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(54) **Eljárás és készülék folyékony médiumok fizikai hőkezeléséhez**

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# METHOD AND DEVICE FOR PHYSICAL HEAT TREATMENT OF LIQUID MEDIA

## DESCRIPTION

The invention relates to a method and apparatus for the physical heat treatment of liquid media and gases.

Conventional methods and apparatus for heat treatment include heating elements which heat the liquid, preferably water or steam. The heating elements usually consist of heating conductor materials, such as metal or semiconductor ceramics. These heating elements are connected to a power source. Other heating elements consist of heat exchangers which are heated by gas flames and in which water flows. Also known are electro-inductive heating elements, as disclosed, for example, in WO 2004/062320. In this case, a non-contact-dependent heating element is arranged inside the body, and the body is wound with a coil controlled by a frequency source.

These devices require a complicated distribution of the heating medium and the flow and gas connection. The contact surfaces of the heating elements are small, the heat treatment is uneven, and the operation is uneconomical because of the high cost. It is customary for steam to be used for the heat supply to heat a liquid, but this is very complicated and costly. The regulation of the heat treatment process is cumbersome, and the heat treatment speed is low. The gas combustion products, the scrubbing gases and the radiant heat are harmful to the environment. During the heat treatment, crystals are formed in the liquid which must be reduced and chemically removed.

A method and a device for the physical heat treatment of liquid media are known from GB 1,460,143. The method is applied to a medium by means of a system of electrochemical potentials as well as electrochemical RC AC signals. The device comprises a body of insulating material, in the axis or in the vicinity of which an electrode is arranged, while a negative electrode is arranged on the circumference. The body has a first inlet-outlet opening as well as a second inlet-outlet opening.

Starting from the above prior art, the invention is based on the object of providing a solution.

The object is solved by the features of the independent claims.

In any event, it is evident that the invention is implemented through a method and/or a device for the physical heat treatment of liquid media in which the hydrodynamically pretreated medium is analyzed polar and/or ionically by means of a system of electrochemical potentials as well as electrochemical RC AC signals. A single or multiple passage of the medium through the system of electrochemical potentials and electromagnetic RC AC signals is provided.

In this case, it is advantageous if the hydrodynamically pretreated medium is connected to the system of electromagnetic potentials with negative electrochemical potential at the outlet and/or inlet. The flow of the medium through the system of electrochemical potentials and electromagnetic RC AC signals is preferably effected several times. The size of the body with electrochemical potentials and electromagnetic signals is variable and adaptable to the circumstances of the case. Measuring instruments may preferably be connected in the hydraulic circuit (compressed air circuit) of the hydrodynamically pretreated medium in order to monitor the physical and/or chemical changes as well as energy changes for the purpose of continuously measuring the targeted parameters, e.g. flow, temperature, conductivity, viscosity, pH, and the like. The positive electrode may preferably consist of a material with positive electrochemical potential, for example copper, carbon or the like, while the negative electrodes are made of a material with negative electrochemical potential, for example iron, aluminum, or stainless steel or the like. In an alternative embodiment of the invention, a tapered/narrowed positive electrode may be formed as a type of source of ions and/or colloids. This engages in the electrochemical material of the positive electrode, which has an insulating layer of glass and Teflon on its circumference. This tapered electrode is separated from the hydrodynamically pretreated medium by an insulating layer, wherein a part of this electrode is surrounded by the medium.

The electrodes, which form the electrochemical potentials in the body of the alternative implementation, preferably consist of synthetic and natural minerals, ceramics or the like. A hydrodynamic treatment of the medium in the body may preferably be achieved with a tangential inlet and an outlet that is directed against the flow direction, wherein flow resolution is achieved. The advantage of the method and the device are their simplicity. In the sense of the invention, distilled and minerlized water, vegetable rape oil, alcohol, petroleum, synthetic alcohol and propane-butane gas were advantageously used and tested as the hydrodynamically pre-treated medium. In the case of these media, physical changes occurred that were characterized by a temperature rise. During multiple passages of the hydrodynamically pretreated medium through the device according to the invention, an increase in the water temperature from room temperature to 83 °C was observed in about 4000 liters of water. In this experiment, it was observed that the boiler scale present on the walls of the water tank was markedly reduced, wherein this method is also advantageously applicable in the water and heating industry. The new, changed properties of the medium, in particular the water, may also be used for the cleaning of surfaces in the laundry industry and for the production of beverages in the food industry. It is also possible to change the oxidation and reduction characteristics of water and gas. These variations are proportional to the number of passages through the device.

By the treatment of the medium according to the invention, the aggressiveness of water may be reduced in a simple manner. In addition, the water becomes sufficiently enriched with negative and positive ions of the elements to lead to a reduction in the corrosion of the pipe or the measuring devices. Chemical water treatment may be preferred in some cases with this treatment. The effect is environmentally-friendly. The efficiency of the heat treatment is very high, wherein a temperature of the medium up to 97 °C may be achieved. By optimal dimensioning of the inner spaces of the body as well as their arrangement in succession and side by side, it is possible to increase the efficiency of the method and the device for the physical heat treatment of liquid media in a simple manner.

The invention is now described in more detail with reference to exemplary embodiments and the appended drawings:

Fig. 1 Shows a simplified plan view of a device for carrying out the method according to the present invention for the physical heat treatment of liquid media with an inlet and outlet perpendicular to the device axis,

Fig. 2 shows a device with an integrated negative electrode,

Fig. 3 shows a section A-A from Fig. 2 with a tangential inlet and outlet, and

Fig. 4 shows an alternative embodiment of a positive electrode with a tapered electrode.

The device for carrying out the method according to the present invention consists of a substantially cylindrical body 1, preferably of an insulating material, for example polyethylene, polypropylene, silicate ceramic or glass, in the axis or in the vicinity of which a positive electrode 2 is arranged. The electrode 2 consists of material with positive electrochemical potential, for example copper, carbon or the like. In an alternative embodiment, this positive electrode 2 is completely or only partially separated from the hydrodynamically pretreated medium 9 by means of an insulating layer 23 made of glass or Teflon. Along a part, or along the entire length, of the positive electrode 2, a negative electrode 3 of negative electrochemical potential formed from aluminum, stainless steel or the like is arranged circumferentially. The body 1 has a first inlet-outlet opening 4 as well as a second inlet-outlet opening 5. These two openings 4, 5 may be arranged with respect to the body 1 either vertically, parallel to its axis, but preferably tangentially-eccentrically, wherein the second inlet-outlet opening 5 is arranged against the flow of the hydrodynamically pre-treated medium 9, which flows through the first inlet-outlet opening 4. Thus, a natural flow of the hydrodynamically pre-treated medium 9 occurs in the body 1. Flow changes may be achieved if the surface structure of the positive electrode 2 and negative electrode 3 is changed or, if necessary, if their shape is changed and the body 1 is appropriately dimensioned. A first inlet-outlet electrode 31 and a second inlet-outlet electrode 32 are arranged in the first inlet-outlet opening 4 and the second inlet-outlet opening 5. The designation of these electrodes is derived from the contact with the hydrodynamically pretreated medium 9 in the body 1 and not thereof, wherein it is disposed in the first and second inlet-outlet openings 4 and 5. These two electrodes may also be arranged in a hydraulic pipe outside the body 1 or they may be replaced by a part of the hydraulic pipe which is made of a material with negative electrochemical potential.

A control electrode 6 is located in the body 1, possibly outside the body with electrochemical potentials, and electromagnetic RC AC signals are supplied to it. For the specific embodiment, a frequency in the range of 150 to 400 Hz is tested, preferably 300 Hz, with a power of 0.5 W.

When several bodies 1 are used, they may be arranged either in series or parallel to one another, namely with different volume sizes and different parameters, for example the frequency, the alternating electromagnetic field, the flow velocity and changes in the direction of flow, or else the flow distribution. In an alternative embodiment, the positive electrode 2 has a tapered electrode 22 at least at one end, and is located in a glass sleeve which forms an insulating layer 21 and which is inserted into the material with positive electrochemical potential, preferably carbon, as a source of ions and/or colloids, and which is also separated from the material with positive electrochemical potential by an insulating layer 23. Such a positive electrode 2 is arranged in the vicinity of the material of the negative electrode 3. This solution is necessary in the case of aggressive water, which is characterized by high corrosion of the metallic control and measuring instruments and also of the pipes. In this particular case, the tapered electrode 22 is formed of the same material as the control and measuring instruments with the greatest corrosion. In the case of bacterial treatment, the material of the tapered electrode 22 consists of germ-destroying material, for example copper, silver or the like. By means of a single or multiple passage of the hydrodynamically pre-treated medium 9 through the body 1 with electrochemical potential and electromagnetic frequency, physical, or possibly chemical changes and energy changes, may occur. It is advantageous if the body 1 is arranged vertically and if a closed gas circuit 7 is arranged in its upper part while a closable sludge circuit 8 is arranged in its lower part.

The hydrodynamically pre-treated medium is preferably mineralized water, distilled water, waste water, a polar and non-polar liquid or a gas. The positive and negative electrodes 2, 3, 31 and 32 of the alternative embodiment consist of minerals, silicates, or artificial or synthetic equivalents. In a further embodiment of the invention, the body 1 is arranged in a closed hydraulic circuit in which, for example, a flow meter, thermometer, viscosity measuring device and other instruments are located, with which physical or chemical changes may be measured. This embodiment is suitable as a measuring stand. It is advantageous if the positive and negative electrodes 2, 3, 31 and 32 have a roughened surface, which, for example, is obtained by a cavity process, embossing or pleating.

An advantageous embodiment of the invention provides for the essentially cylindrical body 1 to have a length of 510 mm and consists of polypropylene (PPR). The outer diameter of the body 1 is about 63 mm, while its inner diameter is about 42 mm. The axis of the inlet-outlet opening extends at right angles to the axis of the body 1. The positive electrode 2 and the control electrode 6 of quartz glass with a diameter of approximately 12 mm are arranged in or about the axis of the body 1. There is carbonaceous powder in the electrode 6, which is, for example, sealed and bonded by means of epoxy. In the control electrode 6 there is a spiral-shaped electrical conductor made of copper, the diameter of which may be 0.1 to 3 mm and the length 200 to 2000 mm. The conductor is connected to an RC AC frequency signal of 150 to 450 MHz, preferably 300 MHz. In general, frequency ranges from 30 MHz to 5

GHz with a power of 0.1 to 3 W may be considered. The positive electrode could also consist of a copper rod with Teflon coating. The glass coating or the Teflon coating need not be distributed over the entire surface of the positive electrode 2.

It is expedient if the positive electrode is not in contact with the medium 9. The negative electrodes consist of aluminum, preferably of a bent sheet metal piece which is in contact with the medium 9. However, it could also be coated with Teflon. Electrodes with insulating coatings are used for the polarization regime, while electrodes without insulation are used for the ionisation regime of the device. The output of the circulating pumps used may lie between 20 W and 3000 W. Heating from the distilled water from room temperature to 50 °C when 1.5 to 2.5 $m^3/h$ were circulated at a speed of 50-79 m/s. Optimization or an increase in the power of the system may be achieved by increasing the electromagnetic potentials between the electrodes and/or by increasing the power of the RA AC signals. Very good results may be achieved with a body 1 with eccentric tangential arrangements of the inlet-outlet openings with diameters of 12, 18 and 36 mm. This results in a decay of the flow swirling by changing the flow orientation. The medium speed is 0.5 to 150 m/s. In the ionization operation of the plant the internal density of CU, Al or the like is about 0 to 1 $g/m^3$.

The application possibilities for the invention are given by the magnitude of the changes in the physical properties of the liquids and gases passing through the device. The changes are relative to the number of passages through the electrochemical potentials, and possibly the application of the control electrode. The application may be used in the enrichment industry of drinking and utility water, industrial and wastewater, construction, balneotherapy and health care, cleaning and laundry, food industry, alcohol production, brewing, health care, dermatology, in ceramics and heat production, in the heat industry, in waste water treatment plants, in the energy industry, in water sources, swimming pools and also in the processing industry, the oil industry and in the automotive industry and similar industries.

Due to increased crystallization of the carbonates, it is advantageous in the course of the medium heating to minimize oxidation. This may be achieved by the treated medium coming into contact with a negative electrode, in particular made of Al, when leaving the device. This is important, for example, when treating aggressive water in mines. In the case of a multiple passage of the medium through the devices, light effects occur in the medium, which may be used for special purposes, for example, advertizing.

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**ELJÁRÁS ÉS KÉSZÜLÉK FOLYÉKONY MÉDIUMOK FIZIKAI HŐKEZELÉSÉHEZ**

SZABADALMI IGÉNYPONTOK

1. Készülék folyékony médiumok fizikai hőkezeléséhez, ahol egy hidrodinamikusan előkezelt médium (9) elektrokémiai, valamint elektrokémiai RC AC jelek rendszerével polárisan, és/vagy ionosan befolyásolható, ahol a rendszer tartalmaz egy testet (1), előnyösen szigetelőanyagból, amelynek tengelyében, illetve annak közelében egy pozitív elektróda van elrendezve, amely pozitív, elektrokémiai potenciálú anyagból van kiképezve, és a médiumtól (9) egy réteggel (21) el van választva, mialatt a kerületen egy negatív elektróda (3) van elrendezve negatív, elektrokémiai potenciállal, ahol a testnek (1) egy első bemenő-kimenő nyílása (4), valamint egy második bemenő kimenő nyílása (5) van, ennek munkatartományában egy első bemenő-kimenő elektróda (31), illetve egy második bemenő-kimenő elektróda (32) van elrendezve.

2. Az 1. igénypont szerinti készülék, **azzal jellemezve, hogy** van egy szabályozó elektróda (6), amelyhez az RC AC elektromágneses jel hozzá van vezetve.

3. Az 1. vagy 2. igénypont szerinti készülék, **azzal jellemezve, hogy** a pozitív elektróda nyersanyagból, pozitív, elektrokémiai potenciállal van kiképezve, előnyösen Cu-ból, vagy C-ből és hasonlókból, és
**hogy** a negatív elektródák (3, 31, 32) negatív, elektrokémiai potenciállal vannak kiképezve, előnyösen rozsdamentes acélból, Fe-ből, Al-ből, és hasonlókból.

4. Az 1.-3. igénypontok egyike szerinti készülék, **azzal jellemezve,**
**hogy** a pozitív elektródák (2) ionjai, és/vagy kolloidjai elvékonyodó elektróda (22) alakjából erednek, amely a pozitív elektróda (2) elektrokémiai nyersanyagába, ami a hidrodinamikailag előkezelt médiumtól (9) egy szigetelő réteggel (23) el van választva, bekapcsolódik, és
**hogy** a pozitív elektródának (2) szigetelő rétege van.

5. Az 1.-4. igénypontok egyike szerinti készülék, **azzal jellemezve, hogy** az elektródák, amelyek az elektrokémiai potenciálokat képezik, természetes, és/vagy mesterséges ásványokból vannak előállítva.

6. Eljárás folyékony médiumok fizikai hőkezeléséhez, az előző igénypontok egyike szerinti készülék alkalmazása mellett, ahol egy hidromechanikailag előkezelt médiumot (9) egy rendszer segítségével, elektrokémiai potenciál, valamint RC AC elektrokémiai jelek útján, polárisan, és/vagy ionosan befolyásolhatunk, ahol a médiumnak (9) a rendszeren keresztül, az elektrokémiai potenciálok és elektrokémiai RC AC útján történő egy, vagy többszörös átfolyását biztosítjuk.

7. A 6. igénypont szerinti eljárás, **azzal jellemezve, hogy** a hidrodinamikusan előkezelt médiumot a rendszer bemenetén és kimenetén negatív, elektrokémiai potenciálokkal hozzuk kapcsolatba.

8. A 6. vagy 7. igénypont szerinti eljárás, **azzal jellemezve, hogy** a hidrodinamikusan előkezelt médiumot (9) elektrokémiai potenciálokkal és RC AC elektromágneses jelekkel többször keresztülvezetjük egy testen (1).

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9. A 6.-8. igénypontok egyike szerinti eljárás, **azzal jellemezve, hogy** az elektrokémiai potenciál és az elektromágnese RC AC jel nagysága és elrendezése változtatható, és **hogy** a médium (9) hidrodinamikus körfolyamatába mérőkészülékeket tudunk elrendezni, a médium fizikai, és/vagy kémiai paramétereinek, mint hőmérséklet, nyomás, vezetőképesség, viszkozitás, pH-érték, oxidációs és redukciós reakciók folyamatos méréséhez.

10. A 6.-9. igénypontok egyike szerinti eljárás, **azzal jellemezve, hogy** a hidrodinamikailag előkezelt médiumot (9) az elemek, mint Ag, Au, Cu, Al, Fe és más elemek negatív, és/vagy pozitív ionjai érdekében gazdagítjuk, amelyek azért szükségesek, hogy a kívánt változásokat, például bakteriális változásokat, megcélozhassuk.

11. A 6.-10. igénypontok egyike szerinti eljárás, **azzal jellemezve, hogy** a hidrodinamikusan előkezelt médiumot (9) a testen (1) kívül is hatásossá tesszük egy elektromágneses szabályozó elektródával

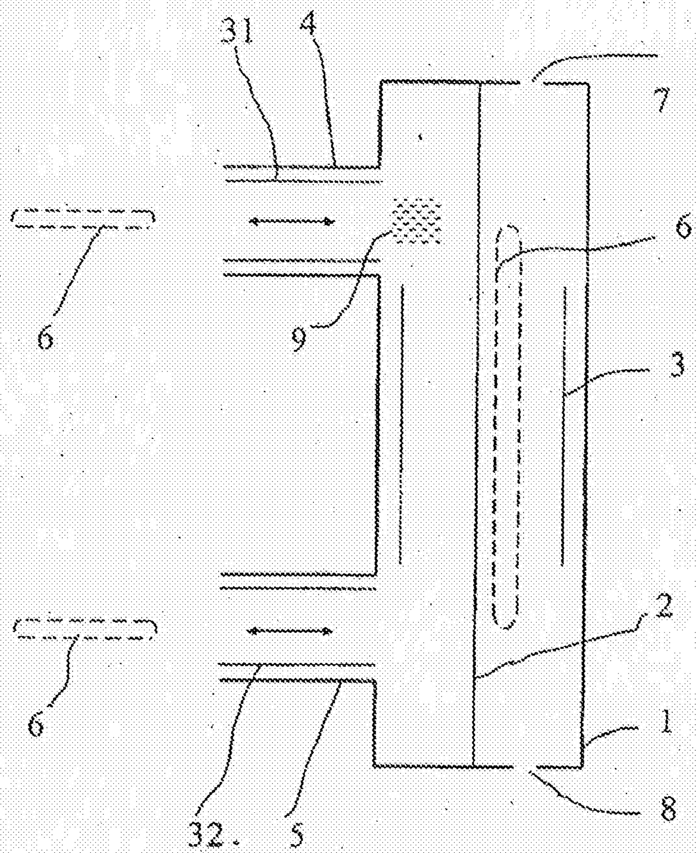


Fig. 1

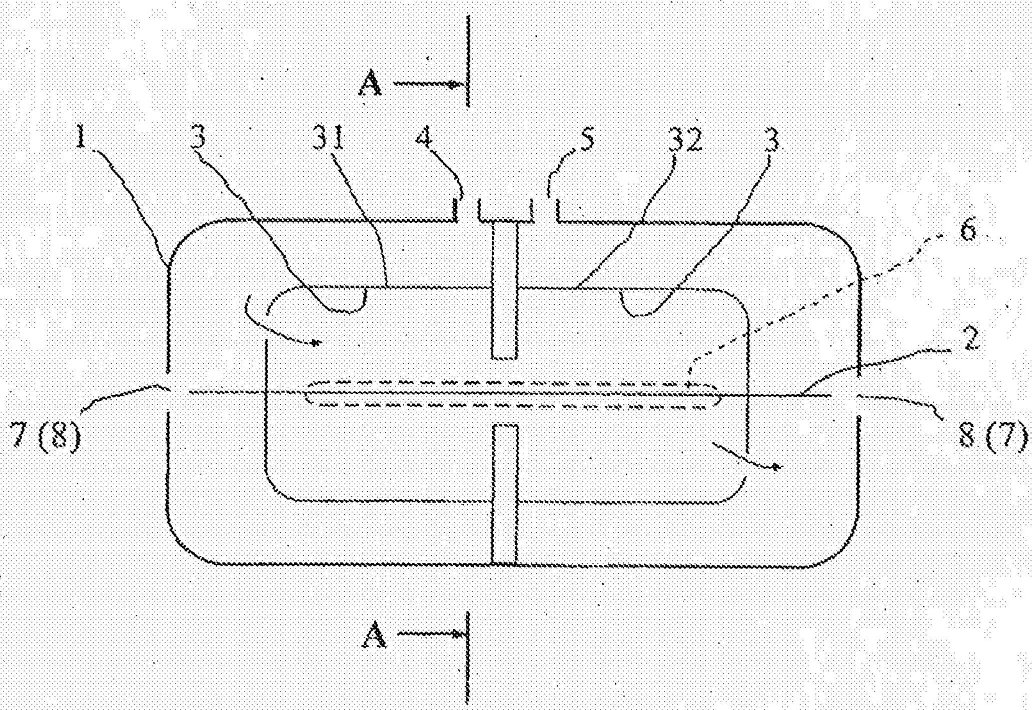


Fig. 2

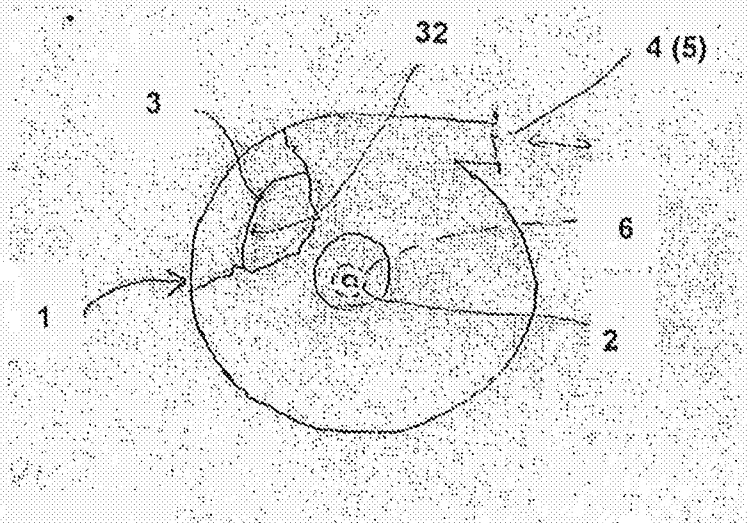


Fig. 3

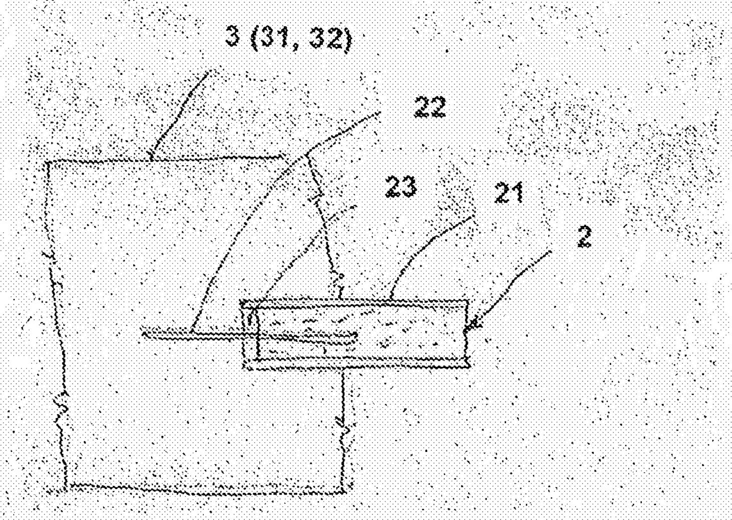


Fig. 4