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MAY 18, 1943.
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APPARATUS FOR THE ELECTRONIC TREATMENT OF LIQUIDS
Filed June 15, 1940

Serial No.
340,856
4 Sheets-Sheet 1

Fig.1

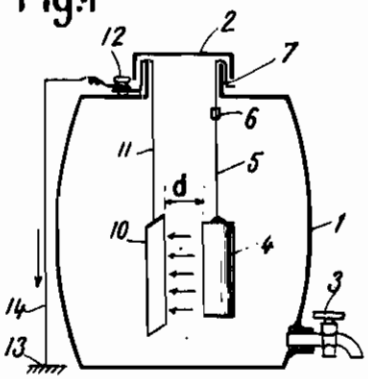

Fig.2

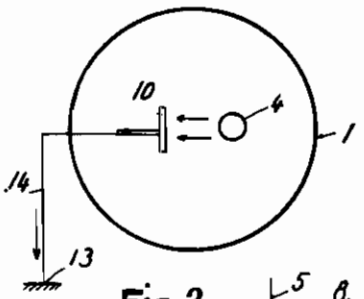

Fig.4

Fig.5

Fig.3

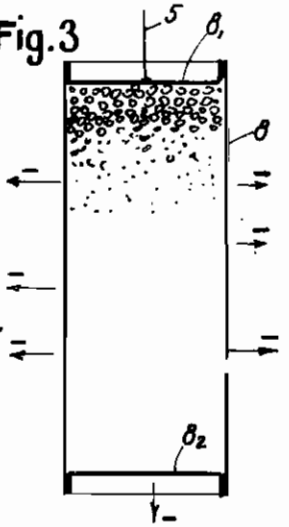

Fig.6

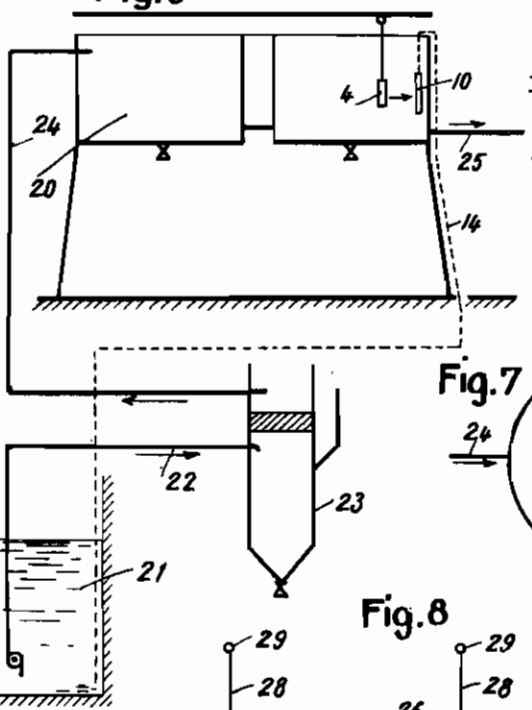

Fig.7

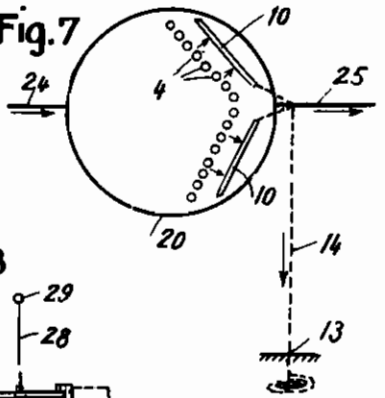

Fig.8

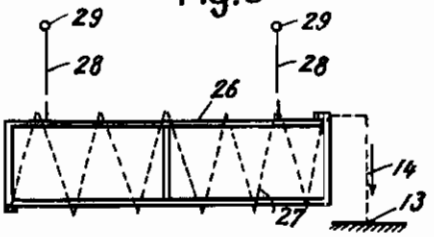

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Fig. 9

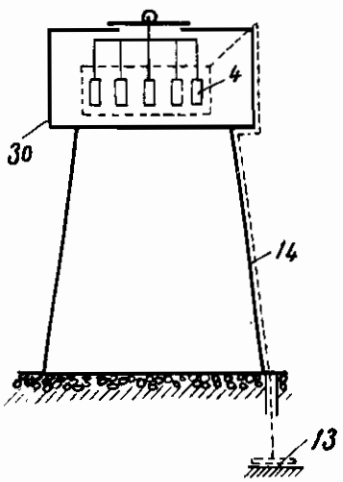
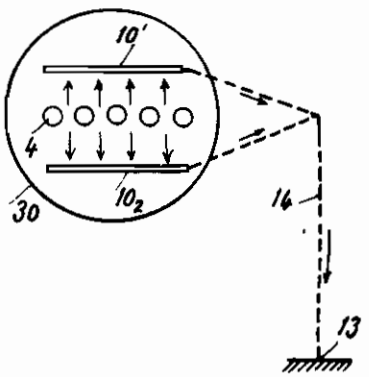


Fig. 10



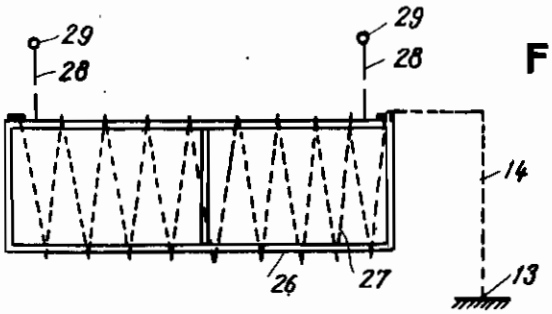


Fig. 11

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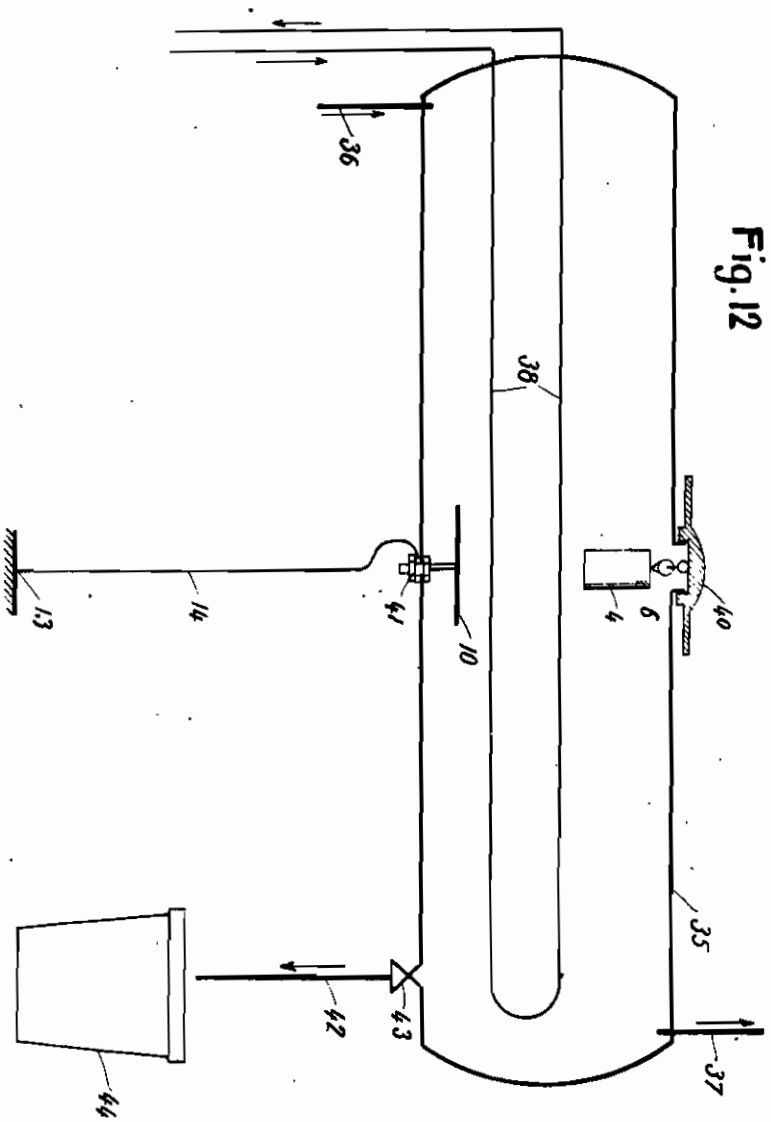

Fig. 12

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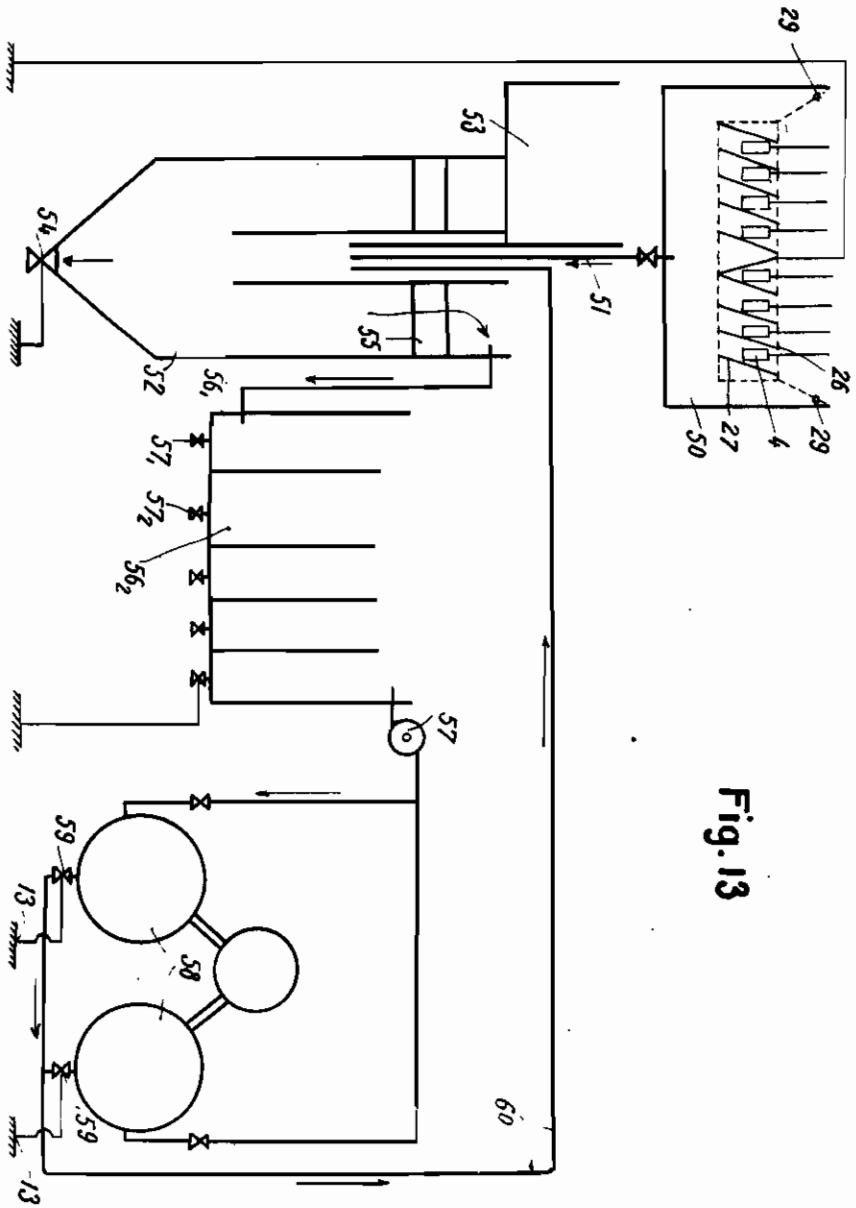

Fig. 13

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APPARATUS FOR THE ELECTRONIC TREATMENT OF LIQUIDS

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The object of the present invention is to provide apparatus for the treatment of liquids by electronic means with a view to accelerating the precipitation of certain impurities, without the invention of the vessel containing the liquid, this vessel admitting of being made of any material, for instance, glass.

Apparatus and plant enabling the aforementioned object to be attained exhibit the characteristics set forth in the ensuing description and more particularly defined in the claims appended thereto.

Installations according to the invention are illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view of a glass vessel provided with a device according to the invention:

Figure 2 is a plan view of this device.

Figure 3 is a section of the emitter of the installation shown in Figures 1 and 2.

Figures 4 and 5 are explanatory diagrams of the electrostatic phenomena that occur in the installation shown in Figures 1 and 2.

Figure 6 shows in sectional elevation a water chamber or column provided with the device according to the invention.

Figure 7 is a plan view of this water chamber.

Figure 8 is a view on a larger scale of a grid mounted in this water chamber.

Figures 9 and 10 are views in elevation and in plan respectively of another water chamber or column according to the invention.

Figure 11 shows in elevation a grid mounted in the installation of Figures 9 and 10.

Figure 12 shows in sectional elevation a vessel with rounded ends containing hot water and provided with the device according to the invention.

Figure 13 is a diagram of another installation according to the invention.

The plan illustrated in Figures 1 to 5 comprises a glass vessel 1 with a removable cover 2 and an outlet cock 3 for the treated water.

An electron emitter 4 is suspended by a wire 5 through the medium of an insulator 6 from the neck 7 at the top of the vessel.

This electron emitter, which is carried to a potential V, may be of any convenient type, and in particular it may be constituted, as indicated in detail in Figure 3, by a casing 8 having a certain coefficient of absorption which depends upon the nature and mass of the casing itself. Hence this casing acts as a wire-drawing cell according to the emissions desired.

This casing contains a roasted and absorbent vegetable product, such as wood charcoal, this vegetable product being impregnated with an organic liquid, for instance ethyl alcohol extracted from garlic.

The mass of vegetable product thus constituted is held in place by two covers 8_1 and 8_2, which grip this mass between them and are soldered to the casing 8.

The mass as a whole, thus constituted, is initially charged with negative electricity, so that the whole of the mass is carried to a substantial potential V.

On the other hand a screen grid 10 is immersed in the liquid facing the emitter 4. This grid may consist for example of a plate of highly conductive metal. In this way a screen is obtained, which, owing to its conductivity and its coefficient of absorption, can be traversed by the electrons, thereby justifying the description of it as a grid.

The grid 10 is suspended from the neck 7 of the vessel 1 by a wire 11, which in its turn is attached to a connecting strip 12, which is earthed at 13 by a wire 14 of metal having a very low resistance, such as a copper. It will obviously be an advantage to construct the connections 11 and 14 by the use of a wire of minimum specific resistance, such as a wire of drawn copper, the specific resistance of which is about 1.6 microhms per square centimeter.

Similarly it is advantageous, in order to reduce the resistance of the connections 11, 12 and 14, to arrange the vessel 1 as close to the ground as possible, in order to reduce to a minimum the length of the connecting wires 11, 12 and 14.

Finally, it is very important to select moist vegetable mold, this moisture being due to the quality of the ground itself. Copper wires embedded in the ground to depths of from 1 to 5 metres may for example be employed.

The various conditions mentioned above cooperate with one another to bring the screen grid 10 to a potential very close to the zero potential of the earth. The potential difference between the emitter 4 and the grid 10 is therefore substantially equal to the potential difference between this emitter and the earth.

In this way a very active emission of electrons are obtained from this emitter to the grid through the liquid mass.

The electric field thus constituted in the interior of the mass of liquid augments the force of repulsion of the electrons arranged around each atom, so that these electrons move further away from one another, thereby modifying the architecture of the atom. The electrostatic phenom-

enon thus produced is clearly illustrated in Figures 4 and 5, which represent the atom and its rampart of electrons, before and after the treatment of the liquid mass by means of thc emitter and grid.

Under this electrostatic action certain impurities will be precipitated from the molecular mass of the liquid and will thus be able to be eliminated.

It will obviously be possible to regulate at will the distance between the emitter **4** and the grid **10** according to the conductivity of the liquid treated and to the potential difference between the emitter **4** and the screen grid **10**. The electromotive force E between this emitter and this grid is inversely proportional to the square of the distance *d* between them.

It is obvious that dissociation effects of the components of the water will be obtained, these effects being the more active as the energy of the electrified particles itself becomes greater. These dissociation effects will therefore be accelerated as a function of the mass and of the velocity of these electrified particles, in accordance with the known law E=mv, in which E represents energy of the electrified particles, *m* represents their mass, and *v* represents the velocity of these particles.

In order to investigate the results obtained with the water treated, the operation may for example be carried out in the following manner:

1 cubic centimeter of a 4% solution of sodium oxalate is precipitated in 50 cubic centimeters of raw water before treatment. After precipitation, decantation and filtering the hydrobimetric titre is taken. The same procedure is followed with the same quantity of water after treatment, and this water should exhibit a titre about 12% lower. This difference in hydrobimétrique titre arises from the acceleration of the precipitation occasioned by a rise in the electric field, causing an augmentation of the phenomena of repulsion of the electronic rampart of the atom, as explained above with reference to Figuers 4 and 5.

When the vessel has contained for some hours water treated by means of the plant described above, it is necessary, if this apparatus is to be used again, to discharge the energy that it has accumulated. For this purpose, in the case of laboratory apparatus, the apparatus will be immersed in a bath of raw water in lost circuit for a period of a least 48 hours, in order to obtain the maximum dissipation of the energy accumulated by the glass or metal of which this apparatus is composed.

In a laboratory installation or in an industrial plant, notwithstanding all the precautions taken, the dissipation of energy to the ground is not always suitably affected.

The local influence of the earth's magnetic field may cause this coefficient of dissipation to vary, and at the end of a certain time it is noticed that the action of the process is ceasing.

There is an accumulation of energy upon the screen grid and upon the glass or metallic masses of the vessels. A couple is established which diminishes the electromotive force owing to an insufficient loss of energy. It is necessary at this stage to discontinue the treatment in order that the low potential of the untreated liquid may permit the energy accumulated by the masses of the vessel to restore this energy to the untreated liquid. This discontinuance of the treatment always lasts from 10 to 15 days, but the process does not cease to act in consequence; it merely acts in the opposite direction.

In point of fact, the metallic masses restore their energy to the untreated liquid, and the dissociation phenomènon continues as during the emission of electrons.

Numerous modifications may be made in the plant that has been described above by way of example.

In particular, Figs. 6, 7 and 8 represent a water chamber or column **20** in which is mounted an installation according to the invention comprising an emitter **4**, a grid **10** and connections **14**, these connections **14** extending down into a well **21**, and ensuring very effective earthing.

The raw water is drawn up from this well through a pipe **22** and is thus passed into a first purifier **23**, and from there is passed through a pipe **24** into the water column, in which it undergoes the electrostatic treatment described abovc.

The emitters **4** may advantageously be arranged in the form of a letter V, as shown in Figure 7, the grids **10** being placed facing these rows of emitters.

The water thus treated is charged with electrons and conveyed through a pipe **25** to the piping that it is desired to treat.

Figure 8 illustrates the construction of the screen grid of large dimensions utilised in the plant shown in Figures 6 and 7. This screen grid consists of a frame **26**, of wood or other material, about which is wound a copper wire **27**, which is earthed at **13** through the connection **14**, while the frame **26** as a whole is suspended by a wire **28** from insulators **29**. In this way a screen grid of very large surface area is obtained, which consequently acts effectually in water chambers of very large dimensions.

Figures 9 and 10 also illustrate a water chamber or column **30** provided with an installation according to the invention. This installation comprises emitters **4** which are arranged between two screen grids 10_1 and 10_2 which are earthed at **13** through the conductor **14**. The grid is in this case constructed in the manner indicated in Fig. **11**, according to a principle which exactly agrees with that already described with reference to Figure 10, comprising therefore a wooden frame **26**, a copper wire **27** wound on to this frame, a copper wire **14** for establishing an earth connection at **13**, and a suspension wire **28**, with insulator **29**.

Finally, Figure 12 illustrated an installation comprising a round ended hot water tank provided with a device according to the invention. This plant included a tank **35**, which receives cold water at **36**, and distributes hot water at **37**. The heating of the mass of water is effected by a nest of tubes **38** supplied with low pressure steam.

The emitter **4** and the grid **10** are arranged one on eaeh side of the nest of tubes **36**. This emitter is suspended from a cover **40** through the medium of an insulator **6**. The grid **10** is connected through a nut **41** and a copper wire **14** to earth at **13**. A pipe **42** connected to a drain cock **43** enables the residues decanted in the interior of the tank **35** to be discharged into a bucket **44**.

The functioning of the plant as a whole represented in Figure 12 is just like that described with reference to the preceding schemes.

The electrostatic dissociation effects obtained by means of the apparatus according to the invention may be combined with chemical reaction

effects, the combination of these means accelerating the said chemical reactions.

Figure 13 illustrates an installation comprising this combination.

This installation includes a tank **50**, in which are immersed eight emitters **4** and a screen grid, which may for example be similar to that shown in Figure 8 and described with reference to that Figure. The liquid, the potential of which has been raised under the action of the electrostatic energy brought into play, flows from the tank **50** through a pipe **51** into a purifier **52**. This purifier receives from some other source a reagent such as sodium carbonate, supplied by a measuring device **53**.

As explained above, the electrostatic energy accelerates the reaction and the precipitation of the separate products. The precipitates are discharged through a drain cock **54**, which is earthed at **13**. The liquid thus purified traverses in an upward direction a filter **55**, and is poured out into decantation troughs 56_1, 56_2 and so forth, which are provided with drain cocks 57_1, 57_2 and so forth.

The water thus purified is delivered by a pump **57** into a boiler **58**. This water, still charged with electrostatic energy, gives up this energy little by little to the metallic walls of the boilers, which are carefully earthed at **13**. In consequence of this the coatings adhering to the internal surface of the boiler are detached, converted into pulverulent mud, and discharged through drain cocks **59**. In this way any excessive concentration of salts in the boiler is prevented.

The water leaving the boiler and still containing the caustic soda formed by hydrolysis in the boiler is passed through a pipe **60** into the purifier **52**, in which it precipitates various products, particularly salts of magnesium, and therefore the excess carbon dioxide entrained by the soda is liberated in the purifier.

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