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Ioniser Device

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(71) Applicant(s)
Charles Cheesman

(72) Inventor(s)
Cheesman, Charles Digby

(74) Agent/Attorney
FB Rice & Co, 139 Rathdowne Street, CARLTON, VIC, 3053

ABSTRACT

An ionising device for introducing metal ions or colloidal dispersions into a liquid has at least one pair of ionising electrodes (12, 14) formed of a material including said metal. A power supply is adapted to apply a voltage between the electrodes (12, 14) such that ions are released into the liquid into which the electrodes are immersed. At least one further electrode (16, 18) is also in the liquid to act as an anode with the ionising electrodes (12, 14) being connected as cathodes to electrolyse the liquid to generate a gas at one or both electrolysing electrodes when the device is operated in an electrolysis mode.

AUSTRALIA

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Charles Digby Cheesman

COMPLETE SPECIFICATION

Invention Title:

Ioniser Device

The invention is described in the following statement:

IONISER DEVICE

Field of the Invention

This invention relates to an ionising device and relates particularly to an electrolysis device for introducing metal ions or colloidal dispersions to liquids.

Although the invention will be described in relation to its application for adding metal ions or metal colloidal dispersions to water, it will be understood that the invention has many other applications, such as for use with other liquids, for use in industrial processes and in the mining industry.

Further reference is made throughout this specification to "liquids", and it will be understood that this term is used to encompass flowable slurrys and practically incompressible fluids.

Background of the Invention

The addition of metal ions or colloidal dispersions into water is generally carried out for the purpose of disinfecting the water or for inhibiting algae growth in the water, or for otherwise treating the water so that it is suitable for swimming and the like. For example, in a domestic or commercial swimming pool, ionising devices are often used in place of chlorine treatment as an algaecide and biocide.

Water may also be treated to correct mineral deficiencies or imbalances in the water, or to add desirable metal ions that may be beneficial to health.

It is also known that, in swimming pools in particular, the enjoyment achieved when using the pool is increased when the level of dissolved oxygen in the water is relatively high. The water appears to "feel" softer and "conditioned" thereby providing the user with an improved experience. In many instances, the beneficial effects of adding metal ions or colloidal dispersions to liquids are also enhanced when the oxygen level in the liquid is relatively high. However, many water treatments result in a reduction in the oxygen level, and increasing that oxygen level is therefore desirable to enhance the effect of the ionising device.

It has been proposed to use separate, additional equipment in conjunction with an ionising device in order to increase levels of oxygen in the liquid. Such equipment may take the form of an oxygenator passing oxygen gas into the water. However,

equipment of this type has varying degrees of effectiveness, may be cumbersome to handle, requires effort and time to install and can require excessive manual operation to use, monitor and maintain. Such equipment also adds to the overall cost of a water treatment system.

It is therefore desirable to provide an improved ionising device which obviates at least some of the disadvantages of previously proposed devices.

It is also desirable to provide an improved ionising device that incorporates means to increase the level of dissolved oxygen in the liquid the subject of the ionising treatment.

It is also desirable to provide an ionising device which may be designed for use with domestic swimming pools, commercial pools, industrial plant and the like and which is safe and easy to use, monitor and maintain.

It is also desirable to provide an improved ionising device for introducing metal ions or colloidal dispersions to liquids whereby the nature of the ions or colloidal dispersions is able to be selected in accordance with the nature of the liquid.

It is also desirable to provide an improved ionising device that is relatively economic to manufacture and use.

Summary of the Invention

In accordance with one aspect of the invention there is provided an ionising device for introducing metal ions or colloidal dispersions to liquids comprising:

an ionising pair of electrodes adapted to be disposed within a liquid path, the electrodes being formed of a material which includes at least one metal the ions of which are to be introduced into the liquid;

power means operable in a first mode for applying an electrical voltage difference between the electrodes of the ionising pair so that, when in the liquid path, an electrical current flows through the liquid from one electrode to the other giving rise to the production of metal ions or colloidal dispersions in the liquid;

further electrode means adapted to extend into the liquid path; and

said power means operable in a second mode to apply an electrical voltage between at least one of the ionising pair of electrodes and the further electrode means such that the

said at least one of the ionising pair of electrodes act as a cathode in an electrolysis process to produce a gas at the anode electrode means.

Preferably, the gas produced is oxygen, but this is dependent on the liquid chemistry.

In one form of the invention, the further electrode means comprises a second electrode, pair or set of electrodes spaced from the ionising pair of electrodes and formed of a substantially inert material that resists electrolytic degradation, thus allowing electrolysis to produce oxygen at the anode electrodes substantially without adding ions to the liquid.

In one embodiment, a plurality of pairs of ionising electrodes are adapted to extend into the fluid path. In this embodiment, each of the electrodes of the pairs of ionising electrodes is electrically connected to become a plurality of cathodes when a voltage is applied therebetween and the further electrode means.

The ionising and further electrodes may be of any suitable shape and relative positional arrangement to facilitate the respective current paths during operation of the device in either the ionising mode or the electrolysis mode. In one form, the electrodes are of cylindrical form, with the ionising electrodes having a diameter greater than the electrolysing electrodes.

In another embodiment, the ionising electrodes are of a plate configuration whilst the electrolysing electrodes are substantially cylindrical.

In one embodiment, the application of an electrical voltage between the ionising electrodes includes means to change the polarity of the electrodes at predetermined intervals. By changing the current direction between the electrodes, the electrodes self-clean to prevent a build-up of scale and impurities. The current direction may be changed at any suitable interval, such as from between about 0.5 seconds and 30 minutes.

In another embodiment, an alternating current is used between the ionising electrodes.

In order that the invention is more readily understood, embodiments thereof will now be described with reference to the accompanying drawings.

Description of the Drawings

Figure 1 is a diagrammatic illustration of one embodiment of an ioniser device in accordance with the present invention;

Figure 2 is a diagrammatic illustration of a second embodiment of the invention; and

Figure 3 is a block circuit diagram illustrating one control circuit for use with an embodiment of the invention.

Description of the Preferred Embodiments

Referring to the drawings, figure 1 illustrates an embodiment of the invention which comprises a pair of plate electrodes 12 and 14, which are ionising electrodes when the device is used in an ionising mode, and a second pair of cylindrical electrodes 16 and 18. The ionising plate electrodes 12 and 14 are formed of an electrode material which includes one or more metals the ions of which or colloidal dispersions of which are to be added to a liquid into which the electrodes are introduced. The electrodes 12, 14, 16 and 18 are located in use in a liquid flow path, such as in a pipe which constrains the liquid to flow past the electrodes. Preferably, the liquid will flow in a direction substantially parallel to the plane of the plate electrodes 12 and 14. Those ionising electrodes may comprise an alloy of a number of metals, ions of each of which are transferred to the liquid, such as water, into which the electrodes are placed. In one particular form, the electrode material comprises a copper, silver and zinc alloy containing between 80 and 94% copper, 5 to 15% silver and 0.5 to 5% zinc. It will be understood, however, that any other alloy of these or other metals may be used in performing the invention. The metals used in the ionising electrodes will be selected according to their beneficial effect in the particular application for which the invention is used. Thus, the electrodes 12 and 14 may be formed of metals such as aluminium, magnesium, nickel, iron or any suitable alloy.

The use of a copper/silver/zinc alloy for use with water provides metal ions or colloidal dispersions of those metal constituents into the water to act as biocides and algaecides. In another application, a greater amount of silver in the electrode material may be used to improve the biocide action. It has been suggested that a silver/copper alloy used with an AC current may form beneficial colloidal dispersions in water.

In order that the electrodes 12 and 14 act as ionising electrodes, an electrical voltage is applied between the electrodes 12 and 14 when the electrodes are immersed in the liquid. The electrical current may be an alternating current but, in the preferred embodiment, a reversible DC current is used. As electrical current flows between the electrodes 12 and 14 through the water into which the electrodes are placed, with the electrodes 16 and 18 not being connected to an electrical power source, the electrolysis effect results in ions of the metals contained in the electrodes to pass into the water. Scale and other impurities may build up on one or both plate electrodes 12 and 14, and by reversing the polarity of the electrical supply, the build-up of scale or impurities may be reduced.

The second pair of electrodes 16 and 18 are preferably formed of a relatively inert material. These electrodes are used in conjunction with the ionising pair of electrodes 12 and 14 to oxygenate the liquid flowing past the electrodes. In this mode of operation, the plate electrodes 12 and 14 are electrically connected to become cathodes and the second pair of cylindrical electrodes 16 and 18 are connected to the DC power supply as anodes. Current therefore flows between the anodes and the cathodes and, as the anodes are substantially inert, no metal ions are transferred into the liquid. The effect of the current flowing through the liquid is to electrolyse the liquid such that oxygen and hydrogen are formed at the anode and cathode, respectively. The oxygen so formed is dissolved in the water flow whilst bubbles of hydrogen are carried in the water for dispersion to atmosphere on discharge from the system.

The ioniser device of this embodiment is particularly suited for use with swimming pools and the like where the introduced metal ions or colloidal dispersions act to kill bacteria and otherwise disinfect or purify the water. Periodically, power is switched to the second set of electrodes to generate oxygen to increase the oxygen concentration in the water thereby improving the water quality for people using the swimming pool.

Referring to figure 2, a second embodiment is illustrated in which the ionising pair of electrodes 20 and 22 are cylindrical but of a larger diameter than the electrolysing electrode pair 16 and 18. The electrode pairs 20 and 22 and 16 and 18 may extend from a base 23 which is adapted to engage in a fluid tight manner in a fitting forming part of pipe work associated with the filtration system of the swimming

pool installation into which the system is fitted, such as a domestic swimming pool. The electrodes 20, 22, 16 and 18 extend into the water flowing through the pipe work and the application of an electrical voltage between the electrodes 20 and 22 produces a current therebetween which causes metal ions, or colloidal dispersions, to pass into the water flowing past the electrodes. The water flow carries the metal ions into the swimming pool.

As with the previous embodiment, the electrical connections to the electrodes 20 and 22 are changed so as to provide a voltage between respective ones of the ionising and electrolysing pair of electrodes. Thus, the large cylindrical electrodes 20 and 22 become cathodes while the smaller electrodes 16 and 18 become anodes whereby electrolysis of the water takes place generating oxygen and hydrogen at the respective electrodes.

It will be appreciated that different shapes and configurations of electrodes may be used in the performance of the invention. Thus, one or a plurality of substantially inert electrodes may be used for the electrolysis electrode. The quantity of oxygen generated is a function of the current passing through the water and the materials used in the electrodes. In the preferred embodiments, the electrolysing pair of electrodes 16 and 18 are formed of a substantially inert material, such as platinum or a mixed metal oxide coated titanium. The mixed metal oxide coating is a proprietary compound known in the art. Titanium is selected as an electrically stable material that is not readily eroded by the electrolysis.

Referring to figure 3, there is illustrated one form of control circuit for switching electrical power between the ionising mode and the electrolysing mode. In the ionising mode, the ionising pair of electrodes 20 and 22 are connected between the positive and negative outputs of the bridge circuit 26. In the electrolysing mode, the electrodes 20 and 22 are both connected to the negative side of the bridge circuit 26 while the electrolysing pair of electrodes 16 and 18 are connected to the positive side of the bridge circuit 26. The switch 24, shown in the electrolysing position, isolates the electrolysing set of electrodes 16 and 18 in the ionising mode of operation.

The block 28 represents a polarity reversing switching circuit which is able to either manually or automatically reverse the polarity of the voltage applied to the

electrodes in the ionising mode of operation to give effect to the self cleaning action on the electrodes resulting from the reversed current flow.

The switching between modes of operation can be carried out manually or automatically. In automatic mode, a water sampling unit periodically tests the water quality and measures an appropriate parameter, such as oxygen concentration, metal ion concentration or the like. Such parameter determinations are then able to be used to effectively control the operation of the ionising device and to determine the need for switching between modes of operation.

In one arrangement, the block 28 also includes voltage controlling circuitry which varies the output DC voltage applied to the electrodes in either the ionising mode or the electrolysing mode. Such voltage variation changes the current and the concentration of ions released into the water.

It will be understood that the invention may be used for a variety of applications. One application is in sewage treatment where, instead of using ions as a biocide, they are added to the sewage treatment system to feed bacteria to aid the breakdown of organic matter. The invention is also useful in wastewater treatment to assist purification of wastewater from industrial processes.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An ionising device for introducing metal ions or colloidal dispersions to liquids comprising:

an ionising pair of electrodes adapted to be disposed within a liquid path, the electrodes being formed of a material which includes at least one metal the ions of which are to be introduced into the liquid;

power means operable in a first mode for applying an electrical voltage difference between the electrodes of the ionising pair so that, when in the liquid path, an electrical current flows through the liquid from one electrode to the other giving rise to the production of metal ions or colloidal dispersions in the liquid;

further electrode means adapted to extend into the liquid path; and

said power means operable in a second mode to apply an electrical voltage between at least one of the ionising pair of electrodes and the further electrode means such that the said at least one of the ionising pair of electrodes acts as a cathode in an electrolysis process to produce a gas at the anode electrode means.

2. An ionising device according to claim 1 wherein the further electrode means comprises a second electrode, a pair, or a set of electrodes spaced from the ionising pair of electrodes and formed of a substantially inert material that resists electrolytic degradation.

3. An ionising device according to claim 1 or claim 2 wherein the electrolysis produces oxygen at the anode electrodes substantially without adding ions to the liquid.

4. An ionising device according to any one of the preceding claims wherein a plurality of pairs of ionising electrodes are adapted to extend into the liquid path

5. An ionising device according to claim 4 wherein each of the electrodes of the pairs of ionising electrodes is electrically connected to become a plurality of cathodes when a voltage is applied therebetween and the further electrode means.

6. An ionising device according to any one of the preceding claims wherein the ionising electrodes are elongated plates extending in the direction of liquid flow.

7. An ionising device according to any one of the preceding claims wherein the electrodes are spaced to optimise release of ions during the first operating mode and to promote electrolysis during the electrolysis mode.

8. An ionising device according to any one of claims 1 to 5 wherein the electrodes are of cylindrical form, with the ionising electrodes having a diameter greater than the electrolysing electrodes.

9. An ionising device according to any one of the preceding claims wherein the power means applying an electrical voltage between the ionising electrodes includes means to change the polarity of the electrodes at predetermined intervals.

10. An ionising device according to claim 9 wherein the current direction is changed at intervals ranging from between about 0.05 seconds and 30 minutes.

11. An ionising device according to any one of claims 1 to 8 wherein an alternating current is used between the ionising electrodes.

12. An ionising device according to any one of claims 1 to 11 wherein the ionising electrodes are formed of an alloy of copper, silver and zinc.

13. An ionising device according to claim 12 wherein the ionising electrodes are formed of an alloy that includes copper, silver and zinc in the ranges of between 80% and 94 % copper, 5% to 15% silver, and 0.5% to 5% zinc.

14. An ionising device according to any one of claims 1 to 11 wherein the ionising electrodes are formed of an alloy that includes any one of or any combination of aluminium, magnesium, nickel, iron, copper, silver.

15. An ionising device according to any one of claims 1 to 13 wherein the further electrode means are formed of or include platinum.

16. An ionising device according to any one of claims 1 to 13 wherein the further electrodes means are formed of a mixed metal oxide coated titanium

17. An ionising device substantially as hereinbefore described with reference to the accompanying drawings.

Dated this eleventh day of December 2003

Charles Digby Cheesman
Patent Attorneys for the Applicant:

F B RICE & CO

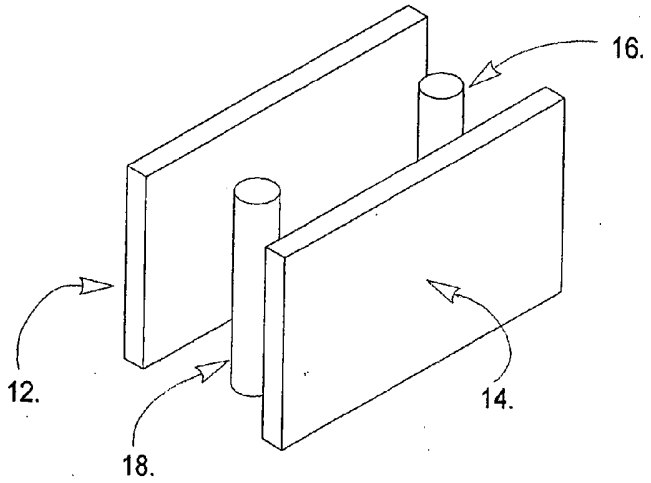

Figure 1

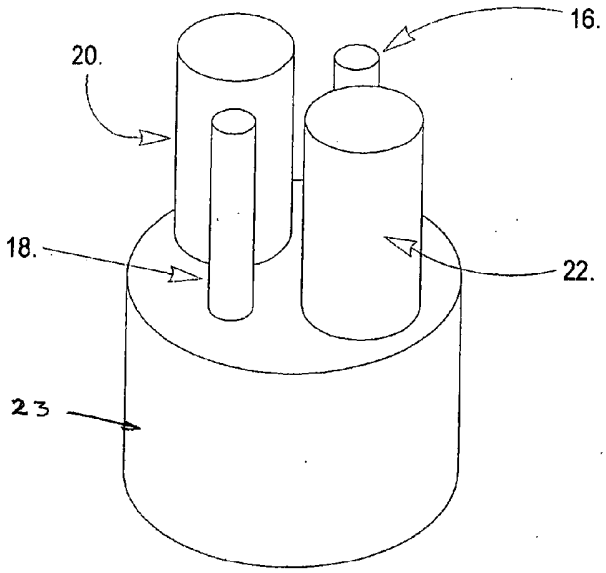

Figure 2

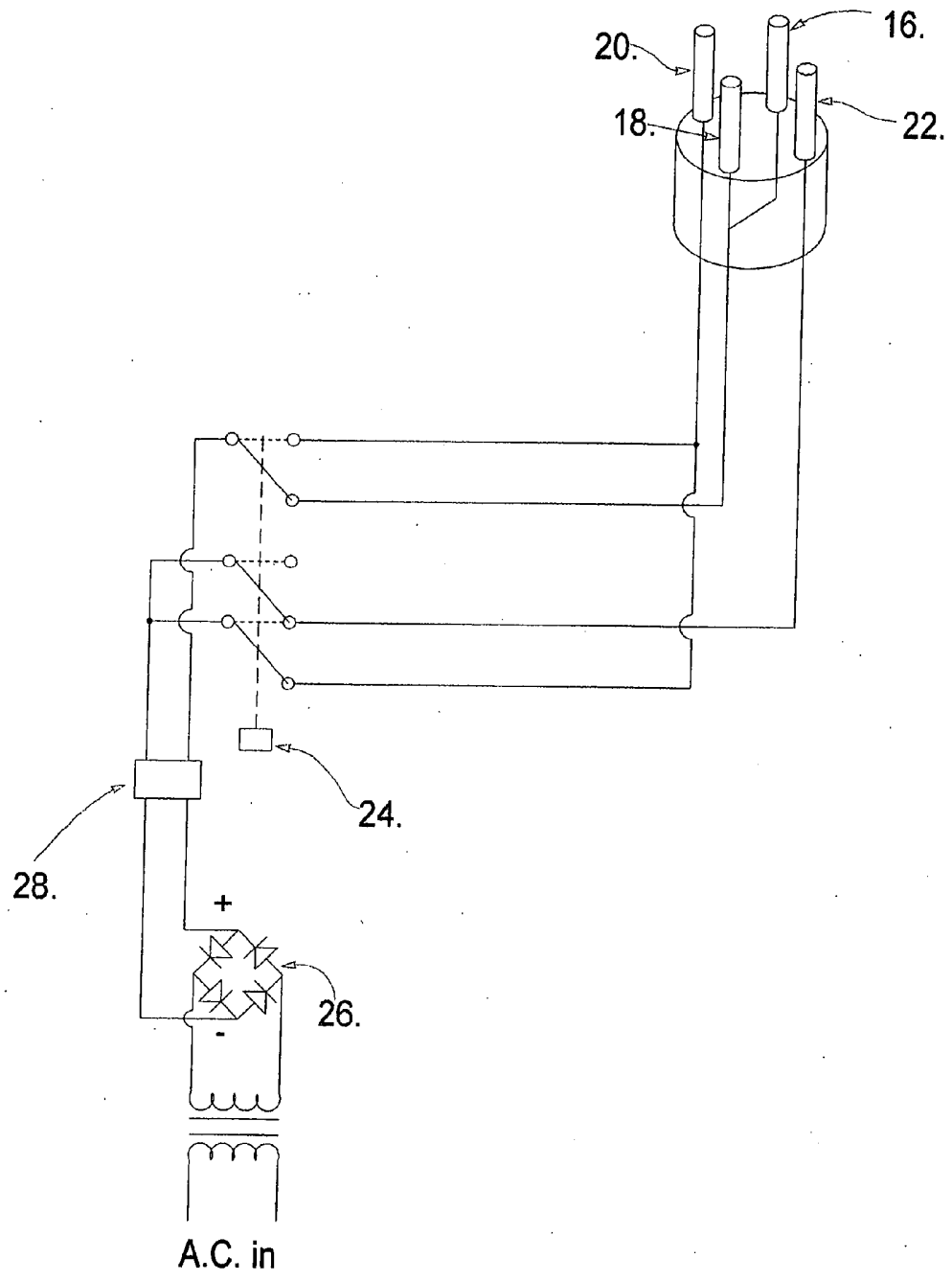

Figure 3