ELECTRICAL TREATER METHOD

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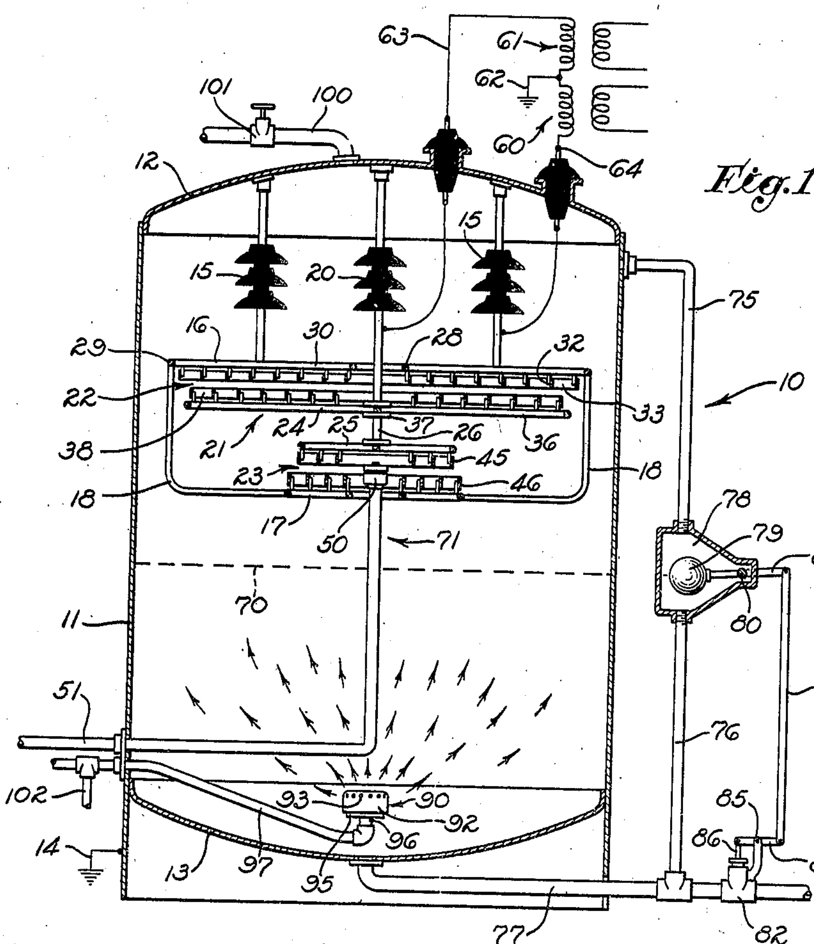

Fig. 1.

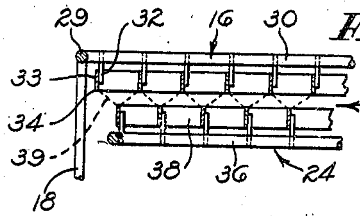

Fig. 2.

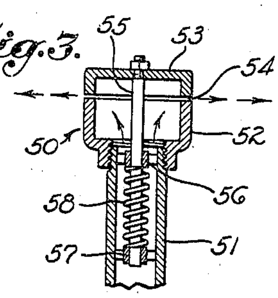

Fig. 3.

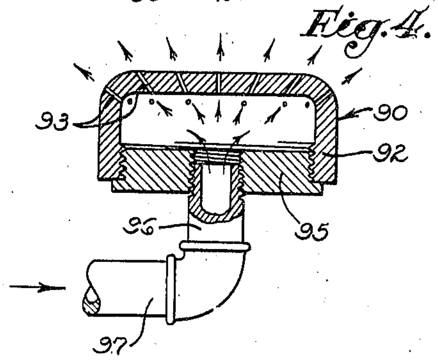

Fig. 4.

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ELECTRICAL TREATER METHOD

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10 Claims. (Cl. 204—190)

This invention relates to the general problem of separating liquids of different densities, and is more particularly concerned with a method and apparatus for the resolution of dispersions and emulsions such as crude oil emulsions by electrical treatment and settling.

An emulsion or mixture having a non-conducting liquid as the external or continuous phase may be subjected to the action of high tension electric fields to induce coalescence of the dispersed phase. By such treatment water-in-oil emulsions may be resolved, and typical examples of such use are the dehydration and desalting processes as applied to crude petroleum, whereby dispersed connate or added water is separated from the petroleum.

Separation as induced by this type of treatment normally involves coalescence of the dispersed droplets under the action of the electric field to form larger masses, and the separation of the coalesced masses by means dependent on the difference in density of the coalesced masses and the non-conducting external phase, such as gravitational settling. There are also actions of the electric field other than coalescence which promote separation. For example, it has been found that particles of the same size settle more rapidly after treatment than before, possibly due to coalescence during settling and subsequent to the action of the electric field. The degree or rate of coalescence or separation obtained is more or less dependent on the voltage used, but the use of very high voltages has hitherto been subject to the danger of short-circuiting by arcing or the formation of conducting chains through the mixture being treated.

It is an object of the present invention to provide an electrical treater and method in which high voltages may be used without undue danger of short-circuiting.

It is furthermore an object of the present invention to provide an electric treater in which the emulsion to be treated may be introduced into the treater through a grounded connection into a field generated by a substantially higher potential than exists between any of the live electrodes and ground.

I find that water-in-oil dispersions are best treated initially in a horizontally extended field between vertically spaced electrodes. During or immediately following such treatment gravitational separation begins to take place. In the case of oils lighter than water, the dispersed water particles following the initial electrical treatment tend to settle downwardly, while the oil tends to rise. The opposite direction of settling of course obtains if the oil is heavier than water. In either case I find that it is advantageous to subject the gravitationally separating streams, one or the other or both, to the action of auxiliary or secondary electric fields prior to the complete coalescence of the streams into a body of separated oil or a body of separated water as the case may be.

It is accordingly an object of the invention to provide vertically spaced electrode structures adapted to form auxiliary or secondary treating fields in the regions in which the water and oil are gravitationally separating.

I find that it is particularly advantageous to subject the settling water particles to a field having its origin in a potential difference maintained between the body of separated water and an electrode immersed in the as yet incompletely coalesced mixture, preferably one of the main treating electrodes. I find it convenient to maintain the body of separated water at zero or grounded potential and to maintain the electrode cooperating with said body of water to form the secondary treating zone at a potential substantially different from ground or zero potential.

It is accordingly an object of the present invention to provide an electric treater having electrode means in which a secondary or auxiliary treating field is maintained between the body of separated water and an electrode comprised in said electrode means and situated in the incompletely separated mixture.

I have furthermore found that it is advantageous to introduce the emulsion to be treated in a region intermediate the main vertically spaced electrodes by means maintained at a potential intermediate that of the electrodes so that the character of the gradient between the electrodes is not materially or substantially changed by the interposition of such emulsion introducing means.

It is accordingly an object of the present invention to provide a means and method for the introduction of emulsion intermediate vertically spaced electrodes maintained at different potentials at a potential intermediate the potentials of the electrodes.

It is furthermore an object of the present invention to provide a novel electrode structure comprising two pairs of vertically spaced electrodes with novel electrical and structural connections therebetween for use in electric treaters of the type described.

Following or during coalescence, the masses of water settle out from the body of oil or mixture to form a separate body of completely coalesced water. Frequently the body of water thus formed contains droplets of oil. The entrainment of oil by the water may arise from a variety of causes, such as insufficient settling, the formation or presence of oil-in-water emulsion, the growth of an emulsified cuff at the interface of the oil and water bodies, or the like. Whatever the cause, the presence of oil in the water bleed from the separator is objectionable, since the disposal of such "dirty" or "cloudy" bleed water is troublesome and since, furthermore, an actual loss in oil is thereby suffered.

It is an object of the present invention to clarify the settled body of water obtained by electric resolution of emulsions, and to remove therefrom entrained oil droplets.

It is furthermore an object of the present invention to provide means and method for inducing currents in the settled body of water whereby the water is swept free from oil and the oil returns to the zone of the auxiliary treating field.

It is furthermore an object of the present invention to provide means and method for coalescing entrained oil particles in the separated water, whereby the oil is massed into particles of sufficient size to float or sink (depending on the relative density) from the water to the interface. It is furthermore an object of the present invention to provide means for such coalescence comprising means for mild agitation of the water, or for changing the temperature of the water, or for changing the composition of the water, or for setting up directed currents in the water, or for introducing de-emulsifying or coalescence-promoting chemicals to the water, or for introducing material favoring coalescence by reason of its physical or chemical nature or the amount and direction of its momentum.

It is furthermore an object of the present invention to provide means and method for returning entrained oil to the interface, such means comprising means for introducing material such as water, or liquids with densities not far removed from that of water, to the body of separated water in such manner that streams thereof move in the direction of the interface in transporting or conveying relationship with entrained oil. Water which is substantially free of oil is preferred.

It is furthermore an object of the present invention to provide an electric field resident in the oil phase or oil-continuous phase adjacent the interface between the oil-continuous phase and the body of separated water, which field cooperates with the above mentioned sweeping, coalescing, or returning means, particularly by its effect on oil droplets returned to the interface by the latter means, in promoting the transfer of such oil droplets across the interface, and in coalescing the oil droplets with the body of oil. It is furthermore an object of the invention to provide a field of the type described which facilitates the passage of both dispersed oil and water droplets across such an interfacial boundary into the phase continuous for the drop concerned, and which in general tends to prevent the formation or accumulation of coarse emulsions or cuffs at the interface.

Further objects and aspects of my invention will be apparent in the following part of the specification.

Referring to the drawing:

Fig. 1 is a vertical sectional view of the preferred form of my electric treater.

Fig. 2 is an enlarged fragmentary view of the upper and intermediate electrode structures.

Fig. 3 is a sectional view of the discharge head which feeds the emulsion into the electric field.

Fig. 4 is a sectional view of a spray head for the introducing of rising liquid masses into the body of separated water.

The details of one type of treater which I have found particularly advantageous are shown in Fig. 1. Referring to this figure, this treater 10 provides a tank 11 including a top member 12 and a bottom member 13, this tank being grounded as indicated by the numeral 14.

Suspended from insulators 15 is a live electrode means shown as including an upper live electrode 16 and a lower live electrode 17, the latter being supported from and electrically connected to the upper live electrode 16 by rods 18.

Suspended from an insulator 20 and positioned between the upper and lower live electrodes 16 and 17 is an intermediate live electrode structure 21 cooperating respectively with the electrodes 16 and 17 in providing an upper treating space 22 and a lower treating space 23. I prefer to form the intermediate electrode structure 21 of two electrodes 24 and 25 connected by a support 26.

The electrodes 16, 17, 24, and 25 are preferably interstitial in character. A form of construction which I have found particularly desirable is illustrated in Figs. 1 and 2. Referring to the electrode 16, this electrode is shown as including a plurality of inner and outer rings 28 and 29 between which extend rods or pipes 30. Pins 32 depend therefrom and carry a plurality of concentric rings 33 each of which provides a lower edge 34 adjacent which the electric field is very concentrated.

The electrode 24 is similarly formed with rods or pipes 36 extending outward from a support 37 and carrying upward-extending pins which in turn mount a plurality of concentric rings 38. The rings 38 are preferably disaligned from the rings 33 so that the most intense portion of any electric field established in the treating space 22 is inclined as indicated by dotted lines 39 in Fig. 2. Such an edge-to-edge field is very effective.

The electrode 25 is formed similarly to the electrode 16 and provides downward-extending rings 45. Similarly, the electrode 17 is formed similarly to the electrode 24 and provides upward-extending rings 46 so that a field is established in the treating space 23 similar to that previously described in the treating space 22. I have found it preferable to form the electrodes 17 and 25 of smaller diameter than the electrodes 16 and 24.

This type of electrode structure presents a minimum impedance to gravitational separation in the tank 11, the rings and the supporting means therefor covering only a small fraction of the total cross-sectional area of the tank. Further, the interstitial nature of these electrodes permits free communication between the electric fields and facilitates rapid removal of coalesced water masses therefrom.

Various means may be utilized for energizing the electrodes to establish electric fields in the treating spaces 22 and 23. All of these electrodes are live, the only grounded portions being the tank and the emulsifying distributor means 50, the latter discharging directly into the treating space 23 to move the emulsion outward therein and successively through the edge-to-edge fields. By proper design of the electrical system, the potential between the intermediate electrode structure 21 and the electrodes 16 and 17 can be made much higher than the potential between any of the live electrodes and ground. In Fig. 1 such a system is shown as including two transformers 60 and 61 connected in additive relation. In this connection one terminal of each secondary winding is grounded as indicated by the numeral 62, the high tension terminal of the transformer 61 being connected by a conductor 63 to the intermediate electrode structure 21, and the high tension terminal of the transformer 60 is connected by a conductor 64 to the upper and lower live electrodes 16 and 17. Suitable switches and control means limiting the current to the primaries of these transformers may be utilized, such means being well known in the art of electric dehydration of emulsions.

Assuming, for instance, that each transformer develops a potential of 12,000 volts, the potential across the upper treating space 22 will be 24,000 volts, as will also the potential across the lower treating space 23. However, the potential between the emulsifying distributor means 50 and the electrode 25, or the electrode 17, will be only 12,000 volts. Use of such a system tends to prevent short-circuiting to the emulsifying distributor means 50 and also permits introduction of the resulting mixture directly into a field of high voltage.

Under certain circumstances it may be desirable to introduce the emulsion at other than a grounded potential. Under these conditions, I still prefer to control the potential concerned so that the potential of the introducing means is intermediate that of the two electrodes forming the primary treating field, and preferably at a potential causing as little disturbance as possible to the gradient between the two treating electrodes. By maintaining the emulsion introducing means at a potential at or near the potential corresponding to an unperturbed field potential of the electrodes at the point or region occupied by the emulsion introducing means, I am able to maintain a maximum gradient throughout the treating space with no danger of shorting due to high local gradients such as would occur in the neighborhood of an emulsion introducing means maintained at a potential other than said intermediate potential. Further advantages arise from the fact that the emulsion itself is introduced into the treating space at a potential corresponding to the unperturbed potential of the field whereby I find I obtain more advantageous treating effects.

I am not prepared to explain the exact theory of this effect, which apparently involves not only the fact that the field is not perturbed, but also the fact that the emulsion is directly submitted to a field extending through and beyond the region occupied by the introduced emulsion and having a component in a direction parallel to the direction of settling, i. e., in a vertical direction.

I may use various means for introducing the emulsion to the primary treating field, although I find the emulsion distributor illustrated in Fig. 3 gives excellent results. Referring to this figure, it will be noted that the pipe 51 carries a primary member 52 which cooperates with a secondary member 53 in forming an annular discharge passage 54. It is often possible to movably mount the secondary member 53, resiliently moving it toward the primary member 52 so that the size of the annular discharge passage 54 is dependent upon the quantity of the mixture moving through the pipe 51. In accomplishing this result, the secondary member 53 may be provided with a pin 55 guided in a spider 56 and carrying a spacer 57 at its lower end. A compression spring 58 is disposed between the spider 56 and the spacer 57 and serves to resiliently move the secondary member 53 downward. When no liquid is moving through the pipe 51, the members 52 and 53 will be in contact, but as soon as a flow is established, the pressure will force the secondary member 53 upward a slight distance to open the annular discharge passage 54 in degree proportional to the quantity of liquid to be discharged.

While satisfactory results can sometimes be obtained by maintaining substantially atmospheric pressure in the treater 10, better results have been obtained by maintaining therein a pressure of from five to twenty-five pounds per square inch. Such a back pressure may be suitably maintained by appropriate throttling of the draw-off valve 101 on the treated oil line 100.

The action of the electric fields is to coalesce or prepare for coalescence the water particles of the mixture, which are thereby formed into masses of sufficient size to gravitate from the oil. Thus, after the treater has been in operation for a period, the upper end of the tank 11 will contain the treated oil and the lower end of the tank will contain a body of separated water. The body of water will separate at a rather definite surface or level indicated in Fig. 1 by the numeral 70. It is desirable to control this level to prevent grounding of the electrode 17 and to control the strength of the lower auxiliary treating field. For example, it will be apparent that an electric field will be established in an auxiliary treating space 71 between the lower live electrode 17 and the body of water in the bottom of the tank 11. If the level 70 is carried too high, this auxiliary field may short out. If the level 70 is brought too low, the gradient through the field becomes too low to afford proper treating characteristics. With proper control of the level 70, this auxiliary field can be utilized to further treat the settling water particles and can be used to break an inverse-phase or reverse-phase emulsion, as will be hereinafter described.

To control the water level in the tank 11, I have shown an automatic system including a pipe 75 communicating with the upper part of the tank 11 and a pipe 76 communicating with a water draw-off pipe 77 which opens on the lower end of the tank 11. The pipes 75 and 76 communicate with a float chamber 78 in which the oil and water are in surface contact at a level corresponding to the level 70. A properly balanced float 79 is disposed in the chamber 78, being so formed as to float in water and sink in oil. The position of this float will thus change in response to changes in the level 70. This float may be pivoted on a pin 80 connected to an arm 81 which is connected to a valve 82 in the pipe 77 by any suitable means such as a link 83 connected to an arm 84 of the valve 82 pivoted at 85 and operatively connected to the stem 86 of this valve. If the water level rises, the valve 82 will thus be opened a further distance to drain additional quantities of water from the tank 11 and thus maintain the water level constant. Various other systems for controlling the position of this water level may be utilized without departing from the spirit of the present invention.

I have found that in many instances there is a tendency for the settling coalesced water masses to carry downward therewith particles of oil. This is not conducive to a clean separation, and, if allowed to continue, will result in contaminated water bleeds, the oil being carried downward into the body of water in the bottom of the tank. I have found that this action can be corrected by moving masses of water upward through the body of water to sweep out any oil present and prevent downward movement of oil toward the water draw-off pipe 77.

A system which I have found very satisfactory in this regard is illustrated in Figs. 1 and 4. Disposed above and in protecting relationship with the water draw-off pipe 77, I illustrate a multi-orifice discharge head 90. This head may be formed of a cap 92, best shown in Fig. 4, and provided with a plurality of orifices 93 formed to direct water upward and outward. Certain of these orifices may be vertically disposed, though best results are obtained if other orifices are angularly disposed relative to the horizontal. A plate 95 closes the cap 92 and receives a pipe 96 to which water is delivered by a pipe 97. The incoming water is thus sprayed into the body of water in the lower end of the tank 11 to form water masses which slowly rise toward the surface 70 due to the inclined nature of the orifices or to thermal action or to a difference in density if the incoming water is fresh, or to various combinations of these factors. A desirable thermal effect is obtained by delivering to the pipe 97 water which is slightly hotter than the water in the bottom of the tank 11. If desired, chemical agents may be delivered through pipe 102 to the stream of water flowing in pipe 97.

The action of these rising water masses is in part to sweep from the body of water in the bottom of the tank 11 any oil or reverse-phase emulsion. The upward movement of the newly added water particles moves such a reverse-phase emulsion toward the surface 70 and thence into the auxiliary electric field 71 in which such an emulsion is separated.

A number of effects actually arise from the introduction of water as above described or from the use of similar means, one of which is to cause a mild agitation of the separated water which is conducive to coalescence of the dispersed oil droplets therein. Mild agitation such as is afforded by the water spray or by other equivlent means for setting up relatively slowly moving currents in the body of water, serves to increase the frequency of encounter between the dispersed particles and is thereby conducive to coalescence and at the same time is sufficiently mild to prevent any redispersion as by shearing and disruption of oil particles. Following coalescence the oil droplets are of sufficient size to gravitationally separate from the water, floating or sinking, depending upon their density, back to the interface between the separated water body and the oil-continuous phase.

I may also promote coalescence of the dispersed oil particles in the separated water by changing the temperature of the water, for example by adding warmer water thereto, as illustrated. The effect of increased temperature is in general to decrease the stability of the films around the oil droplets and thereby to promote coalescence.

I may also change the composition of the water in such a fashion as to decrease the stability of the dispersed oil droplets, and thereby induce coalescence. For example, as illustrated, I may add fresh water to the body of more or less saline separated water, thereby decreasing the salt content of the latter. This is of particular advantage where the dispersed oil droplets have been stabilized by adsorption of certain ions at the interface, for in such circumstances the dilution of the aqueous phase serves to remove or redissolve the adsorbed ions, and thus to decrease the stability of the dispersion and thereby to induce coalescence.

Under other circumstances, dependent to a large extent on the character of the oil and water dispersion being treated, I find it advantageous to cause the adsorption of de-emulsifying agents at the interface, such agents being of the type adapted to reduce the stability of the dispersion and to promote coalescence. I may introduce such chemical agents directly to the body of separated water, or I may add them thereto as aqueous solutions or dispersions, depending on their solubility, such solutions or dispersions, for example, being conveniently added through a water spray of the type described for adding water to the separated body of coalesced water.

A large variety of chemicals are adapted to promote coalescence of the oil droplets as above described. For example, I may add salts, particularly polyvalent salts, which provide ions preferentially adsorbed at the interface and carrying a charge opposite to the charge of the dispersed oil particles. Such salts may be even of the same type as present in the naturally separated water, but which at a greater concentration serve to de-emulsify rather than stabilize the dispersion of oil in water.

A wide variety of organic de-emulsifying agents may be used also for this purpose, particularly salts, esters, and other derivatives of fatty acids or modified fatty acids. Particularly desirable results have been obtained by the use of a chemical de-emulsifying agent which is both oil soluble and water soluble. A convenient method for the introduction of such chemical de-emulsifying agents is to add them by means of pipe 102 to the water flowing through the pipe 97, although various other means for introduction may be used, as indicated above.

In selecting a de-emulsifying agent for promoting coalescence, I find it is particularly advantageous to select an agent which is more or less retained by the oil particle in its passage across the interfacial boundary to the oil-continuous phase and which will cooperate with the electric field present in the region occupied by this phase in promoting amalgamation of the oil particle with the oil-continuous phase and in general promote the electric treatability of the complex dispersed phases present in the neighborhood of the interfacial boundary, as hereinafter explained.

I have thus found various means for inducing coalescence of the oil particles dispersed in the separated water which may be used separately or in combination.

My invention also provides a means for returning the oil particles, with or without prior coalescence, to the interface by inducing conveying or transporting currents in the body of water moving toward said interface. I find it particularly advantageous to provide such currents by the introduction of a material of such density relative to the separated water that convection currents of the desired transporting type are set up. I may also introduce streams or jets of material with an initially directed momentum which serve to set up the desired motion.

It is sometimes possible to dispense with the use of the secondary treating field 22 as shown in Figs. 1 and 2, including both the upper and lower secondary electrodes. On the other hand, the auxiliary treating field in the space 71 between the lower electrode and the separated body of water provides a number of advantages, such as a continued treating of the settling particles, and in particular I have found it advantageous in its effects on the interface in reducing or preventing the formation of the flocculent interfacial emulsions such as the previously mentioned sludge or cuff, and in promoting the transfer of oil or water droplets across the interface and their subsequent coalescence with the phase continuous in oil or water respectively.

Due to the complex nature of the interface, comprising as it normally does a region of transition from an oil-continuous phase to a water-continuous phase with high concentrations of disperse phases throughout, and in many instances comprising polyphase emulsions as well, I am unable to present a precise theory as to the action of the auxiliary field on material at or near the interface. I find, however, that when the strength of this field is diminished, as when the water level is allowed to fall too far away from the electrode cooperating therewith to form the auxiliary field, the quantity of oil in the bleed water increases, and accumulation of sludge or coarse emulsion at the interface takes place, whereas when the field strength is properly maintained, as by maintenance of the water level at a higher point, the coarse emulsion is resolved or ceases to form, and the bleed water is substantially free from entrained oil. I find in general that an auxiliary field of sufficient magnitude serves to promote cleaner separation at the interface, and also cooperates with means for returning entrained oil to facilitate the passage of the latter across the interface.

I find that the effect of the auxiliary field may frequently be enhanced by adding to the separated water certain chemicals which are in part at least adsorbed or dissolved by the oil particles therein, so that the chemicals are brought to the interface by the return of the oil particles thereto. I find that various chemicals of this type serve to increase the electric treatability of materials at or near the interface, or material returned to the interface. I have obtained excellent results by using sulfonated fatty oil derivatives for this purpose, and in general I may use modified fatty acid derivatives, including the esters, and similar chemicals, such as are disclosed in Patent No. 1,467,831, issued to W. S. Barnickel, and in Patent No. 1,829,205, issued to G. C. Walker.

As to the electric fields in general, alternating current fields are preferred, either constantly occurring or intermittently applied, though the desired coalescence can take place in a unidirectional field of constant or pulsating potential. Fields resulting from the application of short electric surges to the electrodes, or application of peaked potentials to the electrodes, can also be used with success. Relatively high potentials are preferred, the potentials and type of current being commensurate with those used in the art of electrically dehydrating emulsions. In addition, various electrode structures can be used with varying degrees of success, the embodiment illustrated being found particularly effective.

While the process has been illustrated with particular reference to oils lighter than the dispersed water, it is not essential that the oil be of lower gravity than the water. If the converse is true, the principles herein disclosed can be applied by withdrawn water from the upper end of the treater tank, and the hydrocarbon from the lower end, suitable changes in position of the insulators being made to prevent short-circuiting of the electrodes. Such conditions may be met in treating certain tars to remove water therefrom.

This application is a continuation-in-part of my copending application Serial No. 122,470, filed January 26, 1937, now patent No. 2,182,145, which is a continuation-in-part of my copending application Serial No. 66,404, filed February 29, 1936.

I claim as my invention:

1. A process for treating water-in-oil dispersions comprising: subjecting the dispersion to the action of a coalescing electric field and to a gravitational separating action, thereby causing the dispersed water particles to settle from the treated dispersion; subjecting the settling water particles to the action of a second coalescing electric field to further coalesce said settling water particles prior to their complete coalescence; maintaining a body of separated water in which the further coalesced water particles completely coalesce adjacent the second electric field, said further coalesced particles tending to carry oil droplets into said body of separated water; and introducing a substantially oil-free aqueous medium in an upward direction into said body of separated water to sweep entrained oil droplets back toward the second electric field to bring the oil of said droplets into a zone of influence of this field.

2. A method of resolving a water-in-oil type of emulsion by treating same in a chamber containing bodies of oil and water, which method includes the steps of: continually introducing the emulsion to be treated directly into an oil-containing portion of said chamber and subjecting this emulsion to the action of an electric field to coalesce at least a portion of the dispersed water into gravitationally separable masses which drop through the oil in said chamber to join said body of water, said body of water tending to become contaminated by dispersed oil droplets; withdrawing water and oil from the lower and upper ends of said chamber respectively; and clearing at least a portion of the body of water adjacent the point of water withdrawal of dispersed oil droplets by introducing into said body of water a hot substantially oil free aqueous medium which is at a temperature above the average temperature of said body of water, said medium being brought into direct contact with the body of water to establish a thermal circulation in said body of water moving the oil droplets upward toward said electric field to bring the oil of said droplets into the zone of influence of said field.

3. A method of resolving a water-in-oil type of emulsion by treating same in a chamber containing bodies of oil and water, which method includes the steps of: continually introducing the emulsion to be treated directly into an oil-containing portion of said chamber and subjecting this emulsion to the action of an electric field to coalesce at least a portion of the dispersed

water into gravitationally separable masses which drop through the oil in said chamber to join said body of water, said body of water forming the lower terminus of said electric field; withdrawing water and oil from the lower and upper ends of said chamber at such rates as to maintain the amounts of oil and water in said chamber substantially constant from time to time and at such rates as to tend to form sludge in said chamber, whereby oil masses tend to pervade the body of water; and spraying water which is substantially oil free upward into said body of water to establish an upward circulation in said body of water tending to move the oil masses therein upward to bring the oil thereof into a zone of influence of the electric field immediately thereabove for re-treatment.

4. A process for clarifying water separated from a treated water-in-oil dispersion resulting from the subjection of an emulsion to a coalescing electric field established adjacent an electrode, which process includes the steps of: maintaining a body of separated water beneath the coalescing electric field to receive the electrically coalesced water masses settling from the oil, said water masses tending to carry oil droplets into said body of separated water; and clarifying said water in said body by spraying thereinto in an upward direction water which is substantially free from oil in a manner to establish upwardly-rising currents in said body which carry the oil droplets upward therewith to bring the oil thereof into a zone of influence of said electric field.

5. A method of resolving a water-in-oil type emulsion by treating same in a chamber containing a body of oil, a body of separated water, and an interfacial zone representing the boundary between said body of oil and said body of separated water, which method includes the steps of: continually discharging the emulsion to be treated directly into said body of oil in said chamber and there subjecting this emulsion to the action of an electric field of sufficient intensity to coalesce at least a portion of the dispersed water into gravitationally separable masses which gravitate from the body of oil in said chamber to join said body of water, said masses tending in their separation to carry small droplets of the oil into said body of separated water; withdrawing water from said body of water at a point removed from said interfacial zone; and clarifying at least the portion of said body of separated water adjacent said point of withdrawal by discharging substantially oil free water into said body of water in a direction toward said interfacial zone to carry oil droplets toward said interfacial zone and subject the oil of said droplets to the action of said electric field.

6. A method of resolving a water-in-oil type emulsion by treating same in a chamber containing a body of oil, a body of separated water, and an interfacial zone representing the boundary between said body of oil and said body of separated water, which method includes the steps of: continually discharging the emulsion to be treated directly into said body of oil in said chamber and there subjecting this emulsion to the action of an electric field of sufficient intensity to coalesce at least a portion of the dispersed water into gravitationally separable masses which gravitate from the body of oil in said chamber to join said body of water, said masses tending in their separation to carry small droplets of oil into said separated body of water; withdrawing water from said body of water at a point removed from said interfacial zone; and clarifying said body of separated water to remove therefrom said oil droplets by discharging directly thereinto water which is substantially oil free and which is of such density relative to the density of the separated water as to establish a circulation in said body of water to move said oil droplets towards said body of oil and to bring the oil of said droplets into a zone of influence of said electric field.

7. A method of resolving water-in-oil type emulsion by treating same in a chamber containing a body of oil, a body of separated water, and an interfacial zone representing the boundary between said body of oil and said body of separated water, which method includes the steps of: continually discharging the emulsion to be treated directly into said body of oil in said chamber and there subjecting this emulsion to the action of an electric field of sufficient intensity to coalesce at least a portion of the dispersed water into gravitationally separable masses which gravitate from the body of oil in said chamber to join said body of water, said masses tending in their separation to carry small droplets of oil into said body of separated water; withdrawing water from said body of water at a point removed from said interfacial zone; and introducing a hot substantially oil free aqueous medium into direct contact with said body of separated water while at a temperature above the temperature of said body of separated water to clarify said body of water and induce upward currents moving said droplets of oil upward whereby the oil of said droplets is moved into a zone of influence of said electric field.

8. A process as defined in claim 6, in which said body of separated water is brackish and in which said water discharged directly thereinto is less brackish so as to have a density less than the water of said body, and in which said less brackish water is discharged into a zone of said body of water which occupies only a portion of the complete horizontal cross-sectional area of said body of water at the point of discharge.

9. A method of resolving a water-in-oil type emulsion by treating same in a chamber containing a body of oil, a body of separated water, and an interfacial zone representing the boundary between said body of oil and said body of separated water, which method includes the steps of: continually discharging the emulsion to be treated directly into said body of oil in said chamber and there subjecting this emulsion to the action of an electric field of sufficient intensity to coalesce at least a portion of the dispersed water into gravitationally separable masses which gravitate from the body of oil in said chamber to join said body of water, said masses tending in their separation to carry small droplets of the oil into said body of separated water; withdrawing water from said body of water at a point removed from said interfacial zone; and discharging substantially oil free water carrying a chemical deemulsifying agent into said body of water to establish a circulation in said body of water away from said point of withdrawal and toward said interfacial zone and carry oil droplets and said chemical deemulsifying agent toward said interfacial zone to bring the oil of said oil droplets into a zone of influence of said electric field.

10. A method of resolving a water-in-oil type emulsion by treating same in a chamber contain-

ing a body of oil, a body of separated water, and an interfacial zone representing the boundary between said oil-continuous body and said body of separated water, which method includes the steps of: continually discharging the emulsion to be treated directly into said body of oil in said chamber and there subjecting this emulsion to the action of an electric field of sufficient intensity to coalesce at least a portion of the dispersed water into gravitationally separable masses which gravitate from the body of oil in said chamber to join said body of water, said masses tending in their separation to carry small droplets of the oil into said body of separated water; withdrawing water from said body of water at a point removed from said interfacial zone; and discharging substantially oil free water into said body of water to establish a circulation therein away from said point of withdrawal and toward said interfacial zone to carry oil droplets toward said interfacial zone and subject the oil of said droplets to the action of said electric field; and adding a chemical deemulsifying agent to said body of water to be carried by said oil droplets toward and into said interfacial zone.

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