

The valve device 1 further optionally comprises at least one sensor assembly 6 for detecting the valve position of at least one of the valve bodies 20. The sensor assembly 6 is currently designed

as an angle sensor, in this case optionally as an optical angle sensor. In the present embodiment, the sensor assembly 6 comprises a sensor ring 61. According to this optional embodiment, the sensor ring 61 has light-transmissive recesses. The sensor assembly 6 optionally further comprises at least one light barrier 62, or optionally a plurality of light barriers 62, which are optionally arranged at predetermined locations, for example, evenly distributed in the circumferential direction relative to the axis of rotation 22. The at least one light barrier 62 may optionally be arranged on the printed circuit board 60.

Depending on the rotational position of the sensor ring 61, the sensor assembly 6 generates signals that can be processed into angular information by a controller for the sensor assembly 6 (not shown here) or by a controller connected to the sensor assembly 6. From this, the rotational position of the valve body 20 relative to the housing part 50 and thus the valve position of the valve body 20 can be determined. The sensor assembly 6 can therefore be designed as an incremental encoder that detects changes in angle.

Alternatively, the sensor assembly 6 may also be configured differently. For example, it may comprise a Hall element.

Figure 4 shows a sectional view of the valve device 1 from Figure 3, with the valve bodies 20 in the closed position. Consequently, the hydraulic circuit flowing through the conduits 111 and the housing parts 50 is interrupted.

Figure 5 schematically shows a perspective cross-sectional view of a gearmotor 8, as it may be configured as a unit comprising a drive 3 and a gearbox 4 according to Figures 1 through 3. One housing part of the gearbox housing 40 is hidden to allow a view of the interior of the gearbox housing 40.

The gearmotor 8 converts electrical energy into rotational energy. The gearbox 4 used here is a self-locking worm gearbox. The drive shaft 30 of the drive 3 is correspondingly designed as a worm.

The drive shaft 30 is coupled to the output shaft 41 via a plurality of gears 43, each of which provides a gear ratio. The large reduction ratio is achieved through the plurality of gear ratios between the drive shaft 30 and the output shaft 41.

It can also be seen that the solid output shaft 41 comprises, at each of its two ends, a coupling section 42 for coupling to a respective valve body 20. Through the coupling section 42, a rotational movement of the output shaft 41 can be transmitted to the valve body 20 coupled to this coupling section 42.

The worm gear design enables self-locking and a high reduction ratio. The self-locking mechanism ensures that the currently set valve position of the valve bodies 20 is maintained when power is off. Accordingly, relatively low power consumption and reliable operation during a power failure can be achieved. Due to the high reduction ratio, only a relatively low drive torque is required at the drive shaft. Consequently, a relatively small motor can be installed.

According to this embodiment, two rotary pistons (the valve bodies 20) can thus be actuated by means of an electric drive 3 via a worm gear 4. Thus, with just one motor, both hydraulic circuits can be shut off and reopened, and the flow through the valves 2 can be regulated.

According to an optional embodiment, the valve device 1 thus comprises two housing parts 50, two rotary pistons (the valve bodies 20), furthermore, two O-rings 22 that seal the receptacles for the valve bodies 20, two adapter plates 53, one or two support plates 52, a gearmotor 8 (comprising the drive 3 and the gearbox 4 as a single unit), a sensor ring 61, and a printed circuit board 60 including at least one light barrier 62.

Figure 6 shows the gearmotor 8 from Figure 5 with the gearbox housing 40 closed. In this view, one of the coupling sections 42 of the output shaft 41 is once again clearly visible.

Optionally, at least one coupling unit (not shown here) may be provided, by means of which the drive 3 can be selectively coupled either to both valves 2 or to only one of the valves 2, or decoupled from both valves 2. The coupling unit may, for example, be integrated into the gearbox 4.

Figure 7 schematically shows a view of a flow battery 100 in which the valves 2 are configured as double-valve assemblies. In other words, the valve device 1 in this example comprises two double-valve assemblies, each of which comprises two sub-valves 2a. The sub-valves 2a of each double-valve assembly are controlled by a common drive 3 for the respective double-valve assembly to enable a (simultaneous) valve position of both sub-valves 2a.

As shown in Figure 7, the design as a double-valve assembly allows two circuits, arranged in parallel, to be provided for each chamber 122 of the galvanic cell 120. Accordingly, a sub-valve 2a is arranged downstream of the respective tank 110 in fluid communication with the line 111 and upstream of the respective chamber 122 to allow a flow of fluid through the tank 110. The other sub-valve 2a is arranged upstream of the respective tank 110, fluidically connected to the line 111, and downstream of the respective chamber 122. In this way, at least a partial bypass to the respective tank 110 can be provided, and a flow rate can be routed in parallel to the tank 110. This at least partial or complete parallel routing to the respective tank 110 is illustrated by corresponding arrows in Figure 7.

To enable a particularly compact design, the outlet of the respective tank 110 may be arranged parallel to the respective inlet. In other words, the outlet may be located at the same end region of the tank 110 where the inlet is also located. The inlet-side fluid path may, if necessary, open lower into the tank 110 to improve the flow behavior of the incoming and outgoing electrolyte flow, as shown schematically in Figure 7.

The embodiments of the invention described herein are intended to explicitly highlight individual features of the invention. The features described in the individual embodiments may be combined accordingly with the features of one or more other embodiments.

List of Reference Numerals

1	Valve device
2	Valve
2a	Sub-valve
20	Valve body
21	Axis of rotation
3	Drive
30	Drive shaft
4	Gearbox
40	Gearbox housing
41	Output shaft
42	Coupling section
43	Gear
5	Housing
50	Housing part
51	Connection interface
52	Support Plate
53	Adapter plate
6	Sensor assembly
61	Sensor ring
62	Light barrier
8	Gearmotor
100	Flow battery
110	Fuel unit
111	Conduit
112	Pump
113	Tank
120	Galvanic cell
121	Membrane
122	Chamber
123	Electrode
130	Battery terminal

Claims

1. Valve device (1) for selectively opening and closing two conduits (111) in a flow battery (100), such as a liquid flow battery (100), for example a redox flow battery (100), a semi-solid flow battery, or a solid flow battery, comprising two valves (2), each of which is configured to selectively open and close an electrolyte-carrying conduit (111),

   characterized in that

   the valve device (1) comprises a drive (3) that is coupled as a common drive (3) to both valves (2) for controlling the valve position of both valves (2).

2. Valve device (1) according to claim 1, characterized in that exactly one drive (3) is provided for controlling the valve position of both valves (2).

3. Valve device (1) according to claim 1 or 2, characterized in that a gearbox (4) is arranged between the drive (3) and the valves (2).

4. Valve device (1) according to claim 3, characterized in that the gearbox (4) and the drive (3) are designed as a gearmotor (8).

5. Valve device (1) according to one of claims 3 or 4, characterized in that the gearbox (4) is designed as a self-locking gearbox (4) and/or as a worm gearbox, wherein, optionally, a drive shaft (31) is designed as a worm.

6. Valve device (1) according to any one of claims 3 to 5, characterized in that the gearbox (4) comprises exactly one output shaft (41) that is coupled to both valves (2), for example to one valve body (20) of each of the two valves (2).

7. Valve device (1) according to claim 6, characterized in that the valves (2) are arranged on opposite sides relative to the output shaft (41).

8. Valve device (1) according to one of the preceding claims, characterized in that the valve device (1) is configured to position the valves (2) between a closed position and an open position and, optionally, in at least one predetermined intermediate position, wherein

the valve device (1) is optionally configured to adjust the valves (2) continuously or in steps between the closed position and the open position.

9. Valve device (1) according to one of the preceding claims, characterized in that the valves (2) each comprise a valve body (20) that is designed, for example, as a rotary piston.

10. Valve device (1) according to one of the preceding claims, characterized in that the valves are arranged on opposite sides relative to the drive (3) and/or the gearbox (4).

11. A valve device (1) according to one of the preceding claims, characterized in that at least one sensor assembly (6) is provided for detecting the valve position of a valve body (20) of at least one of the valves (2), wherein the sensor assembly (6) is optionally configured as an angle sensor, for example an optical angle sensor.

12. Valve device (1) according to one of the preceding claims, characterized in that at least one coupling unit is provided, by means of which the drive (3) can be selectively coupled to both valves (2), coupled to only one of the valves (2), or decoupled from both valves (2).

13. Valve device (1) according to one of the preceding claims, characterized in that each valve (2) is configured as a double-valve assembly, each comprising two sub-valves (2a).

14. Valve device (1) according to claim 13, characterized in that the sub-valves (2a) of each double-valve assembly are firmly connected to one another and/or are adjustable exclusively in relation to one another.

15. A valve device (1) according to claim 13 or 14, characterized in that the sub-valves (2a) are configured such that an increase in the opening angle of one sub-valve (2a) is accompanied by a corresponding decrease in the opening angle of the other sub-valve (2a).

16. A valve device (1) according to one of the preceding claims, characterized in that each valve (2) is designed as a ball valve.

17. Flow battery (100), such as a liquid flow battery (100), such as a redox flow battery (100), a semi-solid flow battery, or a solid-state flow battery, comprising a galvanic cell (120), a first tank (113) connected via a first conduit (111) to a first chamber (122) of the galvanic cell (120) for storing a first electrolyte, and a second tank (113) connected via a second conduit (111) to a second chamber (122) of the galvanic cell (120) for storing a second electrolyte, and a valve device (1) according to one of the preceding claims.

18. Flow battery (100) according to claim 17, comprising a valve device (1) according to claim 12 or 13, wherein a sub-valve (2a) of a respective double-valve assembly is located downstream of the respective tank (113) is fluidically connected to the respective conduit (111), and wherein the other sub-valve (2a) of the respective double-valve assembly is fluidically connected to the respective conduit (111) upstream of the respective tank (113) and is aligned to guide the respective electrolyte parallel to the respective tank (113).

19. Flow battery (100) according to claim 18, comprising a valve device (1) according to claim 13, wherein each double-valve assembly is configured to provide a constant total volumetric flow of the respective electrolyte.