Owen R. Waltrip
INVENTOR.

BY John Doe
and Harvey B. Jackson
Attorneys
ELECTRO-CHEMICAL METHOD FOR SELECTED DISSOCIATION

Fig. 6

Fig. 7

Fig. 5

Owen A. Waltrip
INVENTOR.

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.

BY

Owen R. Waltrip
INVENTOR.
ELECTRO-CHEMICAL METHOD FOR SELECTED DISSOCATION

Owen R. Waltrip, Roseville, Calif., assignor to twenty-five percent to John Konsonlas, ten percent to Paul J. Lunardi, and ten percent to Willis Hampton, all of Roseville, Calif.


Int. Cl. C02b 1/82; C01d 7/34; B01k 1/00

U.S. Cl. 294—130

ABSTRACT OF THE DISCLOSURE

A method for dissociating a medium within a treating zone to recover predetermined elemental components of the medium by establishing a D.C. potential within the treating zone, super-imposing oscillating electrical energy, at a radio frequency value, on the D.C. potential, and simultaneously imparting oscillating mechanical energy within the audio frequency range to the medium entering the treating zone for controlled dissociation of at least a portion of the medium to recover, and thus effectively remove, preselected elemental components of the medium.

This application is a continuation-in-part of application Ser. No. 497,044, filed Oct. 18, 1965, now abandoned.

This invention relates to a method, and an exemplary means, for dissociating chemical elements from a medium containing such elements in solution or suspension or consisting of compounds of such elements. More particularly, this invention relates to a method of utilizing an audio frequency harmonic tone having a predetermined rate of vibration selected on the basis of the chemical element or elements to be manipulated, in conjunction with an oscillating electrical energy input to the medium at a radio frequency value, preferably with the simultaneous utilization of a reaction promoting D.C. potential, within a treating zone containing the medium to be acted upon. The present invention therefore relates to a method of manipulating chemical elements by utilizing harmonic audio frequencies complementary to the harmonic "wave-energy picture," or more simply stated, the harmonic audio frequency tones corresponding to those naturally radiating from and specific to each chemical element whereby chemical elements may be manipulated by utilization of such reproduced harmonic tones which corresponds in nature to thermally induced vibrations. Such thermally induced vibrations have been long recognized as influencing the rate of chemical reaction between chemical elements and compounds and has been theorized as directly related to the newly emerging interpretation by the scientific community of the harmonic wave nature, of matter. Thus, the present invention relates to a method of utilizing combined audio and radio frequency energy, i.e., harmonic wave energy, to promote chemical reactions.

In my copending application referred to hereinbefore I dealt at some length on the theoretical aspects of my interpretation of the harmonic wave energy aspect, or nature, of matter. While it is not my desire to be restricted to the theory set forth at length therein, or briefly again touched upon herein, it will nevertheless be appreciated from the discussion following hereinafter that the present invention has as its primary object the provision of a novel method and means of relating the aforementioned theoretical considerations to the field of chemical processes and apparatus.

In this regard, it is another object of the present invention to provide practical applications of my novel method by disclosing exemplary modes of the method such as for dissociating components in a predetermined medium within a treating zone, comprising a portion of an exemplary apparatus for carrying forth such a mode of my invention, whereby a D.C. potential is established within the treating zone, oscillating electrical energy at a radio frequency value, at a selected variable power input level, i.e., wattage is "superimposed" on the D.C. potential and mechanical energy at an audio oscillating frequency value is imparted to the medium entering the treating zone.

Exemplary embodiments set forth hereinafter to illustrate the carrying forth of the method of the present invention include the desalination of saline water and the purification of domestic or industrial sewage wherein deleterious elemental components are dissociated from, and preferably recovered from, the medium being treated and wherein the liquid effluent from the treating zone is mechanically filtered in a filtering apparatus wherein an audio frequency is imposed upon a filtering membrane therein free from dissociated elemental components carried over from the aforementioned primary treating zone thereby producing a final liquid effluent of a desired degree of purity.

A further object of the present invention is to provide a novel method for dissociating components in a predetermined medium within a treating zone wherein the medium entering the treating zone has imparted thereto an audio oscillating frequency of 256 cycles per second whereby in the treatment of exemplary liquid medium such as saline water, the utilization of such frequency in conjunction with the aforementioned oscillating electrical energy at a radio frequency value preferably in the presence of a D.C. ionizing potential effects the dissociation of elemental carbon, noble metals, iron and magnesium from the saline water.

Still another object of the present invention is to provide a novel method for dissociating elemental components from saline water so as to render the water suitable for agricultural use by imparting an audio oscillating frequency to the saline water entering a treating zone which audio oscillating frequency is the resultant of three audio input frequencies of 3415, 256 and 426.5 cycles per second and wherein the aforementioned audio frequency value imposed on the treating zone is of selectively varied wattage whereby hydrogen, carbon dioxide and oxygen in a gaseous state may be separately and sequentially dissociated from the saline water and collected in the gaseous state for subsequent liquefaction, and elemental sodium, carbon and chlorine separately and sequentially collected by selectively varying the wattage of the radio frequency input.

Still a further object of the present invention is to provide a novel method for treating domestic and industrial sewage to bring about the purification thereby of the sewage and/or the dissociation or degradation of organic substances therein to inorganic substances by the elimination of chemically combined carbon therefrom, and even including the destruction of viable dormant bacteria, by imparting an audio oscillating frequency consisting of the resultant of the aforementioned three audio input frequencies to sewage entering a treating zone wherein the oscillating electrical energy at a radio frequency value imposed on the sewage within the treating zone through positive and negative electrodes therein has its polarity reversed at a low rate.

Still a further object of the present invention is to provide an exemplary apparatus for carrying forth the aforementioned exemplary embodiments of the method of the present invention and wherein such apparatus is provided with auxiliary components adapted to facilitate the recovery of and subsequent liquefaction of gaseous com-
components evolved from the treating zone as well as an auxiliary filtering apparatus which utilizes radio frequency energy to augment filtration of liquid effluent from the primary treating zone.

These together with other objects which will become subsequently apparent reside in the method as more fully described hereinafter in conjunction with the apparatus illustrated in the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a simplified perspective view of an apparatus constructed in accordance with the principles of the present invention and primarily adapted for the treatment of a liquid medium further showing a portion of a gas-tight cover of the apparatus broken away to show the general organization of the major components within the interior of the apparatus.

FIGURE 2 is an enlarged vertical transverse cross-sectional view taken substantially along the plane of the line 2—2 of FIGURE 1.

FIGURE 3 is an enlarged longitudinal vertical cross-sectional view of the apparatus of FIGURE 1 taken substantially along the plane of the line 3—3 of FIGURE 1.

FIGURE 4 is a schematic illustration of an auxiliary gaseous component recovery means which may be utilized in conjunction with the primary treatment apparatus of FIGURE 1.

FIGURE 5 is a somewhat schematic view of an auxiliary or secondary, filtration means adapted to be operatively associated with the primary treatment apparatus of FIGURE 1.

FIGURE 6 is an enlarged cross-sectional view of the osmotic filter of the auxiliary apparatus of FIGURE 5 taken substantially along the plane of the line 6—6 of FIGURE 5; and

FIGURE 7 is a diagrammatic illustration of the major components of the exemplary liquid medium treating apparatus of FIGURE 1 and further showing means for generating the audio and radio frequencies required for the carrying forth of the method of the present invention.

Referring now to the drawings in greater detail, and FIGURES 1, 2 and 7 in particular, it will be seen that liquid medium treating apparatus indicated generally at 10 therein basically includes a generally fluid-tight tank 12 and a removable cover 14 sealingly secured to the tank 12 as so to provide a generally fluid-tight enclosure. The interior of the tank 12 is divided into two chambers by an apertured bulkhead 16 provided with a plurality of through apertures 18 to permit liquid medium introduced into a liquid medium pre-treatment zone 20 defined by the bulkhead 16 to flow into a liquid medium treating zone comprising a second chamber indicated generally at 22. In a continuous processing form of the invention, liquid medium is supplied to the pre-treatment chamber 20 through a conduit 24 by a centrifugal pump means 26 receiving liquid medium to be treated through an intake conduit 28. The pre-treatment chamber 20 is provided with a transducer means 30 adapted to operate within an audio frequency band to impart mechanical energy to the medium to be treated and which as seen best in FIGURE 7 receives an audio frequency input from one or more of three conventional audio frequency generators 32, 34 and 36 preset to generate a harmonic frequency and operatively connected to an audio power amplifier 38 which is in turn connected to the transducer means 30 by a coaxial cable 40 which sealingly passes through a side wall of the tank 12.

The treatment chamber 22 is provided with a plurality of vertically disposed longitudinally extending spaced-apart negative and positive electrodes indicated generally at 42 and consisting of alternately disposed generally negative electrodes 44 such as formed of lead and generally positive electrodes 46 such as formed of stainless steel. The negative electrodes 44 are connected in parallel by a negative electrode bus bar 48 and the positive electrodes 46 are connected in parallel by a bus bar 50. The bus bars 48 and 50 are energized by imposing D.C. potential thereon through suitable conductor means indicated generally at 52 extending from a terminal box 54 receiving a D.C. potential input from a metal generator, not shown, through cable 56 and wherein, as seen best in FIGURES 1 and 2, the conductor means 52 comprises a plurality of paired conductors 58 connected at a plurality of points 51 to the respective bus bars 48 and 50 so as to obtain relatively uniform current distribution. The bus bars 48 and 50 are also conductively connected to the output of a radio frequency generator 60 through a radio frequency amplifier 62 connected by lead wires 64 and 66 to the bus bars 48 and 50 through reversing switch means 68. The output energy level of the radio frequency amplifier 62 is relatively high as compared to the output of the audio frequency amplifier 38.

The tank 12 is further provided with a discharge outlet 70 in communication with the treating chamber 22 and wherein the height of the outlet conduit 70 assists in maintaining the maximum level of liquid within the treating chamber 22 and wherein it will be observed that FIGURES 1, 2 and 7 in particular, it will be seen that the chambers 20 and 22 are provisioned with a gas outlet 72 and 74, positioned well above the maximum level of liquid within the tank 12, which gas outlets are connected by a gas header bus bar 76 to an auxiliary gaseous product recovery means indicated generally at 80 which includes a compressor means 82 which intakes gaseous components from the header 76 on an intake stroke through a one-way check valve 84. On its discharge compression stroke, the compressor forces the condensed gaseous component through a one-way check valve 86 to a high pressure gas condensing means 88 wherein the high pressure gaseous components are condensed to a high pressure liquid which liquid is conveyed to a liquid gas storage tank 90 through a one-way check valve 92 and from which storage tank 90 liquefied gas may be withdrawn as desired by means of a valve means 94.

Now further considering FIGURE 1 in conjunction with FIGURES 5 and 6 it will be seen that the discharge conduit 70 which conveys the effluent from the treating chamber 22 and wherein it will be observed that FIGURES 1, 2 and 7 in particular, it will be seen that the chambers 20 and 22 are provisioned with a gas outlet 72 and 74, positioned well above the maximum level of liquid within the tank 12, which gas outlets are connected by a gas header bus bar 76 to an auxiliary gaseous product recovery means indicated generally at 100 which basically comprises an enclosed tank 102 receiving liquid effluent from the conduit 70. The filtration unit 100 generally comprises a secondary filtration means for the liquid effluent of the treating chamber 22. Towards this end, the filtration unit 100 has operatively positioned within the tank 102 thereof an osmotic membrane filter means indicated generally at 104 which filter includes a perforated stainless steel cylinder 106 having an osmotic membrane 108 secured to the exterior thereof and including an annular cylinder of sharp clean filtering sand 110 interposed between the osmotic membrane 108 and a second osmotic membrane 112. The osmotic membranes and sand are secured to the stainless steel cylinder 106 by a diamond pattern steel mesh fabric 114 secured by a plurality of support bands 116.

The interior 118 of the stainless steel tank 106 is connected through a one-way check valve 120, and conduit 122 to a vacuum pump means indicated generally at 124 which assists in reducing the relative pressure between the interior of the tank 106 and the interior of the tank 102 so as to enhance the passage of liquid medium from within the tank 102 through the osmotic membranes and filtering sand 110 into the interior 118 of the tank 106 as will be discussed in greater detail hereinafter.

In addition, the steel mesh 114 is connected by suitable conductors 126 to the radio frequency generator 60.

The exemplary apparatus briefly discussed hereinabove may be utilized for the selected dissociation of innumerable liquid mediums and merely for the sake of brevity.
the discussion hereinafter with regard to the utilization of the above apparatus for the carrying forth of the method of the present invention will be restricted to the utilization thereof for the separate treatment of two liquid mediums consisting of saline water, i.e., sea water, and industrial or domestic sewage. In addition, the treatment of saline water will be discussed with regard to the separate and sequential recovery of hydrogen, carbon dioxide and oxygen gases as well as elemental sodium, carbon and chlorine and alternatively for the simultaneous dissociation of such noble metals as iron and magnesium from saline water and the compounds therein. Furthermore, the discussion of the method of the present invention with regard to the treatment of industrial or domestic sewage centers primarily around the dissociation of organic compounds which it will be appreciated comprise the greatest proportion of contaminants in sewage and wherein for purposes of discussion herein viable organisms such as bacteria, and even including viable dormant bacteria are subjected to dissociation and thus irreversible destruction. Thus, the discussion of the utilization of the apparatus is intended to specifically set forth exemplary modes of carrying forth the method comprising the present invention.

EXAMPLE I

In this example, the apparatus described hereinafter is utilized for the dissociation of hydrogen, carbon dioxide, oxygen and chlorine in a gaseous state and the dissociation of sodium, and carbon which are collected as solids. In this regard, saline water, such as sea water, is introduced into the tank 12 and thus the compartments 20 and 22, to a level somewhat below the top of the electrodes 44 and 46 which level is generally determined by the configuration of the effluent conduit 70. At this point, and as will be appreciated from a simultaneous consideration of FIGURES 1 and 7, audio generators 32, 34 and 36 are individually energized at 3415, 256 and 4265 cycles per second respectively which three audio frequencies generated comprise the input to the audio amplifier 38, having a power output range of 1 to approximately 1000 watts, and wherein the aforementioned three separately generated audio frequencies are combined whereby the amplifier 38 has a resultant beat pulse output frequency of 384 cycles per second which is fed to the transducer 30. The transducer 30 when intended for operation in a power range of 1 to approximately 20 watts most generally is of the crystal type and when intended for operation in a power amplification range of 1 to approximately 1000 watts is generally a fully transistorized type. Thus, upon energization of the transducer 30 in the aforementioned manner mechanical energy at a beat pulse frequency value of 384 cycles per second is imparted to the saline water within the pretreatment chamber 20. Simultaneously, a D.C. potential is applied to the negative and positive electrodes 44 and 46 respectively which potential is of a current density conventionally utilized in electrolytic cells. To complete energization of the treating apparatus 10 the radio frequency generator 60 is energized and the output thereof amplified in the radio frequency amplifier 62 which is also applied in a polarized manner to the bars 48 and 50. The power output of the amplifier can be as high as 100,000 watts. It will be understood that the method of the present invention can be carried forth at a preferred, optimum radio frequency requiring a relatively lower power output of the radio amplifier 62 than when the apparatus 10 is operated at another less suitable but nonetheless suitable frequency. In this regard, the preferred radio frequency for this example is 80 megacycles. However, since this frequency is within a band allocated to the United States Marine Corps, the actual tests were conducted at approximately 27 megacycles which it will be appreciated is within a less stringently regulated citizen's band. As discussed hereinafter, the output of the amplifier 62 is fed to the bus bars 48 and 50 by means of their respective leads 64 and 66. Due to the variable composition of the saline water being introduced by the pump means 26 the power output of the radio amplifier 62 is empirically determined by gradually increasing the power output until conventional analytical chemical monitoring of the gaseous effluent of the treating zone 22 discharging through the outlet 74 indicates the presence of the initial component to be dissociated which in this instance generally comprises hydrogen gas. It will thus be seen that the saline water is treated at a pulse beat audio frequency of 384 cycles per second in the pre-treating zone 20 passes through the apertures 18 in the bulkhead 16 wherein the mechanically energized saline water travels downwardly between the respective electrodes 44 and 46 and the combined effect of the audio frequency energy imparted to the water in chamber 20 which it is theorized is somehow "coupled" with the radio frequency imparted to the liquid medium traveling through the treating zone 22 effects dissociation of the liquid medium whereby the potential established between the electrodes 44 and 46 acts to collect the respective components dissociated. As indicated hereinabove the hydrogen, for example, is evolved in a gas fraction for subsequent collection, compression and condensing in the apparatus 80. Furthermore, as the power output of the radio amplifier 62 is increased and monitoring of the system indicates that the desired component has become dissociated, the power amplification of the radio frequency input to the treating zone 22 is maintained at a constant level while the volume of saline water being introduced to the pretreatment zone 20 by the pump 26 is maintained at uniform flow whereby monitoring of the liquid medium in the treating zone 22 by an electrical meter, not shown, indicates that a minimal potential is present in the treating zone. It will be appreciated that the presence of a minimal potential indicates that there is a nearly complete removal of elements from the saline water that permit the establishment of the potential between the respective electrodes 44 and 46. It will be apparent that the treating apparatus 10 is preferably operated in a continuous manner. However, it will also be appreciated that if so desired the treating apparatus 10 could be operated in a batch manner wherein subsequent to loss of conductivity in the treating zone 22 the liquid therein would be drained and replaced by additional amounts of liquid medium to be treated introduced through the pre-treatment zone 20. Liquid effluent leaving the treating zone 22 through the conduit 70 may if desired be subjected to the auxiliary filtration apparatus 100 wherein the diamond steel mesh 144 has a radio frequency value imposed thereon, it having been found unnecessary to reapply the pulse beat audio frequency which is carried over in the liquid medium so as to keep the outer membrane 112 free from any sludge carried over and repel sodium and chlorine whereby only pure water passes through to the interior 118 of the steel cylinder 106. The vacuum pump means 124 accordingly withdraws purified water from the interior of the tank 106.

EXAMPLE II

The method set forth in Example I was again carried forth utilizing saline water as the medium to be treated with the exception that the treatment was by association of the colloidally dispersed noble metals consisting of gold, silver, mercury, platinum, palladium, iridium, rhodium, ruthenium and osmium, as well as iron and magnesium and to effect dissociation of carbon, therefore bringing about the degradation of the carbon compound in the saline water. In carrying out the dissociation of this example the audio frequency input to the transducer 30 consists solely of the output of audio generator 34, which as indicated heretofore, generates a harmonic audio frequency of 256 cycles per second. The over-all operation of the treating apparatus 10 and the ancillary
treatment means 80 and 100 was the same as set forth with regard to Example I.

EXAMPLE III

In still another test involving the utilization of the treatment apparatus 10 to carry forth the method of the present invention substantially treated sewage, comprising a mixture of industrial and domestic sewage obtained from a municipal sewage plant, was treated by introducing the sewage into the pre-treatment chamber 20 wherein mechanical energy was imparted thereto by subjecting the influent to a resultant beat pulse of 384 cycles per second to the transducer 30 which beat pulse was a resultant of the combined outputs of audio generators 32, 34 and 36 operating at 341/2, 256, and 426/3 cycles per second respectively combined into a beat pulse and amplified by the audio frequency amplifier 38. As in Example I, the negative electrodes 44 and positive electrodes 46 had a D.C. potential applied thereacross through the paired leads 58 operatively and conductively connected to a source of D.C. current as discussed hereinafter and wherein the positive lead 66 of the radio frequency amplifier 62 was connected to the bus bar 50 and the negative lead 54 from the radio frequency amplifier 62 connected to the bus bar 48. For test purposes only a frequency of 27 megacycles was used. From the foregoing it will be seen that the operation of the treating apparatus 10 for the treatment of sewage is substantially the same as that utilized in Example I for treating industrial and domestic sewage so that the description thereof and/or separate recovery of several other components thereof. However, to effect dissociation of the organic compounds, i.e. the bulk of the contaminants in sewage and including viable dormant bacteria, the radio frequency polarity reversing switch operatively interposed in the output leads 64 and 66 of the radio amplifier 62, is utilized to reverse the polarity of the radio frequency energy applied to the bus bars 48 and 50, and thus the electrodes 44 and 46. The reversing was carried out at a low rate, i.e., a few times per minute, whereby the liquid effluent leaving the treatment zone 22 through the discharge conduit 70 had an exceptionally low B.O.D., only a trace of settleable solids and actually exhibited an increase in dissolved oxygen apparently due to liberation of oxygen from the organic compounds dissociated. The effluent also had an extremely low density of coliform organisms per unit of effluent. It will be appreciated of course that with the utilization of a relatively simple treating apparatus as shown herein the device would of necessity have to be shutdown periodically to remove the carbonaceous precipitate resulting from the dissociation of the organic compounds, which precipitate will eventually bring a halt to the dissociation action within the treating zone 22. When treating sewage in the aforementioned manner, it has also been found to be desirable to operate the harmonic frequency-osmotic filter means 100 to insure removal of any minute amounts of sludge, i.e. carbonaceous material, carried over from the primary treating zone 22. In such case, the harmonic frequency-osmotic filter means 100 is operated substantially as set forth hereinafter to effect final filtration of the effluent of the primary treating zone 22.

Thus, from the foregoing it will be understood that the method of the present invention apparently permits the coupling of a key harmonic frequency or key harmonic frequencies to a radio frequency carrier in a liquid medium simultaneously subjected to a D.C. potential wherein the dissociation of elemental components contained in the liquid medium may be readily effected.

The foregoing is considered as illustrative only of the principles of the invention and since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A method for dissociating components in a predetermined medium within a treating zone comprising the steps of: establishing a D.C. potential within the treating zone; superimposing oscillating electrical energy on said potential at a radio frequency value; and imparting mechanical energy to the medium entering the treating zone at an audio oscillating frequency.

2. The method of claim 1 wherein said audio oscillating frequency is 256 cycles per second.

3. The method of claim 1 wherein said audio oscillating frequency is 30 cycles per second.

4. The method of claim 1 including the step of: reversing the polarity of said potential relative to the superimposed electrical energy at a rate less than the audio frequency of the mechanical energy.

5. The method of claim 1 including the step of withdrawing gases released in the treating zone from the medium.

6. The method of claim 3 wherein said audio oscillating frequency is 256 cycles per second.

7. The method of claim 5 wherein said audio oscillating frequency is 30 cycles per second.

8. The method of claim 1 including the step of filtering the medium after withdrawing from the treating zone.

9. The method of claim 8 including the step of: reversing the polarity of said potential relative to the superimposed electrical energy at a rate less than the audio frequency of the mechanical energy.

References Cited

UNITED STATES PATENTS

2,085,711 6/1937 Biesmann.
2,555,103 2/1952 Fitzgerald ------------ 210—19 X
2,861,932 11/1958 Pohl ----------- 204—273 X
2,907,455 10/1959 Sasaki ----------- 210—19 X
3,206,397 9/1965 Harvey ----------- 210—19 X
3,266,631 8/1966 Snaper ----------- 210—19 X
3,394,666 12/1966 Wiersma ----------- 204—228

ALLEN B. CURTIS, Primary Examiner

U.S. Cl. X.R.

204—149, 152, 273; 210—19