

(19) **DANMARK**

(10) **DK/EP 2683852 T3**



(12)

Oversættelse af europæisk patentskrift

Patent- og
Varemærkestyrelsen

-
- (51) Int.Cl.: **C 25 B 9/20 (2006.01)** **H 01 M 8/02 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2015-08-03**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2015-04-29**
- (86) Europæisk ansøgning nr.: **12713653.9**
- (86) Europæisk indleveringsdag: **2012-03-27**
- (87) Den europæiske ansøgnings publiceringsdag: **2014-01-15**
- (86) International ansøgning nr.: **EP2012055366**
- (87) Internationalt publikationsnr.: **WO2012143211**
- (30) Prioritet: **2011-04-20 DE 102011007759**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **Siemens Aktiengesellschaft, Wittelsbacherplatz 2, 80333 München, Tyskland**
- (72) Opfinder: **HAHN, Alexander, Mühlbergstr. 8, 91341 Röttenbach, Tyskland**
Hertsch, Hagen, Huthausweg 16, 91056 Erlangen, Tyskland
HUBER, Norbert, Taunusstr. 86, 91056 Erlangen, Tyskland
CORDES, Ralf, Sperbersklinge 3a, 91056 Erlangen, Tyskland
DENNERLEIN, Klaus, Anna-Goes-Str. 14, 91058 Erlangen, Tyskland
KÜHN, Carola, Grosshabersdorfer Weg 22, 90449 Nürnberg, Tyskland
- (74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**
- (54) Benævnelse: **Elektrolysecelle med en pladepakke af plader, der er stablet oven på hinanden, med udsparinger og fremgangsmåde til fremstilling og drift af denne**
- (56) Fremdragne publikationer:
EP-A1- 1 742 285
WO-A1-99/67447
DE-A1-102007 029 428
US-A1- 2005 115 825
US-A1- 2010 062 289

Description

The present invention relates to an electrolysis cell comprising at least two bipolar plates, at least one fluid
5 inflow and outflow and at least one laminated core arranged between the at least two bipolar plates, the laminated core being constructed from laminations which are stacked on top of one another and at least two laminations have recesses which are configured to extend through the entire thickness of the
10 respective lamination. The present invention also relates to a method for manufacturing and operating the electrolysis cell.

Electrolysis cells are made of massive parts, for example, titanium plates. The channel systems are introduced into the
15 material by cutting or stamping machining of the massive parts. These channel systems serve for water infeed and gas removal. In order to be able to introduce channels into the massive parts by cutting machining, the parts must have a large thickness in the centimetre range. This results in high
20 material costs and processing costs. Specifically with regard to series production, reduction of the material to be used, the manufacturing effort and the costs is desirable.

It is an object of the present invention to provide an
25 electrolysis cell that is easily manufactured, requires only small amounts of material for production thereof and which therefore save costs. It is a further object of the present invention to provide a method for manufacturing an electrolysis cell of this type and a method for operating the
30 electrolysis cell.

The specified object is achieved, in relation to the electrolysis cell, through the features of claim 1 and, in

relation to the method for the operation of the electrolysis cell, through the features of claim 11 and, in relation to the method for the manufacturing of the electrolysis cell, through the features of claim 14.

5

Advantageous embodiments of the inventive electrolysis cell and of the method for operating the electrolysis cell are disclosed in the respectively associated dependent claims. The features of the additional independent claims can be combined
10 with one another and with the features of a respective associated dependent claim or preferably also with the features of a plurality of associated dependent claims.

The electrolysis cell according to the invention comprises at
15 least two bipolar plates, at least two water inflows and outflows and at least one laminated core, arranged between the at least two bipolar plates. The laminated core is constructed from laminations stacked on top of one another, at least two laminations having recesses which are configured to extend
20 through the entire thickness of the respective lamination. The at least two laminations are arranged on top of one another such that recesses of adjacent laminations partially, but not completely, overlap so that in the direction of the plane of the laminations, continuous channels are formed which are in
25 fluidic contact with the fluid inflow and the fluid outflow. Said laminations can be manufactured easily and economically in a method for manufacturing the electrolysis cell in that the recesses are, for example, stamped out of the laminations. Alternatively, the recesses can be drilled out, milled, etched
30 and/or formed with the aid of a laser. The use of laminations stacked on top of one another with recesses to form channels leads to a saving of material, in contrast to the use of massive parts, into the surface of which the channels are

milled, since the laminations can be manufactured very thin with continuous recesses through the respective lamination.

In a preferred embodiment of the inventive electrolysis cell,
5 the channels are fluidically connected to the fluid inflow and outflow. The fluid inflow and outflow can each comprise connections to the electrolysis cell for an inward or outward flow of fluids. Furthermore, the electrolysis cell can comprise electrical terminals, in particular at the bipolar
10 plates and/or laminations. By means of said terminals, an electrical voltage can be applied to the electrolysis cell in order to achieve electrolysis in the interior. The electrolysis cell can also comprise at least one MEA (Membrane Electrode Assembly) which enables a separation of oxygen and
15 hydrogen.

The electrolysis cell can comprise at least two first laminations which are arranged on top of one another such that recesses in the at least two first laminations overlap
20 partially, but not completely. By this means, continuous first channels are formed in the direction of the plane of the laminations. Said channels can be fluidically connected to a first fluid inflow and outflow. By this means, a first half cell of the electrolysis cell can be or is formed. The
25 electrolysis cell can comprise at least two second laminations which are arranged on top of one another such that recesses in the at least two second laminations overlap partially, but not completely. By this means, continuous second channels are formed in the direction of the plane of the laminations. Said
30 second channels can be fluidically connected to a second fluid inflow and outflow. By this means, a second half cell of the electrolysis cell can be or is formed. An MEA can be arranged between the at least two first laminations and the at least

two second laminations, by means of which MEA a fluidic contact exists between the first and second channels.

In a method for operating the electrolysis cell, a fluid, in particular water, is fed in via a fluid inflow. Said fluid flows into the channels of the at least two laminations and is conducted away from the electrolysis cell, in particular, via a fluid outflow, from the channels of the at least two laminations.

A fluid, in particular water, can be fed via a first fluid inflow, and flow into the channels of the at least two first laminations and can be conducted away from the channels of the at least two first laminations out of the electrolysis cell, in particular via a first fluid outflow. A fluid, in particular water, can be fed via a second fluid inflow, and can flow into the channels of the at least two second laminations and can be conducted away from the channels of the at least two second laminations out of the electrolysis cell, in particular via a second fluid outflow. If the at least two first laminations and the at least two second laminations are separated from one another by an MEA, then on application of a voltage between the at least two first laminations and the at least two second laminations, an electrolytic conversion of water can be carried out.

The voltage can be applied by means of electrical terminals at the bipolar plates and/or at the laminations. Hydrogen is formed in the channels of the at least two first laminations and can be conducted out of the electrolysis cell via the first fluid outflow. Oxygen is formed in the channels of the at least two second laminations and can be conducted out of the electrolysis cell via the second fluid outflow.

Alternatively, depending on the polarity of the voltage applied, hydrogen can be formed in the channels of the at least two second laminations and can be conducted out of the electrolysis cell in particular via the second fluid outflow.

5 In this case, oxygen is formed in the channels of the at least two first laminations and can be conducted out of the electrolysis cell via the first fluid outflow.

The MEA provides for a separation of oxygen and hydrogen in
10 that the bipolar plates and/or laminations act, with a voltage applied thereto, as electrodes. As a result, the conversion of water to oxygen and positively charged hydrogen ions takes place at the anode (positively charged), wherein said hydrogen ions can wander and/or diffuse through the MEA. The conversion
15 of the hydrogen ions to molecular hydrogen takes place at the cathode (negatively charged).

The recesses which form the channels have a Y-form according to the invention. The Y-form can be made up from similar parts
20 each rotated through 120 degrees.

The recesses can result in a regular pattern, which is advantageous in order to form continuous channels from the overlapping recesses. Regular patterns can also be
25 particularly easily generated or manufactured.

The recesses which have the shape of a letter Y and are arranged in adjacent mutually contacting laminations, can be arranged so as to overlap only in the region of the ends of
30 the Y-shape. Each end of a Y-shaped recess in one lamination can be arranged overlapping with one end of a Y-shaped recess of an adjacent lamination.

The laminations can have a thickness in the range from 0.5 mm to 5 mm and the channels can have a width in the range from 2 mm to 10 mm.

5 The laminations can be made of or comprise a metal, in particular, electrically conductive iron, steel, titanium or copper. By this means, the laminations can simultaneously be used, in addition to forming the channels, as electrodes. The laminations can be in electrical contact with one another via
10 regions of direct physical contact. Alternatively or additionally, the laminations can be in electrical contact with the electrical terminals of the electrolysis cell. A good current flow is thus possible via the laminations and, in conjunction therewith, good conversion during the electrolysis
15 at the surface in the channels of the laminations, i.e. effective electrolysis can occur.

The invention is based, in general, on the concept that a particularly good conversion of material is achieved by means
20 of electrolysis in an electrolysis cell with a laminated core using channels having a large internal surface area, wherein the channels can be configured particularly easily, for example, by stamping out a pattern of recesses from a lamination and overlaying, for example, identical laminations
25 on top of one another, particularly pushed against one another. The fluid which is to be converted (e.g. water) and the fluid which is produced by the conversion (e.g. oxygen and hydrogen) flows through relevant regions of the electrolysis cell with the smallest possible loss of pressure. A large
30 surface area in the channels results in improved electron transfer during the electrolysis at the channel surfaces/electrode surfaces. Specific forms of the recesses lead to particularly favourable flow conditions in the cooling

channels with a small space requirement for the channels in the laminations and to a high mechanical stability in the stack of laminations. The result is an even mass flow of fluid, a possibly good cooling effect, a high electrical conductivity, in particular, in the lamination stacking direction (perpendicular to the longitudinal extent of the laminations) and a high level of efficiency in the electrolysis cell.

10 The inventive method for manufacturing the electrolysis cell and the inventive method for operating the electrolysis cell result in the above-mentioned advantages as described above for the electrolysis cell according to the invention.

15 Preferred embodiments of the invention with advantageous developments according to the features of the dependent claims will now be described by reference to the following drawings, without being restricted thereby.

20 In the drawings:

Fig. 1 is a schematic illustration of an electrolysis cell 1 according to the prior art in a lateral section, and

Fig. 2 is a half cell 2 of the electrolysis cell 1 of Fig. 1,
25 and

Fig. 3 is a half cell 2 of the inventive electrolysis cell 1 comprising a laminated core 13 which comprises fluid channels 9, and

Fig. 4 is the laminated core 13 with channels 9 of Fig. 3 in
30 a perspective view in detail, and

Fig. 5 is a plan view of the laminations 11, 12 and the arrangement 13 thereof.

Fig. 1 shows the structure, in principle, as a section along a longitudinal axis, of an electrolysis cell 1 according to the prior art. The electrolysis cell 1 comprises two half cells 2 arranged congruently on top of one another, each comprising a bipolar plate 3. Arranged on the bipolar plate 3 is a current terminal or voltage terminal which hereinafter is designated the electrical terminal 4. When the electrolysis cell is used in a stack, said terminals are replaced with adjoining cells. Furthermore, provided at each half cell 2 is a fluid inflow 5 and a fluid outflow 6. Arranged between the two half cells 2 which are arranged on top of one another is an MEA 7, i.e. a membrane electrode assembly. The side 8 of each half cell 2 which is in direct contact with the MEA 7 is provided with channels 9 which are in fluidic contact with the connection for the fluid inflow 5 and the connection for the fluid outflow 6. The side 8 and the channels 9 are covered by a gas diffusion layer 10 which is in direct contact with the MEA 7. Since the two half cells 2 of an electrolysis cell 1 are constructed to be identical and/or mirror images, hereinafter the same reference signs are used for equivalent elements or parts of the two half cells 2.

Fig. 2 shows a detailed view of a half cell 2 of the electrolysis cell 1 of Fig. 1, as a section along the longitudinal axis. An electrolysis cell 1 consists of two identically constructed half cells 2. Thus, for the sake of simplicity, only one half cell 2 is shown in detail. The channels 9 are machined into the bipolar plate 3 of the half cell 2 at the surface on one side 8 of the massive plate material, for example, by milling. The plate material consists of a good conductor material, such as copper, titanium, steel or iron. An electrical contact 4 is attached directly to the bipolar plate 3 in order to be able to apply an electric

potential to the plate 3 or to be able to pass an electric current via the plate 3.

By means of the connection for the fluid inflow 5 and the
5 connection for the fluid outflow 6, a fluid which flows through the channels 9 can be fed to the half cell 2 and conducted away from the half cell 2. When a positive voltage is applied, the fluid, for example water, is electrolytically converted, that is, oxygen and positively charged hydrogen
10 ions are formed in the channels 9 at the bipolar plate 3. The oxygen can be conducted away via the connection for the fluid outlet 6.

The positively charged hydrogen ions can drift through the gas
15 diffusion layer 10, via the MEA 7 shown in Fig. 1, into the second half cell 2 of the electrolysis cell 1, where with the bipolar plate 3 negatively charged, said ions are converted into molecular hydrogen. The expression drifting is understood to mean diffusion, concentration equalising movements and/or
20 movements of particles caused by electrical fields. The molecular hydrogen is conducted away via the channels 9 of the second half cell 2 and via the connection for the fluid outlet 6.

25 The construction of an electrolysis cell 1 from two half cells 2 as shown in Figs. 1 and 2, each with a massive bipolar plate 3 has the disadvantage that a very large amount of material is required for the bipolar plate 3 and production of the channels 9 in the bipolar plate 3 requires a high degree of
30 effort.

Fig. 3 shows a half cell 2 of an inventive electrolysis cell 1 comprising a laminated core 13 which is constructed from two

laminations 11, 12 stacked on top of one another. The half cell 2 is constructed similarly to that shown in Fig. 2 with the exception of the bipolar plate 3. Rather than introducing the channels 9 in the bipolar plate 3 as depressions, for example, by milling, laminations 11, 12 with recesses 14 are arranged on the bipolar plate 3. The recesses 9 in the laminations 11, 12 are pushed against one another so as to form continuous channels in the longitudinal plane of the laminations (perpendicular to the image plane in Fig. 3). On the laminations 11, 12, a gas diffusion layer 10 is arranged on the channels 9, similarly to the example in Fig. 2.

Fig. 4 shows the arrangement of the laminations 11, 12 with the recesses 14 illustrated in detail in an oblique view. The Y-shaped recesses 14 of the lamination 12 are arranged on the Y-shaped recesses 14 of the lamination 11 such that the recesses 14 of the adjacent laminations 11, 12 each overlap only at the ends of the Y-shapes and thus form channels 9 along the sheet plane. Shown purely schematically are the gas diffusion layer 10 and the bipolar plate 3.

The recesses 14 in one lamination 11 (without considering the second lamination 12) are arranged at regular separations from one another without touching one another. The second lamination 12 is similarly constructed. Adjacent laminations 11 and 12 are arranged with the recesses 14 thereof such that the recesses of the laminations 11 and 12 overlap only in the edge regions thereof. Each end of a Y-shaped recess of a lamination 11 overlaps one end, in particular exactly one end, of a Y-shaped recess of an adjacent lamination 12 and vice versa. Due to the overlapping recesses 14 of adjacent laminations 11 and 12, continuous fluid channels 14 are formed through the laminations 11, 12. The channels 14 thereby formed

enable fluid flows with a minimum pressure drop in the channels 14. The fluid flows in the channels 14 both in the plane of the laminations as well as perpendicularly to the plane of the laminations. The result is that particularly good perfusion of the laminations 11, 12 is possible and, despite a compact construction, a large area is formed in the channels 14 for electrolytic conversion.

For the sake of simplicity, the construction of the laminated core 13 from more than 2 laminations 11, 12 is not shown.

Alternative possibilities exist for the stacking of laminations. The laminations in a laminated core can be arranged such that each end of a recess overlaps, in each case, with exactly one end of a recess of an adjacent lamination. All the laminations have the same pattern of recesses and are pushed against one another. An alternative embodiment is the alternating arrangement of laminations. Recesses of only two adjacent laminations overlap and form cooling channels in each case. In each case, a third lamination is arranged with the recesses thereof so as not to overlap with the recesses of the first two laminations, but rather with a further lamination adjacent to said third lamination.

In another embodiment, each laminated core can be formed from a plurality of laminations which have identical recesses and are stacked completely congruently on top of one another. Adjacent laminated cores, each formed from the plurality of congruent laminations are pushed against one another such that the recesses of adjacent lamination stacks overlap only in the edge region thereof. In this way, with laminations of equal thickness having the same patterns of recesses, if required,

different channel diameters can be created, depending on the number of laminations in a lamination stack.

5 The laminations typically have a thickness in the range from 0.5 mm to 5 mm. The channels therefore typically also have a thickness in the range of 0.5 mm to 5 mm (1 mm to 10 mm at points where recesses overlap) in the direction perpendicular to the plane of the laminations. However, the laminations and channels can also have other sizes, for example, in the region
10 of a few centimetres' thickness.

The width of the recesses, and therefore of the channels, is preferably in the range from 2 mm to 10 mm. However, channel widths in the region of centimetres are also possible.

15

In the laminations and/or laminated cores, in place of regular patterns with Y-recesses of the same size, differently shaped recesses can also be formed.

20 Fig. 5 shows a view of the laminated core 13 of laminations 11 and 12 shown in Fig. 4, having a fluid inflow 15 and a fluid outflow 16 in the form of a broad channel with bores for the connections 5, 6 in the bipolar plate 3. By means of the connection 5, water can be fed to a half cell 2 and flow via
25 the fluid inflow 15 to the channels 9 formed by the recesses 14 and, with a positive potential applied to the half cell 2, can be electrolytically converted to oxygen and negatively charged hydrogen ions. The oxygen and the unconverted water is conducted away from the electrolytic cell 1 via the fluid
30 outflow 16 and the outflow connection 6. The positively charged hydrogen flows via a gas diffusion layer 10 of the half cell 2, via the MEA 7 and the gas diffusion layer 10 of a second half cell 2 into channels of the second half cell 2, is

converted there with a negative potential applied at the second half cell 2 or the laminated core 13 thereof into molecular hydrogen and is conducted via the channels 9 into the fluid outflow 16 and from there, via the connection 6, out of the second half cell 2. The second half cell 2 can also be perfused with water which is fed, via the connection 5 of the second half cell 2 to the fluid inflow 15 of the second half cell 2, into the channels 9, the channels being formed by recesses 14 in a second laminated core 13.

The laminations of the first and second half cell 2 of the electrolysis cell 1 preferably consist of an electrically conductive metal, in particular a steel, iron, copper or titanium. When provided with an electrical contact, the surfaces of the channels or laminations act as electrode surfaces for the electrolysis. However, other pure metals or metal alloys are also suitable.

Patentkrav

1. Elektrolysecelle (1) omfattende mindst to bipolære plader (3), mindst et fluidindløb (15) og fluidafløb (16) samt mindst en pladspakke (13), anbragt mellem de mindst to bipolære plader (3), hvor pladepakken (13) er opbygget af plader (11, 12), der er stablet oven på hinanden, og mindst to plader (11, 12) har udsparinger (14), som er udformet, så de går igennem hele den pågældende plades (11, 12) tykkelse, hvor de mindst to plader (11, 12) er anbragt oven over hinanden på en sådan måde, at udsparinger (14) i plader (11, 12), der grænser op til hinanden, overlapper hinanden delvist, men ikke fuldstændigt, **kendetegnet ved, at** der i pladeplanets retning er udformet gennemgående kanaler (9), som befinder sig i fluidforbindelse med fluidindløbet (15) og fluidafløbet (16), hvor udsparingerne (14) har en Y-form.
2. Elektrolysecelle (1) ifølge krav 1, **kendetegnet ved, at** kanaler (9) er fluidforbundet med fluidindløbet (15) og fluidafløbet (16), og/eller at fluidindløbet (15) og afløbet (16) hver især omfatter tilslutninger (5, 6) på elektrolysecellen (1) for en ind- eller udstrømning af fluid, og/eller at elektrolysecellen (1) omfatter elektriske tilslutninger (4) især på de bipolære plader (3) og eller pladerne (11, 12), og/eller at elektrolysecellen (1) omfatter mindst en MEA (7).
3. Elektrolysecelle (1) ifølge et af de foregående krav, **kendetegnet ved, at** mindst to første plader (11, 12) er anbragt oven over hinanden på en sådan måde, at udsparinger (14) i de mindst to første plader (11, 12) overlapper hinanden delvist, men ikke fuldstændigt, hvorigennem der i pladeplanets retning er udformet gennemgående første kanaler (9), som især er fluidforbundet med et første fluidindløb (15) og afløb (16), og at mindst to andre plader (11, 12) er anbragt oven over hinanden på en sådan måde, at udsparinger (14) i de mindst to andre plader (11, 12) overlapper hinanden delvist, men ikke fuldstændigt, hvorigennem der i pladeplanets retning er udformet gennemgående andre kanaler (9), som især er fluidforbundet med et andet fluidindløb (15) og udløb (16), hvor der mellem de mindst to første plader (11, 12) og de mindst to andre plader (11, 12) er anbragt en MEA (7), via hvilken der er en fluidforbindelse mellem de første og andre kanaler (9).

4. Elektrolysecelle (1) ifølge et af de foregående krav, **kendetegnet ved, at** Y-formen er sammensat af ens dele, der hver især er drejet med 120 grader.
5. Elektrolysecelle (1) ifølge et af de foregående krav, **kendetegnet ved, at** udsparingerne (14) giver et regelmæssigt mønster.
6. Elektrolysecelle (1) ifølge et af kravene 4 eller 5, **kendetegnet ved, at** udsparinger (14), som har form som et Y og er anbragt i plader (11, 12), der grænser op til hinanden og berører hinanden, kun overlapper hinanden i området ved Y-formens ender.
7. Elektrolysecelle (1) ifølge krav 6, **kendetegnet ved, at** hver ende af en udsparing (14) med Y-form af en plade (11, 12) er anbragt overlappet med hver sin ende af en udsparing (14) med Y-form af en tilgrænsende plade (12, 11).
8. Elektrolysecelle (1) ifølge et af de foregående krav, **kendetegnet ved, at** pladerne (11, 12) har en tykkelse på 0,5 til 5 mm, og kanalerne (9) har en bredde på 2 til 10 mm.
9. Elektrolysecelle (1) ifølge et af de foregående krav, **kendetegnet ved, at** pladerne (11, 12) består af et metal, især elektrisk ledende stål, jern, kobber eller titanium, eller omfatter dette.
10. Elektrolysecelle (1) ifølge et af kravene 2 til 9, **kendetegnet ved, at** pladerne (11, 12) befinder sig i elektrisk kontakt med hinanden via områder, hvor de berører hinanden direkte, og/eller at pladerne (11, 12) befinder sig i elektrisk kontakt med de elektriske tilslutninger (4) på elektrolysecellen (1).
11. Fremgangsmåde til drift af en elektrolysecelle (1) ifølge et af de foregående krav, ved hvilken der via et fluidindløb (15) indføres et fluid, især vand, som strømmer ind i kanalerne (9) af de mindst to plader (11, 12) og især via et fluidafløb (16) ledes fra kanalerne (9) af de mindst to plader (11, 12) ud af elektrolysecellen (1).

5 **12.** Fremgangsmåde ifølge krav 11, **kendetegnet ved, at** der via et første fluidindløb (5) indføres et fluid, især vand, som strømmer ind i kanalerne (9) af de mindst to første plader (11, 12) og især via et første fluidafløb (16) ledes fra kanalerne (9) af de mindst to første plader (11, 12) ud af elektrolyse-
10 cellen (1), og at der via et andet fluidindløb (15) indføres et fluid, især vand, som strømmer ind i kanalerne (9) af de mindst to andre plader (11, 12) og især via et andet fluidafløb (16) ledes fra kanalerne (9) af de mindst to andre plader (11, 12) ud af elektrolysecellen (1), hvor de mindst to første plader (11, 12) og de mindst to andre plader (11, 12) adskilles fra hinanden ved
15 hjælp af en MEA (7).

15 **13.** Fremgangsmåde ifølge krav 12, **kendetegnet ved, at** der ved påtrykning af en spænding mellem de mindst to første plader (11, 12) og de mindst to andre plader (11, 12), især via elektriske tilslutninger (4) på de bipolære plader (3) og/eller pladerne (11, 12), sker en elektrolytisk omsætning af vand, hvorved der opstår hydrogen i kanalerne (9) af de mindst to andre plader (11, 12) og især ledes ud af elektrolysecellen (1) via det første fluidafløb (16), og der opstår oxygen i kanalerne (9) af de mindst to andre plader (11, 12) og især ledes ud af elektrolysecellen (1) via det andet fluidafløb (16), eller hvorved der opstår hydrogen i kanalerne (9) af de mindst to andre plader (11, 12) og især ledes ud af elektrolysecellen (1) via det andet fluidafløb (16), og der opstår oxygen i kanalerne (9) af de mindst to første plader (11, 12) og især ledes ud af elektrolysecellen (1) via det første fluidafløb (16).

25 **14.** Fremgangsmåde til fremstilling af en elektrolysecelle (1) ifølge et af kravene 1 til 10, **kendetegnet ved, at** udsparingerne (14) er stanset og/eller boret og/eller fræset og/eller ætset ud af pladerne (11, 12) eller udformes ved hjælp af en laser.

FIG 1

Prior art

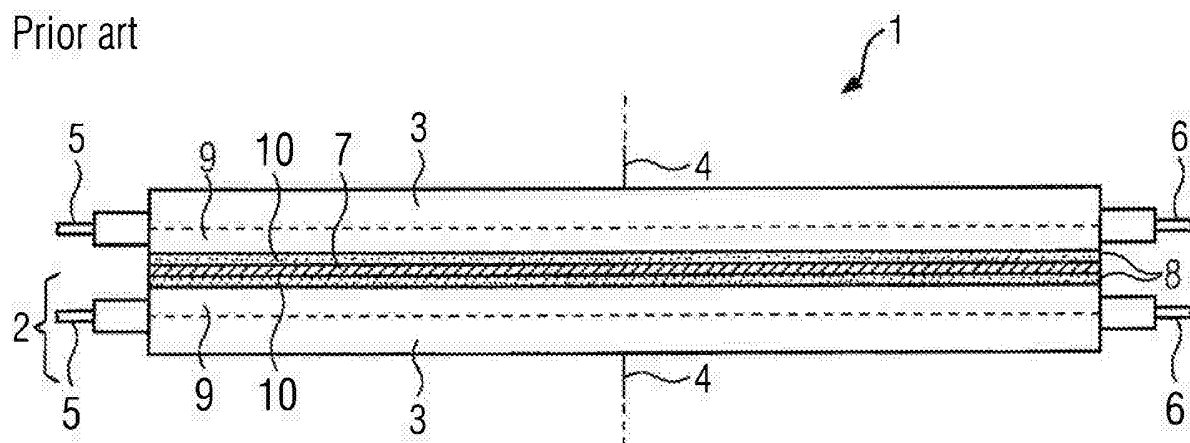


FIG 2

Prior art

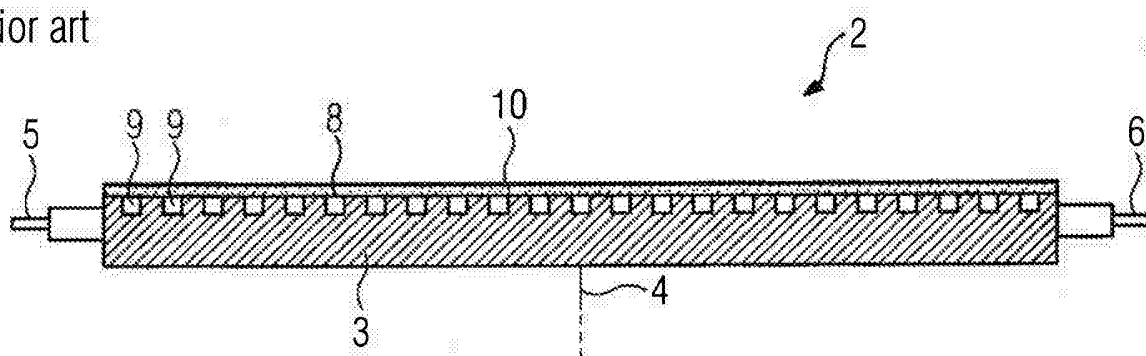


FIG 3

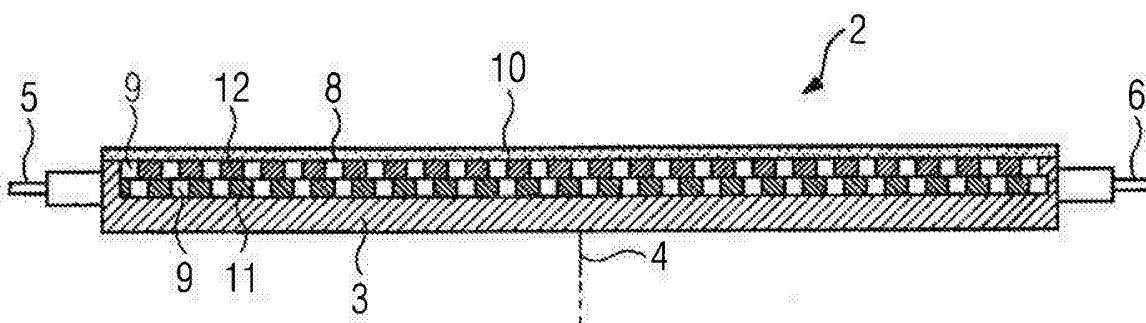


FIG 4

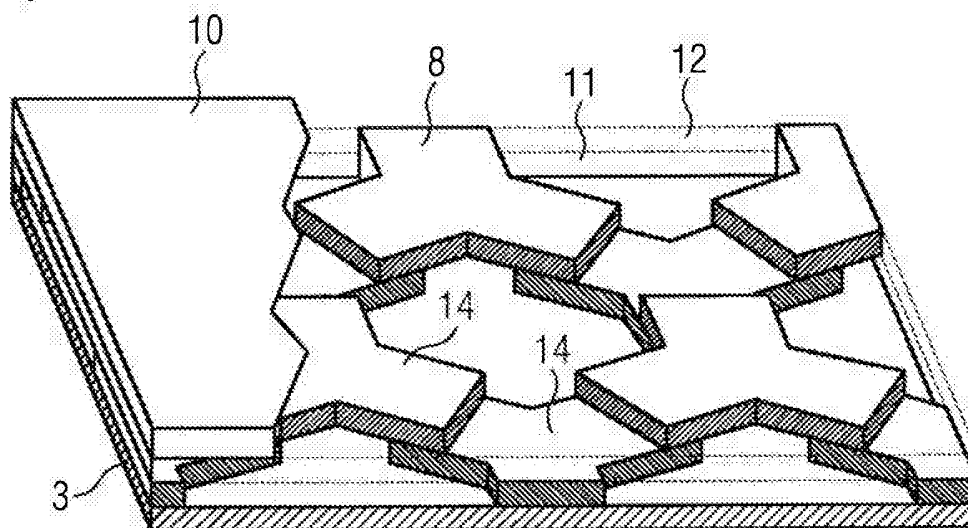


FIG 5

