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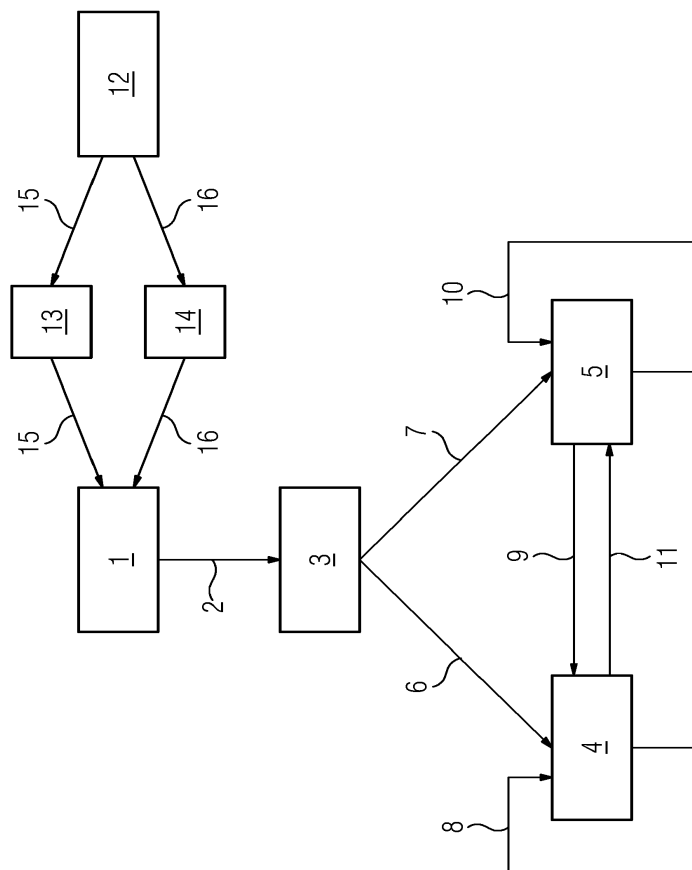
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(54) **METHOD OF PRODUCING A CONCENTRATED HYDROGEN PEROXIDE SOLUTION**

(57) The present invention refers to an optimized production method to provide a concentrated hydrogen peroxide solution being able to be scaled down significantly and efficiently provide hydrogen peroxide for industrial applications on site. Significantly reducing the required effort and manage and transport such hydrogen peroxide

solutions to a desired location requiring such material. Furthermore, the present invention refers to a hydrogen peroxide solution production device being adapted to realize the inventive method. Additionally, the present invention refers to a fiber based material processing facility utilizing the inventive device.



Description

[0001] The present invention refers to an optimized production method to provide a concentrated hydrogen peroxide solution. Furthermore, the present invention refers to a hydrogen peroxide solution production device being adapted to realize the inventive method. Additionally, the present invention refers to a fiber based material processing facility utilizing the inventive device. Furthermore, the present invention refers to a computer program product being adapted to realize the inventive method.

[0002] Hydrogen peroxide solutions are common chemicals utilized in a huge variety throughout our daily life. Also, it is one of the core chemicals required in many processing procedures as utilized in the industry. For example, fiber based material related industries strongly rely on hydrogen peroxide solutions to process the fiber based material. For example, to disinfect such fiber based materials or whiten the material. Avoiding other chemicals like chlorine posing a significant health threat and challenges to be removed completely without setting such chlorine free into the environment.

[0003] While hydrogen peroxide is some very versatile chemical being able to be utilized in many different ways especially transporting it poses some challenge. Beyond a certain percentage the hydrogen peroxide solutions become instable and pose a significant threat based on the possible decomposition of hydrogen peroxide. Yet, transporting huge amounts of hydrogen peroxide solutions especially in cases of low concentration solutions poses a significant challenge too. Additionally, storing the required amounts of hydrogen peroxide solution requires storage facilities being typically not available especially after relying on demand deliveries for many years. Simultaneously, the past years showed the vulnerability of such system. While there are methods available to manufacture hydrogen peroxide solutions on small scale too utilizing electrochemical cells the resulting concentration is too low to be utilized in many applications. While concentrating such solutions requires significant effort and space typically not available. Additionally, controlling such means to concentrate the solution are typically requiring expertise not available to the available operators. Still providing not enough work to fill the schedule of an operator specifically for this purpose. Thus, there is a need to provide an improved method to produce sufficient hydrogen peroxide solutions for corresponding applications to, for example, secure the reliable supply of hydrogen peroxide countering especially the new challenges and to improve the overall process and security.

[0004] This and further problems are solved by the products and methods as disclosed hereafter and in the claims. Further beneficial embodiments are disclosed in the dependent claims and the further description and figures. These benefits can be used to adapt the corresponding solution to specific needs or to solve additional problems.

[0005] According to one aspect the present invention

refers to a method of producing hydrogen peroxide solution, containing the steps of

- producing a hydrogen peroxide solution in an electrochemical cell,
- concentrating a hydrogen peroxide solution in an electrotechnical cell,

wherein in the electrotechnical cell a fluid stream of the hydrogen peroxide solution is directed through an electrical or magnetic field, wherein the fluid stream is split into a hydrogen peroxide enriched part of the fluid stream and a hydrogen peroxide depleted part of the fluid stream.

[0006] It was noted that such method allows to flexibly and reliably provide a desired concentration of hydrogen peroxide solution on site as desired. Simultaneously, the method requires little to no expertise to be monitored. Preventing the necessity to add staff solely for such purpose and being under-worked. Even the limitations of the method to reach high concentrations of hydrogen peroxide solutions like 30wt.-% and higher even poses a benefit for such purpose, as even some malfunction or incorrect operation of a device realizing the inventive method does not result in solutions possibly decomposing a posing a threat to the facility or especially the personal of such facility. Most of corresponding devices can be encapsulated and provided as stand alone system requiring little to no maintenance further decreasing risks associated thereto. All the benefits identified for the inventive method render it well suited to provide a distributed hydrogen peroxide solutions network ensuring a continuous industrial work independent from supply problems and simultaneously providing many benefits rendering the application of hydrogen peroxide even more beneficial than before. Rendering even new application now possible and beneficial.

[0007] According to a further aspect the present invention refers to a Hydrogen peroxide solution production device, wherein the Hydrogen peroxide solution production device is adapted execute the steps of the inventive method. Surprisingly, it becomes possible to realize such complete hydrogen peroxide manufacturing device on a very small scale to reliably and flexibly provide hydrogen peroxide

[0008] According to a further aspect the present invention refers to a fiber based material processing facility containing at least one inventive Hydrogen peroxide solution production device. Fiber based materials represent common materials being utilized since centuries. Herein, corresponding materials like paper changed from a high value item to commodity products being essential elements of modern life. Yet, the need for, for example, bleaching corresponding fiber based materials like in pulp and paper industry or disinfecting such fiber based material like for producing masks and comparable equipment required a reliable source of chemicals like hydro-

gen peroxide solution. While in the past on demand deliveries secured such processes the inventive method allows to, for example, further increase the reliability of supporting the industry with the required chemicals as well as significantly increasing the overall efficiency and even security of the personal utilizing the inventive device. Allowing to easily adapt even existing facilities with very limited effort to constantly avoid, for example, security risks for the future. The term "fiber based material" as used herein preferably refers to a material containing fiber material like cellulose fibers.

[0009] According to a further aspect the present invention refers to a computer program product, tangibly embodied in a machine-readable storage medium, including instructions operable to cause a computing entity to execute an inventive method.

[0010] According to a further aspect the present invention refers to a storage device for providing an inventive computer program product wherein the device stores the computer program product and/or provides the computer program product for further use.

[0011] To simplify understanding of the present invention it is referred to the detailed description hereafter and the figures attached as well as their description. Herein, the figures are to be understood being not limiting the scope of the present invention, but disclosing preferred embodiments explaining the invention further.

[0012] Fig. 1 shows a scheme of an inventive hydrogen peroxide solution production device.

[0013] Preferably, the embodiments hereafter contain, unless specified otherwise, at least one processor and/or data storage unit to implement the inventive method.

[0014] The term "data storage" or comparable terms as used herein, for example, refer to a temporary data storage like RAM (Random Access Memory) or long term data storage like hard drives or data storage units like CDs, DVDs, USB sticks and the like. Such data storage can additionally include or be connected to a processing unit to allow a processing of the data stored on the data storage.

[0015] In the following the invention will be exemplarily refer to pulp manufacturing as example of a fiber based material manufacturing process. It was noted that the application of the invention in such area is especially beneficial. Corresponding pulp processing is, for example, typically utilized to manufacture paper or cardboard products. The inventive method can be very beneficially utilized to provide a flexible, efficient and safe hydrogen peroxide source allowing to significantly improve the efficiency and reliability of, for example, pulp and paper production. Besides the overall increased provision and efficient handling of hydrogen peroxide it, for example, counters increasing risks with regard to delivery problems and the like rendering past kinds of organizing the continuous delivery on demand less and less attractive.

[0016] According to one aspect the present invention refers to a method as described above.

[0017] Like stated above it was noted that the inventive

method is very suitable to be applied to pulp related processing. According to further embodiments it is preferred that the fiber based material is fiber pulp or paper.

[0018] According to further embodiments it is preferred that the fluid stream provides a flow speed of at least 0.7 m/s, more preferred at least 0.8 m/s, even more preferred at least 0.95 m/s. Herein m/s stands for meter per second. It was noted that corresponding flow speeds surprisingly provide an improved separation of the enriched and depleted fraction not fully understood to this point. The flow speed can be measured by the skilled person using commonly available means. For example, magnetic-inductive flow meters can be utilized. Herein, the fluid flows in the pipe and an electrode voltage is induced between a pair of electrodes placed at right angles to the direction of magnetic field. The resulting electrode voltage is directly proportional to the average fluid velocity. Allowing to easily determine the fluid velocity. Naturally, the skilled person is also able to utilize different means known to him to determine this value.

[0019] According to further embodiments it is preferred that the hydrogen peroxide concentration of the hydrogen peroxide enriched part of the fluid stream is at least 7wt.-%, more preferred at least 8wt.-%, even more preferred at least 10wt.-%, based on the total weight of the hydrogen peroxide solution. While it is possible to easily produce lower concentrations too it was noted that providing at least such concentrations is especially beneficial to close a gap for many applications like fiber based material applications. Herein, this aforementioned concentration does not represent the required concentration for the industrial application. The present method allows to easily reach these concentrations, such concentrations can be easily handled by the inventive method and forwarding the accordingly concentrated solutions can easily be arranged by thin pipes easily introduced into available industrial facilities to distribute the hydrogen peroxide solution to the desired location. It was noted that lower concentrated solutions are often less beneficially included in an existing industrial plant based on the quantity of fluid to be handled and changes to existing facilities to be introduced. While such concentrations are easily transported to the desired location, utilized and still being very beneficial compared to transporting high concentrated hydrogen peroxide solutions to the required location. It was noted that such benefit especially contributes to applications like pulp and paper industry being typically confronted with a lack of space to introduce such solution.

[0020] According to further embodiments it is preferred that the hydrogen peroxide concentration of the hydrogen peroxide enriched part of the fluid stream is at most 25wt.-%, more preferred at most 24wt.-%, even more preferred at most 21wt.-%, based on the total weight of the hydrogen peroxide solution. While it is possible to provide higher concentrations the benefit obtained is typically less emphasized in such cases. Additionally, it was noted that these concentrations still allowed to utilize the hydrogen peroxide solutions for the intended purposes,

while simultaneously the requirements with regard to safety are significantly reduced increasing the overall benefit of implementing the inventive method. As the concentration of the hydrogen peroxide solutions required for applications like fiber based industry such as paper pulp industry is lower and the concentrated solutions need to be lowered down the inventive possibility to easily provide lower concentrated solutions for such purpose directly is surprisingly beneficial. Especially, it was noted that many accidents related to watering down corresponding solutions and, thus, can at least be reduced if not completely prevented. It needs to be noted that special care needs to be taken for diluting high concentrated solutions significantly increasing beyond a certain level of concentration. While the requirements for transporting and storing the hydrogen peroxide solutions to this point favored this risk compared to the significantly increased problems of transporting and storing the lower concentrated solutions. Thus, the inventive method allowing to especially efficiently provide such lower concentrated solutions is very efficient to improve the workflow and security in such industrial facilities.

[0021] Especially, it was noted that the combination of the above described lower limits and higher limits are very beneficially. It was noted that utilizing such method allows to implement a hydrogen peroxide network inside an existing industrial facility. The small space required for the distribution network based on the lower limit allows to introduce such network easily. While the higher limit of the hydrogen peroxide solution simplifies diluting the solution according to the specific needs by requiring lower amounts of diluting agent at the corresponding location. Posing a surprising challenge for real life utilization. As well as significantly reducing the risks compared to watering down high concentrated solutions especially in case such step is to be realized by a plurality of persons with limited expert knowledge. Which practically resulted in a significant threat to the health of corresponding workers. Combining such possibility with the inventive method excelling at producing such solutions allows to provide an surprising raise in multiple aspects of the workflow in corresponding industrial facilities.

[0022] According to further embodiments it is preferred that the hydrogen peroxide enriched part of the fluid stream and/or the hydrogen peroxide depleted part of the fluid stream is directed through the same or a further electrotechnical cell. The enrichment of corresponding hydrogen peroxide solutions acquired by the first run through such electrotechnical cell is typically already enough to applications such as fiber processing. However, in case of low power electrotechnical cells, different applications, or intended higher concentrations to, for example, provide some higher enriched hydrogen peroxide solution for storing a reserve it can be preferred to run the solutions multiple times through such electrotechnical cells.

[0023] According to further embodiments it is preferred that the method contains utilizing a first electrotechnical

cell and a second electrotechnical cell,

wherein the method contains the step of directing the fluid stream through the first electrotechnical cell and second electrotechnical cell,

wherein the fluid stream is directed as loop through the first electrotechnical cell and the second electrotechnical cell,

wherein the hydrogen peroxide enriched part of the fluid stream is directed through the first electrotechnical cell and the hydrogen peroxide depleted part of the fluid stream is directed through the second electrotechnical cell, wherein the first electrotechnical cell provides a first hydrogen peroxide enriched part and a first hydrogen peroxide depleted part and wherein the second electrotechnical cell provides a second hydrogen peroxide enriched part and a second hydrogen peroxide depleted part,

wherein the contains the step of creating a loop of enriching the concentration of the hydrogen peroxide utilizing the first electrotechnical cell and the second electrotechnical cell until a predefined hydrogen peroxide concentration is achieved. Herein, the first electrotechnical cell and the second electrotechnical cell can, naturally be the electrotechnical cell providing the first separation of the fluid stream into the hydrogen peroxide enriched part of the fluid stream and the hydrogen peroxide depleted part of the fluid stream. Also, it is possible to direct the fluid stream into both electrotechnical cells (the first electrotechnical cell or the second electrotechnical cell) at the beginning and direct the hydrogen peroxide enriched parts of the fluid stream of both electrotechnical cells into the first technical cell. While the hydrogen peroxide depleted parts of the fluid stream of both electrotechnical cells is directed to the second electrotechnical cell. Typically, it is preferred to utilize the part of the fluid stream depleted of hydrogen peroxide in the end again in the production of hydrogen peroxide in the beginning step.

[0024] According to further embodiments it is preferred that the step of producing the hydrogen peroxide is realized by reacting hydrogen and oxygen in the electrochemical cell. It was noted that such method is, for example, very suited for very small scaled applications to be implemented anywhere on demand.

[0025] According to further embodiments it is preferred that the step of producing the hydrogen peroxide is realized by oxidizing water in the electrochemical cell. Corresponding methods are very suitable to be included in, for example, chemistry related facilities. It was noted that, for example, the expertise at such facilities allows to even allow most service tasks to be executed by the existing personal. Essentially avoiding any third party involvement and providing an independent production.

[0026] According to further embodiments it is preferred that the step of producing the hydrogen peroxide is real-

ized by reacting hydrogen and oxygen in a first electrochemical cell or wherein the step of producing the hydrogen peroxide is realized by oxidizing water in a second electrochemical cell. It was noted that such flexible method allows to provide a significant degree of flexibility and, especially, make use of cheap electricity to fill gas containers with hydrogen and oxygen to be flexibly convert these gases into hydrogen peroxide on demand.

[0027] According to further embodiments it is preferred that the method further contains the step of generating hydrogen and oxygen in an electrolysis cell, wherein the hydrogen and the oxygen are stored in local gas containers, wherein the hydrogen and the oxygen are used in the electrochemical cell in the step of producing manufacturing of hydrogen peroxide. Such flexible solutions were noted to possibly provide an essential backbone in future society by storing overproduction of renewable energies flexibly and produce valuable chemicals on site. Simultaneously even avoiding having to spend fossil fuel or electricity to drive a vehicle transporting hydrogen peroxide solution to such facility.

[0028] According to further embodiments it is preferred that the method contains retrieving data regarding the availability of electricity in an electricity network, wherein dependent on the availability of electricity the electrolysis cell is utilized to generate hydrogen and oxygen. It was noted that utilizing the inventive method allows to reduce an overproduction of electricity within a electricity network to, for example, compensate for overproduction resulting from renewable energy like wind power and photovoltaic. Herein, even a national power grid can benefit from it as a plurality of corresponding devices distributed within the borders can flexibly store such power locally as hydrogen and oxygen to be flexibly converted to hydrogen peroxide for further use. Instead of having to even shut down corresponding renewable energy sources in times of massive overproduction the electricity produced can be, thus, beneficially stored and utilized while the power grid is secured.

[0029] According to further embodiments it is preferred that the concentration of the hydrogen peroxide of the enriched part to fluid stream and/or the concentration of the hydrogen peroxide of the depleted part of the fluid stream are determined using UV light. It was noted that using the fluorescence of hydrogen peroxide in response to UV light allows to very efficiently monitor the increasing or decreasing hydrogen peroxide content of the fluid stream. Allowing to very efficiently control such method and, for example, adapt the flow of the fluid streams or define an end point of a cascade of repeated enriching and depleting the hydrogen peroxide content in a cascade of repeated flows through electrotechnical cells until a satisfying hydrogen peroxide content is achieved.

[0030] According to further embodiments it is preferred that the fluid stream is run repeatedly through at least three, more preferred at least five, even more preferred at least eight, electrotechnical cells simultaneously, wherein different concentrations of hydrogen peroxide

solutions are fed into the electrotechnical cells, and wherein the hydrogen peroxide enriched parts of the fluid stream and the hydrogen peroxide depleted part of the fluid stream from the electrotechnical cells are fed into each other to establish a cascade continuously increasing the hydrogen peroxide concentration of a part of the fluid stream. It was noted that establishing such cascade of interconnected electrotechnical cells allows to continuously increase the hydrogen peroxide concentration in a part of the fluid stream that can be separated after a required and specified concentration has been reached. While a corresponding depleted part of the fluid stream can be disposed of or preferably utilized again got produce new hydrogen peroxide to be fed again into the cascade of the electrotechnical cells.

[0031] According to a further aspect the present invention refers to a hydrogen peroxide solution production device, wherein the hydrogen peroxide solution production device is adapted to execute the steps of the inventive method. Surprisingly, it becomes possible to realize such complete hydrogen peroxide manufacturing device on a very small scale to reliably and flexibly provide hydrogen peroxide

[0032] According to further embodiments it is preferred that the hydrogen peroxide solution production device contains an electrolysis cell adapted to generating hydrogen and oxygen from water using electricity.

[0033] According to a further aspect the present invention refers to a fiber based material processing facility containing at least one inventive hydrogen peroxide production device. It was noted that corresponding facilities not only benefit significantly from the inventive hydrogen peroxide production devices. Corresponding hydrogen peroxide production can be easily implemented in existing types of fiber based material processing facilities. Additionally, there is a huge demand for such solution a well acceptance to solve the current needs by such means.

[0034] According to a further aspect the present invention refers to a computer program product, tangibly embodied in a machine-readable storage medium, including instructions operable to cause a computing entity to execute an inventive method.

[0035] According to a further aspect the present invention refers to a storage device for providing an inventive computer program product wherein the device stores the computer program product and/or provides the computer program product for further use.

[0036] The following detailed description of the figure uses the figure to discuss illustrative embodiments, which are not to be construed as restrictive, along with the features and further advantages thereof.

[0037] Figure 1 shows a scheme of an inventive hydrogen peroxide solution production device. Said hydrogen peroxide solution production device is beneficially utilized in paper pulp industry as example of the fiber based material applications, for example, for bleaching the fiber material without further chemicals. Herein, the electrochemical cell 1 produces the hydrogen peroxide

solution to be processed according to the inventive method. The figure shows an specific example of the inventive hydrogen peroxide solution production device containing an integrated electrolyzer 12 receiving electricity from external sources like especially renewable energy. Utilizing the electricity the electrolyzer 12 generates an oxygen stream 15 and a hydrogen stream 16. These streams are temporarily stored in the oxygen container 13 and the hydrogen container 14 for further use. As required the oxygen and hydrogen are retrieved from the oxygen container 13 and the hydrogen container 14 and utilized by the electrochemical cell 1 to produce hydrogen peroxide being soluted in a watery low concentration hydrogen peroxide solution.

[0038] The resulting hydrogen peroxide solution is forwarded as fluid stream 2 to the electrotechnical cell 3. Within the electrotechnical cell 3 the fluid stream 2 is sped up to a speed of more than 1 m/s and flows through an electrical field leading to an inhomogeneity of the hydrogen peroxide molecules within the fluid stream based on the dipol moment of the molecules. The fluid stream 2 is split into two parts thereafter by passing through a blade like components physically dividing the fluid stream 2 into a hydrogen peroxide enriched part of the fluid stream 6 and a hydrogen peroxide depleted part of the fluid stream 7.

[0039] The hydrogen peroxide enriched part of the fluid stream 6 is forwarded to a first electrotechnical cell 4 being tasked with providing the final concentrated hydrogen peroxide solution in the end. The hydrogen peroxide depleted part of the fluid stream 7 is forwarded to a second hydrogen peroxide enriched part 9 processing the depleted part of the solution.

[0040] The first hydrogen peroxide enriched part 8 originating from the first electrotechnical cell 4 is fed again into the first electrotechnical cell 4 to be enriched again. While the second hydrogen peroxide depleted part 10 of the second electrotechnical cell 5 is fed again into the second electrotechnical cell 5 to be further decreased. To compensate the lost amount of fluid the second hydrogen peroxide enriched part 9 is also fed into the first electrotechnical cell 4 along with the first hydrogen peroxide enriched part 8 for the repeated enrichment step. In turn the first hydrogen peroxide depleted part 11 is fed along the second hydrogen peroxide depleted part 10 to the second electrotechnical cell 5 to repeat the depletion step. By repeating these steps, the hydrogen peroxide concentration easily reaches the required concentrations for subsequent industrial processes with very little energy and effort being required.

[0041] While it is possible to reach quite high concentrations be repeated processes it is typically to be preferred to include additional electrotechnical cells parallel to each other like the first and second electrotechnical cell allowing to provide a cascade of connected fluid streams efficiently increasing the hydrogen peroxide concentration with a low number of cycles through the electrotechnical cells. The hydrogen peroxide concen-

tration in the solution can be easily monitored by UV light resulting in a fluorescence of the hydrogen peroxide being able to be quantified by simple measurement to directly identify the amount of hydrogen peroxide available. Herein, based on the interrelation of such electrotechnical cells it is possible to monitor the whole system with a single sensor. Yet, including multiple sensor and UV lights allows to simplify the system and prevent urgent actions in case in case of a malfunction. Rendering service actions unnecessary being very valuable for, for example, excapsulated systems.

[0042] A corresponding arrangement can naturally also beneficially utilized for other types of electrochemical cells like especially ones that utilize an oxidation of water instead of a direct reaction of hydrogen and oxygen.

[0043] The present invention was only described in further detail for explanatory purposes. However, the invention is not to be understood being limited to these embodiments as they represent embodiments providing benefits to solve specific problems or fulfilling specific needs. The scope of the protection should be understood to be only limited by the claims attached.

Claims

1. Method of producing hydrogen peroxide solution, containing the steps of
 - producing a hydrogen peroxide solution in a electrochemical cell,
 - concentrating a hydrogen peroxide solution in an electrotechnical cell,
 - wherein in the electrotechnical cell a fluid stream of the hydrogen peroxide solution is directed through an electrical or magnetic field,
 - wherein the fluid stream is split into a hydrogen peroxide enriched part of the fluid stream and an hydrogen peroxide depleted part of the fluid stream.
2. Method according to any of the aforementioned claims, wherein the fluid stream provides a flow speed of at least 0.7 m/s.
3. Method according to any of the aforementioned claims, wherein hydrogen peroxide concentration of the hydrogen peroxide enriched part of the fluid stream is at least 7wt.-%, based on the total weight of the hydrogen peroxide solution.
4. Method according to any of the aforementioned claims, wherein hydrogen peroxide concentration of the hydrogen peroxide enriched part of the fluid stream is at most 25%wt.-%, based on the total weight of the hydrogen peroxide solution.
5. Method according to any of the aforementioned

claims, wherein the hydrogen peroxide enriched part of the fluid stream and/or the hydrogen peroxide depleted part of the fluid stream is directed through the same or a further electrotechnical cell.

6. Method according to any of the aforementioned claims, wherein the method contains utilizing a first electrotechnical cell and a second electrotechnical cell,

wherein the method contains the step of directing the fluid stream through the first electrotechnical cell and second electrotechnical cell, wherein the fluid stream is directed as loop through the first electrotechnical cell and the second electrotechnical cell, wherein the hydrogen peroxide enriched part of the fluid stream is directed through the first electrotechnical cell and the hydrogen peroxide depleted part of the fluid stream is directed through the second electrotechnical cell, wherein the first electrotechnical cell provides a first hydrogen peroxide enriched part and a first hydrogen peroxide depleted part and

wherein the second electrotechnical cell provides a second hydrogen peroxide enriched part and a second hydrogen peroxide depleted part, wherein the contains the step of creating a loop of enriching the concentration of the hydrogen peroxide utilizing the first electrotechnical cell and the second electrotechnical cell until a predefined hydrogen peroxide concentration is achieved.

7. Method according to any of the aforementioned claims, wherein the step of producing the hydrogen peroxide is realized by reacting hydrogen and oxygen in the electrochemical cell.

8. Method according to any of the aforementioned claims, wherein the step of producing the hydrogen peroxide is realized by oxidizing water in the electrochemical cell.

9. Method according to any of the aforementioned claims, wherein the step of producing the hydrogen peroxide is realized by reacting hydrogen and oxygen in a first electrochemical cell or wherein the step of producing the hydrogen peroxide is realized by oxidizing water in a second electrochemical cell.

10. Method according to any of the aforementioned claims, wherein the method further contains the step of generating hydrogen and oxygen in an electrolysis cell,

wherein the hydrogen and the oxygen are stored in local gas containers,

wherein the hydrogen and the oxygen are used in the electrochemical cell in the step of producing manufacturing of hydrogen peroxide.

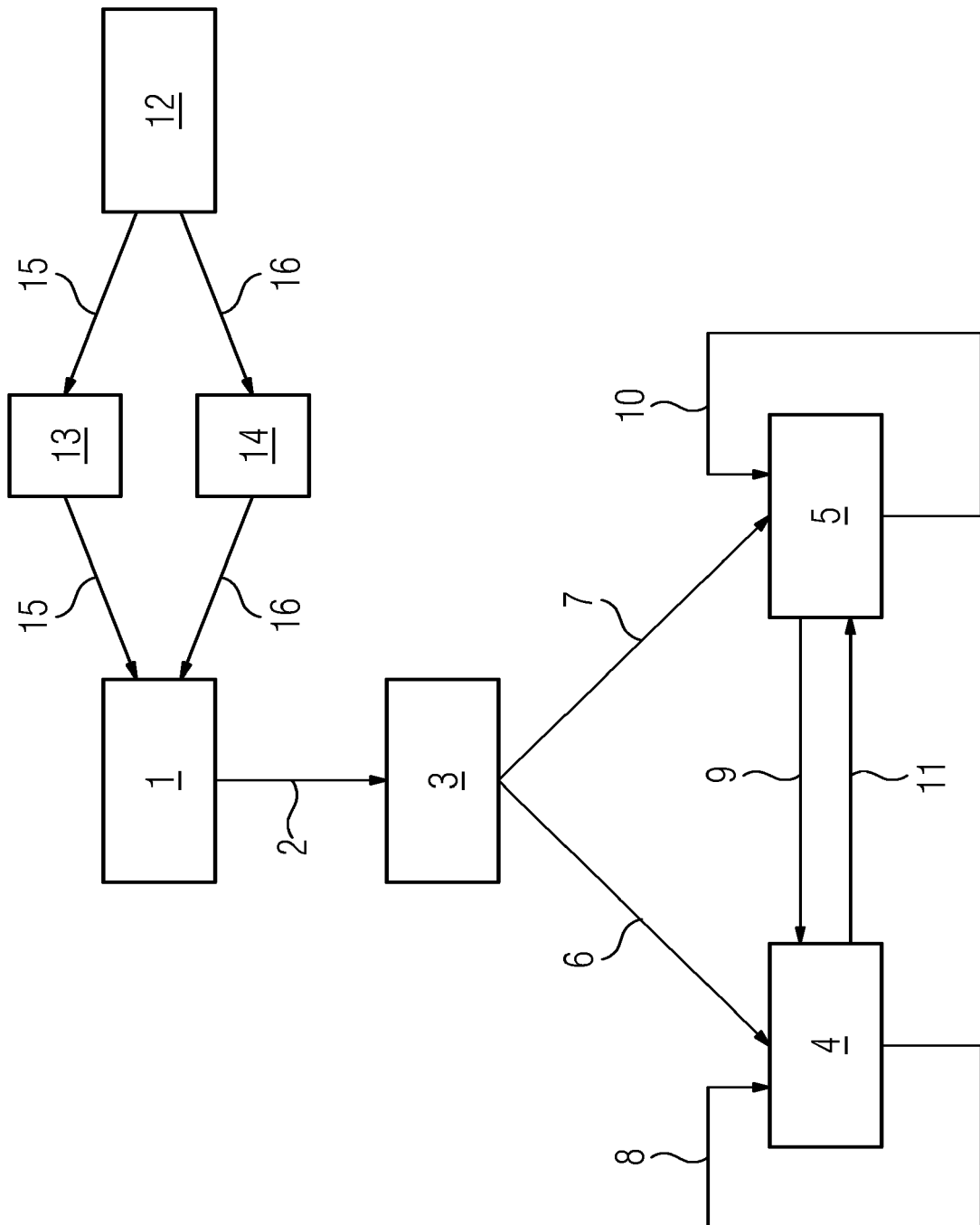
11. Method according to any of the aforementioned claims, wherein the concentration of the hydrogen peroxide of the enriched part to fluid stream and/or the concentration of the hydrogen peroxide of the depleted part of the fluid stream are determined using UV light.

12. Method according to any of the aforementioned claims, wherein the fluid stream is run repeatedly through at least three electrotechnical cells simultaneously, wherein different concentrations of hydrogen peroxide solutions are fed into the electrotechnical cells, and wherein the hydrogen peroxide enriched parts of the fluid stream and the hydrogen peroxide depleted part of the fluid stream from the electrotechnical cells are fed into each other to establish a cascade continuously increasing the hydrogen peroxide concentration of a part of the fluid stream.

13. Hydrogen peroxide solution production device, wherein the hydrogen peroxide solution production device is adapted to execute the steps of the method according to any of claim 1 to 12.

14. Fiber based material processing facility containing at least one hydrogen peroxide production device according to claim 13.

15. Computer program product, tangibly embodied in a machine-readable storage medium, including instructions operable to cause a computing entity to execute a method according to any of claims 1 to 12.





EUROPEAN SEARCH REPORT

Application Number

EP 22 17 4986

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EPO FORM 1503 03.82 (P04C01)

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		13 January 2023	Juhart, Matjaz
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 17 4986

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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