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(54) Titre : DISPOSITIF D'ELECTROLYSE EQUIPE D'UN CIRCUIT D'EAU D'ALIMENTATION
(54) Title: ELECTROLYSIS DEVICE WITH FEED WATER CIRCUIT

(57) Abrégé/Abstract:
An electrolysis device (7) with a water circuit (6), in which an electrolyser (5), a collection container (1) and at least one pump (2) are arranged, wherein the water is pumped by way of the at least one pump (2) out of the collection container (1) to the electrolyser (5), wherein the water circuit (6) is branched into at least one first branch (8) and into a second branch (9) which is parallel to the first branch (8), wherein the electrolyser (5) is arranged in the first branch (8) and wherein a heat exchanger (3) for cooling the water is arranged in the second branch (9).

Abstract

An electrolysis device (7) with a water circuit (6), in which an electrolyser (5), a collection container (1) and at least one pump (2) are arranged, wherein the water is pumped by way of the at least one pump (2) out of the collection container (1) to the electrolyser (5), wherein the water circuit (6) is branched into at least one first branch (8) and into a second branch (9) which is parallel to the first branch (8), wherein the electrolyser (5) is arranged in the first branch (8) and wherein a heat exchanger (3) for cooling the water is arranged in the second branch (9).

ELECTROLYSIS DEVICE WITH FEED WATER CIRCUIT

Electrolysis devices which use an electrolyser for the electrolytic decomposition of water into hydrogen and oxygen are known from the state of the art. In a water circuit of such an electrolysis device, thereby water from a collection container is fed to the electrolyser by way of a pump. Then hydrogen exits out of the electrolyser at one side and this hydrogen is led away in a targeted manner. An oxygen-water mixture exits at the other side and this is fed again to the connection container, in which a gas-water separation is then effected. All components of the electrolysis device, i.e. the collection container, the pump, a heat exchanger for heat discharge, a filter and the electrolyser or electrolysis stack are installed in series with configurations known from the state of the art, so that a single water flow flows through all these components.

There are different types of electrolysers; amongst others the so-called acid or proton exchange membrane electrolyser (PEM) which comprises a proton-permeable polymer membrane and therefore can only operate with distilled water, since this would otherwise be damaged.

On operation of the electrolysis device, hereby, the pump used for feeding the water to the electrolyser represents a limiting factor, since on account of the distilled water which is used in the circuit and which is extremely aggressive, only pumps lined with plastic instead of stainless steel can be used. These pumps, however, can only be operated with temperatures up to maximal 80 C, which is a problem due to the already above-mentioned series arrangement of the components of the electrolysis device. As already mentioned, with the known configuration the water is pumped around in the circuit. Since the applied centrifugal pumps are difficult to bleed, their position in the water circuit is usefully directly downstream of the collection container for gas-water separation, into which however the water lead away from the electrolyser and greatly heated by this is directly introduced. Thus this construction has the disadvantage that the temperature-sensitive pump is subjected to a very high water temperature.

Also, it is not possible to connect a heat exchanger for cooling the water heated by the electrolyser, directly downstream of this electrolyser, due to the high share of gas bubbles in the water which is led away from the electrolyser. In contrast, the heat exchanger in the configurations known form the state of the art is arranged downstream of the pump, which however in turn leads to the disadvantage that the water fed to the electrolyser is cooled by the heat exchanger, by which means the efficiency of the electrolyser as well as its power reduces.

It is therefore an object of the present invention, to provide an electrolysis device which at least partly avoids these disadvantages.

According to the invention, an electrolysis device with a water circuit (cycle) is provided, in which an electrolyser, a collection container, and at least one pump are arranged, wherein the water is pumped by way of the at least one pump out of the collection container to the electrolyser, wherein the water circuit is branched into at least one first branch and into a second branch which is parallel to the first branch, wherein the electrolyser is arranged in the first branch and wherein a heat exchanger for cooling the water is arranged in the second branch.

The basic concept of the present invention is not to cool the water flow fed to the electrolyser, but to let the cooling be effected in an auxiliary flow. In this manner, on the one hand the maximal temperature permissible for the operation of the pump can be utilised and on the other hand the electrolyser can be fed with water at this temperature, which increases the efficiency. The cooling is effected in the auxiliary flow and therefore has no direct influence on the electrolysis process.

According to a preferred embodiment, the water circuit, downstream of the at least one pump branches into the at least one first branch and the second branch. This circuit arrangement has the advantage that the circulation of the water in both branches can be effected with only one pump.

Advantageously, the first branch comprises a first return, which runs out into the collection container.

Moreover, it is advantageous if the second branch has a second return which runs out into the collection container.

Preferably, the collection container is designed for gas-water separation.

Particularly preferably, the electrolyser is a proton-exchange-membrane electrolyser.

According to a further preferred embodiment, the water of the water circuit in the second branch is pumped out of the collection container to the heat exchanger by way of a further pump.

Moreover, preferably a filter is arranged in the water circuit, in particular in the first branch upstream of the electrolyser.

It is possible on account of the configuration of the electrolysis device according to the invention, to cool the water already before the pump, but simultaneously to supply the electrolyser itself with water having a greater temperature or thus operating it with a higher water temperature, so that the efficiency of the installation can be improved.

The invention is hereinafter described in more detail by way of an embodiment represented in FIG. 1. FIG. 1 is a schematic water circuit diagram of an electrolysis device according to one embodiment of the present disclosure.

Referring to FIG. 1, a water circuit 6 of an electrolysis device 7 according to one embodiment of the invention is represented. A collection container 1 for the gas-water separation, a pump 2, a

heat exchanger 2, a filter 4 and an electrolyser 5 for decomposing water into hydrogen and oxygen are arranged in the water circuit 6. With regard to the electrolyser 5, it is the case of a proton-exchange-membrane electrolyser (PEM) and as a result the water circuit 6 is operated with distilled water.

In contrast to the configurations known from the state of the art, with which the collection container 1, the pump 2, the heat exchanger 3, the filter 4 and the electrolyser 5, as already explained, are installed in series, so that only a single water flow flows through all mentioned components, here the water circuit 6 is branched into a first branch 8 and into a second branch 9 which is parallel to the first branch 8. The branching of the water flow pumped by the pump 2 out of the collection container 1 is thereby effected directly downstream or behind the pump 2, or upstream which is to say in front of the filter 4.

The filter 4 and the electrolyser 5 which brings the heat into the water circuit 6 are arranged in the first branch 8. The heat exchanger 2 for cooling the water is located in the second branch 9.

A first return 10 of the first branch 8 and a second return 11 of the second branch 9 run out into the collection container 1 for gas-water separation, in which the water cooled by the heat exchanger 3 and the water heated by the electrolyser 5 now mix. With this, a lower water temperature in the collection container 1 is achieved, in contrast to the configuration which is known from the state of the art and with which only the water heated by the electrolyser 5 runs back into the collection container 1. It is possible without any problem, to use a pump which is lined with plastic, since the water in this manner is cooled already upstream of the pump 2 which pumps the water out of the collection container 1. However, simultaneously the electrolyser 5 can also be operated at a higher operating temperature due to this configuration, and the efficiency and its performance can be increased by way of this.

According to a further embodiment which is not shown here, it is furthermore possible for the first branch 8 as well as the second branch 9 to be supplied in each case by their own pump. Moreover, according to a yet further embodiment, it is possible to divide the water circuit 6 into more than two branches.

List of reference numerals

1	collection container
2	pump
3	heat exchanger
4	filter
5	electrolyser
6	water circuit
7	electrolysis device
8	first branch
9	second branch
10	first return
11	second return

Claims:

1. An electrolysis device comprising a feed water circuit , a proton-exchange-membrane electrolyser , a collection container , and at least one pump for pumping feed water out of the collection container to the proton-exchange-membrane electrolyser , wherein the feed water circuit is branched into at least one first branch and into a second branch which is parallel to the first branch , wherein the proton-exchange-membrane electrolyser is arranged in the first branch and wherein a heat exchanger for cooling the feed water is arranged in the second branch .

2. The electrolysis device according to claim 1, characterised in that the feed water circuit branches downstream of the at least one pump , into the at least one first branch and the second branch .

3. The electrolysis device according to claim 1 or 2, characterised in that the first branch comprises a first return which runs out into the collection container .

4. The electrolysis device according to any one of the claims 1 to 3, characterised in that the second branch comprises a second return which runs out into the collection container .

5. The electrolysis device according to any one of the claims 1 to 4, characterised in that the collection container is designed for gas-water separation.

6. The electrolysis device according to any one of the claims 1 to 5, characterised in that the second branch comprises a further pump configured for pumping the feed water of the feed water circuit out of the collection container to the heat exchanger .

7. The electrolysis device according to any one of the claims 1 to 6, characterised in that a filter is arranged in the feed water circuit .

8. The electrolysis device according to claim 7, characterized in that the filter is arranged in the first branch upstream of the proton-exchange-membrane electrolyser.

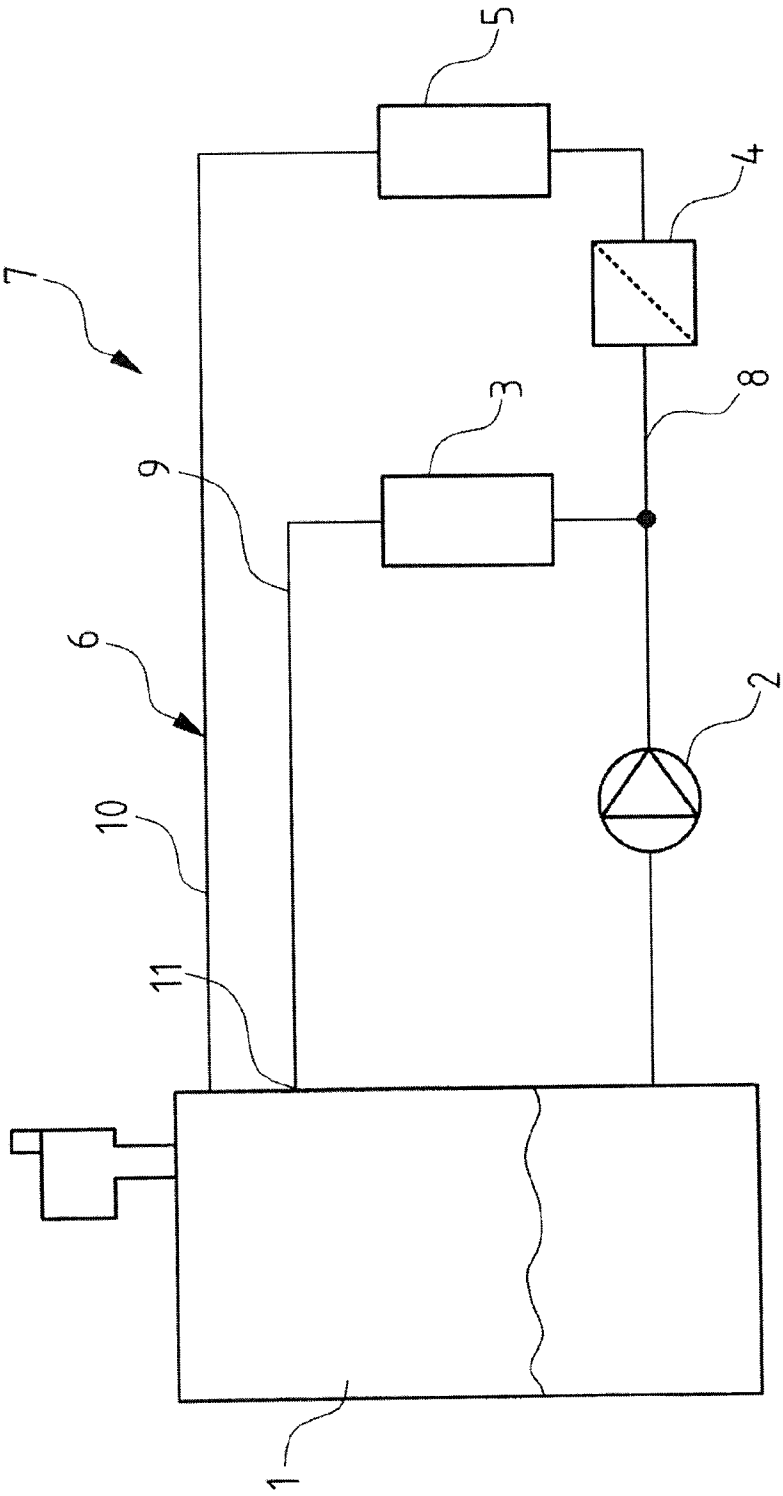

FIG. 1

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