

Description

Fluid-conducting system with cathodic corrosion protection

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The invention relates to a fluid-conducting system with cathodic corrosion protection, having at least one device conveying and/or influencing a flow rate, in particular a pump and/or armature having at least one connection device, and having at least one device guiding a flow rate, in particular a pipe element, having connection means.

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Fluid-conducting systems of this type having pumps or armatures are widespread and are often used to convey and influence corrosive fluids or media, whereby the inner walls exposed to the fluid or medium sustain damage and parts of the system or of the devices have to be replaced after a certain time.

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In order to protect pumps or armatures against corrosion, it is known for example from KR 100540390 B1 to attach a bolt connecting the casing of an armature to a water pipe to a sacrificial anode.

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Pumps are also known that have sacrificial anodes arranged inside the casing. Examples for this include JP 2002295389 A, JP 2002295390 A or JP 2002242874 A.

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The disadvantage with both variants lies in the fact that recurring maintenance works have to be performed and, in particular with internal sacrificial anodes, the entire system has to be switched off.

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DE 7603732 U discloses a water container in the lower region of which an electric heating element is arranged. A passive anti-corrosion layer made of enamel is formed on the inner wall of the container. Furthermore, electrodes supplied with external current

and providing cathodic corrosion protection are provided, wherein the electrodes can be set to an optimal potential by means of a potentiostat and a reference electrode, and at least one external current
5 anode is arranged in the vicinity of the heating element. An arrangement of this type, however, has proven to be unsuitable for systems having a relatively high flow.

- 10 The object of the invention is to provide a fluid-conducting system or a device conveying or influencing a flow rate, having a cathodic corrosion protection system, in which the above-mentioned disadvantages are overcome, without disturbing the flow rate in the
15 device or a pipe system connected thereto.

The object is achieved in accordance with the invention in that the fluid-conducting system comprises annular anodes, wherein an anode is arranged in each case
20 between a first and a second connection device and/or between a first connection device and a connection means and/or between a second connection device and a connection means, the anodes are electrically connected to a monitoring arrangement by means of lines
25 comprising one or more conductors, and the inner diameter of the anodes is equal to the inner diameter of the device guiding a flow rate and arranged on the respective anode.

- 30 According to the invention, in a further embodiment, the inner diameter of the anodes also corresponds to the inner diameter of the inflow or outflow opening, assigned to the respective anode, of the device conveying or influencing a flow rate. Turbulences
35 and/or flow vortices in the fluid-conducting system are thus prevented.

In a further embodiment one or more threaded bores are provided in the casing, into which bores reference electrodes electrically conductively connected to the casing are screwed. It is thus possible to bring the
5 reference electrodes into contact with the fluid or the flow rate within the casing without said electrodes protruding into the casing or without a dead space forming, i.e. a blind hole-like indentation. At the same time, this opening in the casing can be easily
10 sealed.

The fact that the reference electrodes are arranged relative to one another in such a way that the greatest possible inner surface of the casing can be balanced in
15 terms of the potential enables the system to be reliably operated. A state monitoring of all surfaces within the casing contacted by a medium or fluid is thus reliably ensured.

20 In accordance with a further embodiment, in order to optimize the operation, the monitoring arrangement comprises a control or regulation unit, a first rectifier, a second rectifier and a measuring module.

25 It is proposed in accordance with the invention for an annular and electrically insulating first insulation washer to be arranged between the anode and the first or the second connection device and also for an electrically insulating second insulation washer to be
30 arranged between the anode and the connection means. It is thus possible to compensate for varying distances between the casing of the pump or the armature using insulation washers of different thickness or by using a number of insulation washers.

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In order to ensure reliable insulation protection, bores are provided in accordance with the invention in the first and/or second connection device and in the

connection device of the pipe elements, there being electrically insulating insulation sleeves arranged in said bores. These are preferably inserted into the bores for simple assembly.

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In order to increase the insulation protection, the insulation sleeves at their free end have a collar.

The invention is also achieved by a device conveying or
10 influencing a flow rate, in particular a pump arrangement or armature arrangement for a fluid-conducting system with cathodic corrosion protection.

Exemplary embodiments of the invention are illustrated
15 in the drawing and will be described in greater detail hereinafter. In the drawing

figure 1 shows the side view of a horizontally divided spiral casing pump attached to a pipe system
20 and connected to a control and monitoring device,

figure 2 shows a schematic diagram of a monitoring arrangement,

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figure 3 shows a sectional view of an armature attached to a pipe system, and

figure 4 shows a detailed view of the connection region of the spiral casing pump and of the
30 pipe system in section.

A device 1 conveying a flow rate is illustrated in figure 1, said device being in the form of a
35 horizontally divided spiral casing pump for a fluid-conducting system, wherein the device 1 conveying a flow rate comprises a casing 2 having an inlet connection piece 3 and an inflow opening 4 and an

outlet connection piece 5 having an outflow opening 6. A first connection device 7 is formed at the inflow opening 4 and a second connection device 8 is formed at the outflow opening 6, in each case in the form of a flange. Whereas the first connection device 7 is attached to a connection means 9, for example a connection flange, of a pipe element 10, the second connection device 8 of the device 1 conveying a flow rate is attached to a connection device 11 of a pipe element 12.

An annular first anode 13 formed as an external current anode and insulated with respect to the connection device 7 and the connection means 9 is arranged between the first connection device 7 of the device 1 conveying a flow rate and the connection means 9 of the pipe element 10. An annular second anode 14 formed as an external current anode and insulated with respect to the connection devices 8 and the connection means 11 is arranged between the second connection device 8 of the device 1 conveying a flow rate and the connection means 11 of the pipe element 12. The inner diameter d_A of the anodes 13 and 14, as shown in detail in figure 4, corresponds to the inner diameter d_R of the pipe elements 10 and 12 assigned to the anodes 13 and 14 respectively and corresponds to the inner diameters d_v of the inflow or outflow opening, arranged on the anodes 13 and 14, of the device 1 conveying a flow rate. The anodes 13 and 14 therefore do not protrude into the flow path of the flow rate and also do not form any 'dead spaces', i.e. indentations, for example annular groove-like indentations, in which turbulences may occur. The anodes 13 and 14, which are produced substantially from a titanium alloy, are coated at the region contacting the fluid or the flow rate with a substrate 15, as illustrated in figure 4, formed from a mixture of different metal oxides, for example iridium, tantalum and/or ruthenium.

A threaded bore (not illustrated) is provided on the inlet connection piece 3, there being a first reference electrode 16 screwed into said bore. The outlet connection piece 5 also comprises a threaded bore (not illustrated), into which a second reference electrode 17 is screwed. A third reference electrode 18 is screwed on the upper side of the casing 2 into a further threaded bore (not shown). First, second and third reference electrodes are electrically conductively connected to the casing 2, screwed into the bores. The reference electrodes, which are preferably produced from pure zinc, silver or a silver alloy, come directly into contact with the fluid or flow rate within the casing 2 without protruding into the casing interior or forming a dead space, i.e. a blind hole-like indentation. In the case of the spiral casing pump 1 shown in figure 1, three reference electrodes are preferably used, however the number of reference electrodes can be increased or reduced as necessary, in particular with different casing forms.

The reference electrodes 16, 17 and 18 are preferably arranged relative to one another such that they can balance the greatest possible inner surface of the casing in terms of the potential. In figure 1 a monitoring arrangement 19 is also shown, which for example is accommodated in a switch cabinet. The monitoring arrangement 19 has a control or regulation unit 20, a first rectifier 21, a second rectifier 22 and a measuring module 23, as shown in greater detail in figure 2. A line 24 comprising one or more conductors leads from the first rectifier 21 to the first anode 13. The second rectifier 22 is connected to the second anode 14 via a line 25 comprising one or more conductors. The casing 2 is attached both to the first rectifier 21 and to the second rectifier 22 via a line 26 comprising one or more conductors. The

measuring module 23 is attached to the first reference electrode 16 by means of a line 27 comprising one or more conductors and is connected to the third reference electrode 18 via a line 28 comprising one or more conductors. A line 29 comprising one or more conductors leads to the second reference electrode 17. A line 30 comprising one or more conductors can be guided to further, external input/output devices, measuring and/or monitoring arrangements, or computers (not illustrated).

The monitoring arrangement 19 is also supplied with electrical energy from a conventional AC voltage source via a supply line 31. The monitoring arrangement 19 is preferably additionally attached to an alarm bus line 32.

Figure 3 shows a device 101 influencing a flow rate in the form of an armature, in particular a gate valve, for a fluid-conducting system. The device 101 influencing a flow rate comprises a casing 102 having an inlet connection piece 103 and an inflow opening 104 and an outlet connection piece 105 having an outflow opening 106. A first connection device 107 is formed at the inflow opening 104 and a second connection device 108 is formed at the outflow opening 106, in each case in the form of a flange. The first connection device 107 is attached to a connection means 109 of a pipe element 110, and the second connection device 108 of the device 101 influencing a flow rate is attached to a connection means 111 of a pipe element 112.

An annular first anode 113 insulated with respect to the connection device 107 and the connection means 109 is arranged between the first connection device 107 of the device 101 influencing a flow rate and the connection means 109 of the pipe element 110. An annular second anode 114 insulated with respect to the

connection device 108 and the connection means 111 is arranged between the second connection device 108 of the armature 101 and the connection means 111 of the pipe element 112. The inner diameter d_A of the anodes 113 and 114 corresponds substantially to the inner diameter d_R of the pipe elements 110 and 112 and to the inner diameter d_V of the inflow or outflow opening 104 and 106 respectively. The structure of the anodes corresponds to the structure described with reference to figure 1.

A first reference electrode 116 is screwed into a threaded bore at the inlet connection piece 103. A second reference electrode 117 is screwed into a threaded bore in the outlet connection piece 105. As necessary, a third reference electrode 118 can be screwed into a further threaded bore in the upper part of the casing 102. First, second and third reference electrodes are screwed into the bores and in so doing are electrically conductively connected to the casing 102. The reference electrodes come directly into contact with the fluid inside the casing 2 without protruding into the armature interior or without forming a dead space.

The attachment of the casing 102, the reference electrodes 116, 117 and 118 and of the anodes 113 and 114 to a monitoring unit (not illustrated here) is performed in accordance with the circuit examples shown in figure 1 and figure 2.

Figure 4 shows the detailed illustration of the outlet connection piece 5 of the device 1 conveying a flow rate, with the pipe element 12. The second anode 14 is arranged between the second connection device 8 of the device 1 conveying a flow rate and the connection device 11 of the pipe element 12. An annular and electrically insulating first insulation washer 33 is

arranged between the second anode 14 and the second connection device 8 of the device 1 conveying a flow rate. An annular and electrically insulating second insulation washer 34 is arranged between the second
5 anode 14 and the connection device 11 of the pipe element 12. The inner diameter (not designated in greater detail in the figures) of the insulation washers corresponds to the inner diameters d_a of the anodes and the inner diameters of the inflow or outflow
10 openings of the device 1 conveying a flow rate. Bores 35 are provided in the second connection device 8, and bores 36 are provided in the connection device 11. Electrically insulating insulation sleeves 37 are inserted into the bores 35 and 36. The insulation
15 sleeves can be formed in one or more parts and where appropriate may have at their free end a collar 38, on which a screw head or a screw nut (not illustrated) come into abutment. Electrically insulating separate washers can also be used optionally. This arrangement
20 of external current anode, insulation washers and insulation sleeves is also provided for the inlet connection piece of the device 1 conveying a flow rate and for inlet and outlet connection pieces of the device 101 influencing a flow rate.

25 In the monitoring arrangement 19 shown in figures 1 and 2 the direct current required for the cathodic protection is generated and is guided via the line 24 from the first rectified 21 to the anode 13 and from
30 the second rectifier 22 via the line 25 to the second anode 14. The purpose of the monitoring arrangement 19 lies primarily in balancing the signals sent via the reference electrodes 16, 17 and 18 in terms of the potential within the pump casing with the preset limit
35 values and, where appropriate, in adapting these via the direct current guided across the anodes 13 and 14. This is true equally also for the device 101 influencing a flow rate illustrated in figure 3 and

having the anodes 113 and 114 and the reference electrodes 116, 117 and 118.

List of reference signs

1	device conveying a flow rate	26	line
		27	line
2	pump casing	28	line
3	inlet connection piece	29	line
		30	line
4	inflow opening	31	supply line
5	outlet connection piece	32	alarm bus line
		33	first insulation washer
6	outflow opening		
7	first connection device	34	second insulation washer
8	second connection device	35	bore
		36	bore
9	connection means	37	insulation sleeve
10	pipe element	38	collar
11	connection means	101	device influencing a flow rate
12	pipe element	102	casing
13	first anode	103	inlet connection piece
14	second anode		
15	substrate	104	inflow opening
16	first reference electrode	105	outlet connection piece
17	second reference electrode	106	outflow opening
		107	first connection device
18	third reference electrode		
		108	second connection device
19	monitoring arrangement		
		109	connection device
20	control or regulation unit	110	pipe element
		111	connection device
21	first rectifier	112	pipe element
22	second rectifier	113	first anode
23	measuring module	114	second anode
24	line	115	substrate
25	line		

- 116 first reference
electrode
- 117 second reference
electrode
- 118 third reference
electrode

Claims

Fluid-conducting system with cathodic corrosion protection

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1. A fluid-conducting system with cathodic corrosion protection, having at least one device conveying and/or influencing a flow rate, in particular a pump and/or armature having at least one connection device, and having at least one device guiding a flow rate, in particular a pipe element, having connection means,

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characterized in that

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- the fluid-conducting system comprises annular anodes (13, 14, 113, 114), wherein an anode (13, 14, 113, 114) is arranged in each case between a first (7, 107) and a second connection device (8, 108) and/or between a first connection device (7, 107) and a connection means (9, 109) and/or between a second connection device (8, 108) and a connection means (11, 111), the anodes (13, 14, 113, 114) are electrically connected to a monitoring arrangement (19) by means of lines (24, 25) comprising one or more conductors, and the inner diameter (d_A) of the anodes (13, 14, 113, 114) is equal to the inner diameter (d_R) of the device (10, 12, 110, 112) guiding a flow rate and arranged on the respective anode (13, 14, 113, 114).

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2. The fluid-conducting system as claimed in claim 1, characterized in that the inner diameter (d_A) of the anodes (13, 14, 113, 114) corresponds to the inner diameter (d_V) of the inflow or outflow opening, assigned to the respective anode (13, 14, 113, 114), of the device (1, 101) conveying or influencing a flow rate.

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3. The fluid-conducting system as claimed in claim 1 or 2, characterized in that the device (1, 101) conveying or influencing a flow rate comprises a casing (2, 102), in which one or more threaded bores are provided, into which reference electrodes (16, 17, 18, 116, 117, 118) electrically conductively connected to the casing (2, 102) are screwed.
4. The fluid-conducting system as claimed in claim 3, characterized in that the reference electrodes (16, 17, 18, 116, 117, 118) are arranged relative to one another in such a way that the greatest possible inner surface of the casing (2, 102) can be balanced in terms of the potential.
5. The fluid-conducting system as claimed in one of claims 1 to 4, characterized in that the monitoring arrangement (19) comprises a control or regulation unit (20), a first rectifier (21), a second rectifier (22), and a measuring module (23).
6. The fluid-conducting system as claimed in one of claims 1 to 5, characterized in that an annular and electrically insulating first insulation washer (33) is arranged between the anode (13, 14, 113, 114) and the first or the second connection device (7, 8, 107, 108) and an electrically insulating second insulation washer (34) is arranged between the anode (13, 14, 113, 114) and the connection means (9, 11, 109, 111).
7. The fluid-conducting system as claimed in one of claims 1 to 6, characterized in that bores (35) are provided in the first and second connection

device (7, 8, 107, 108) and bores (36) are provided in the connection means (9, 11, 109, 111), there being electrically insulating insulation sleeves (37) arranged in said bores.

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8. The fluid-conducting system as claimed in claim 7, characterized in that the insulation sleeves (37) at their free end have a collar (38).

10 9. A device conveying or influencing a flow rate, in particular a pump arrangement or armature arrangement for a fluid-conducting system with cathodic corrosion protection as claimed in claim 1.