June 15, 1954

H. P. DE WIT

2,681,311

ELECTRIC TREATER

Filed July 12, 1948

2 Sheets-Sheet 1

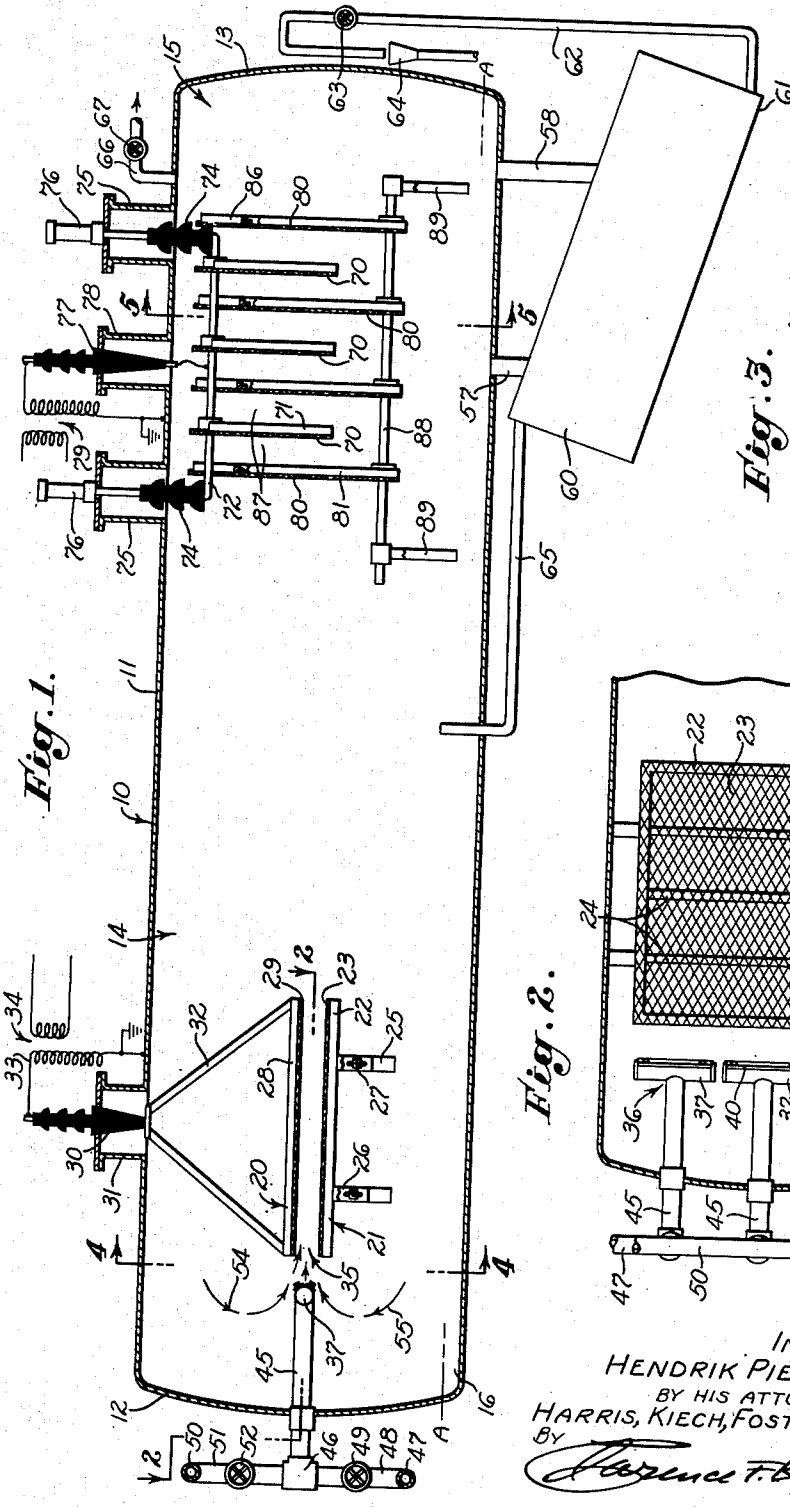


Fig. 1.

Fig. 2.

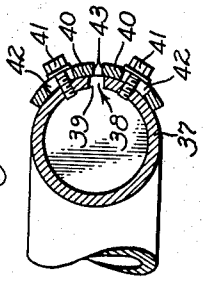


Fig. 3.

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2 Sheets-Sheet 2

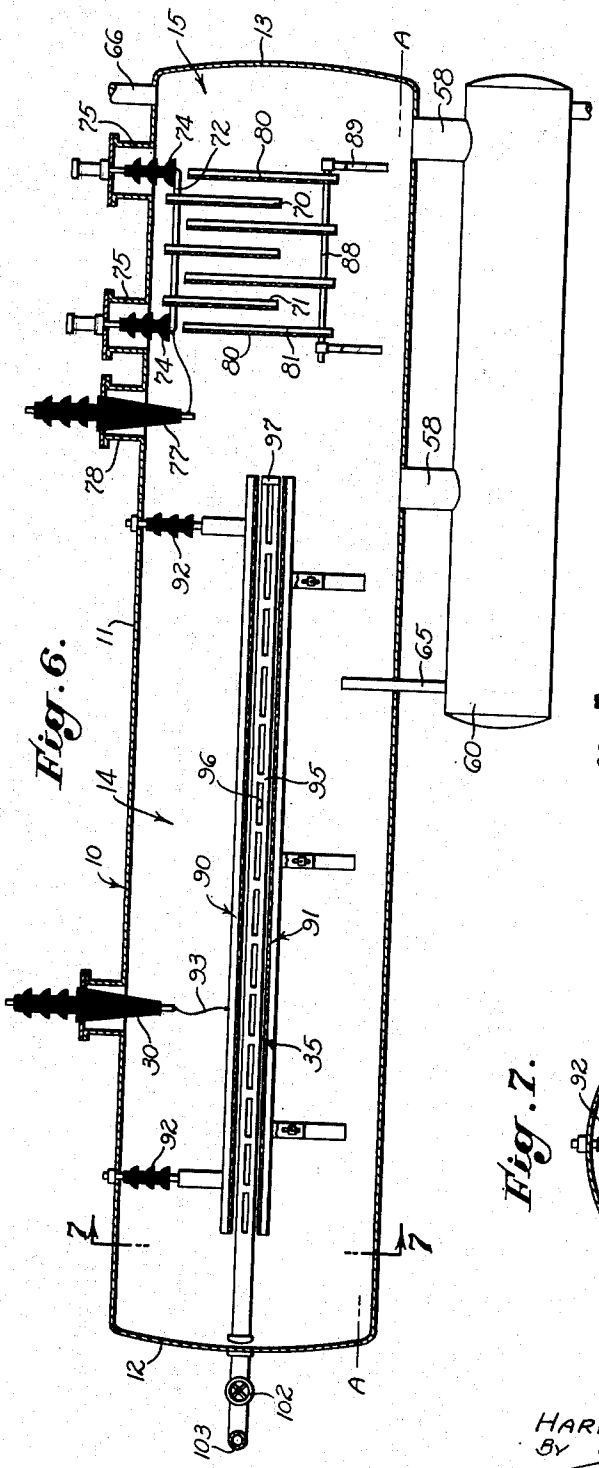


Fig. 6.

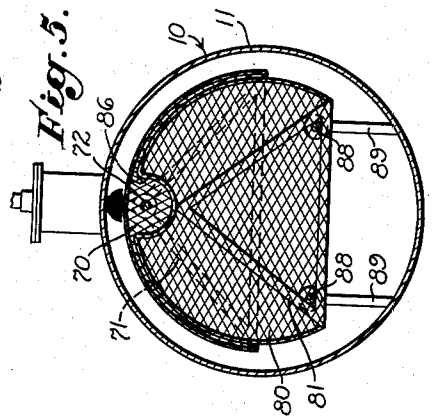


Fig. 5.

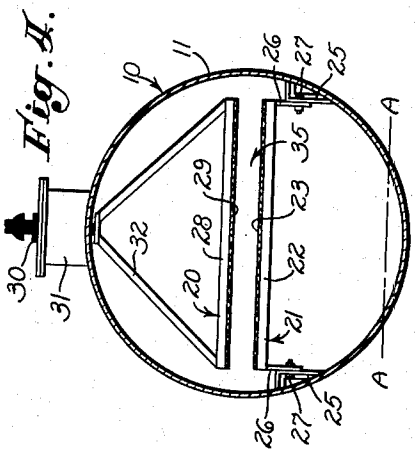


Fig. 4.

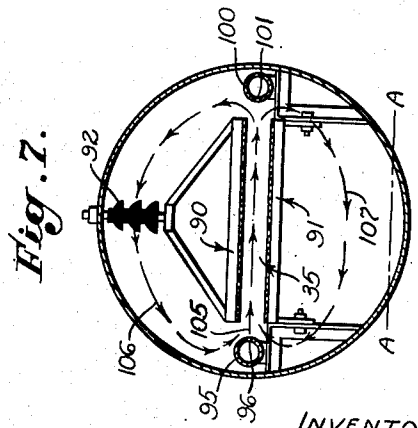


Fig. 7.

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UNITED STATES PATENT OFFICE

2,681,311

ELECTRIC TREATER

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Application July 12, 1948, Serial No. 38,232

19 Claims. (Cl. 204—302)

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My invention relates to the electrical resolution of emulsions and more particularly to a novel electric treater for resolving emulsions of the water-in-oil type.

Heretofore, it has been the general practice to dispose electrodes in an upright cylindrical container, these electrodes being energized to establish a high-voltage electric field therebetween. The emulsion, typically a crude oil emulsion, is delivered to the field which coalesces the dispersed water into masses of sufficient size to settle through the oil to a body of water in the lower end of the container. The separated oil is drawn from the top of the container and the settling water masses must gravitate through the oil in a direction counter to the general direction of flow of the oil in the container.

It is an object of the present invention to provide an electric treater in which the water or coalesced phase can separate rapidly and directly and without substantial interference from the moving oil stream in the container.

Another object of the invention is to employ a horizontally-elongated container, the emulsion entering the container near one end portion, the electrically treated and separated constituents being withdrawn from the other end portion whereby the general direction of flow through the container is substantially horizontal. The coalesced masses are required to settle only a relatively short distance before reaching the lowermost wall of the container, along which the coalesced material may flow as a relatively thin layer to the exit end of the container.

Another object of the invention is to provide an electric treater in which the coalesced material is moved to a separate container, positioned at a lower level. In this separate container any residual oil can separate and be returned to the main container.

Another object of the invention is to provide a novel electrode structure for electric treaters and including a pair of substantially flat electrodes spaced from each other to define a treating space open at each of its sides, the emulsion being introduced into one side of the treating space, either in a direction longitudinally of the container or transverse to the axis thereof. A further object is to employ perforated electrodes and to effect substantial separation of the emulsion constituents in the region of the electrodes.

A further object of the invention is to employ an elongated nozzle structure adjacent one side of such a treating space and providing emulsion-discharge orifice means disposed in a direction

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parallel to the electrodes and directing a stream of emulsion toward the center of the treating space.

An additional object of the invention resides in the design of an electric treater wherein the partially-separated oil can be subjected to additional electric action before being withdrawn from the container, thereby permitting additional lowering of the water content of the effluent oil.

Further objects of the invention will be evident to those skilled in the art from the following descriptions of exemplary embodiments.

Referring to the drawings:

Fig. 1 is a longitudinal sectional view of one embodiment of the electric treater of the invention;

Fig. 2 is a horizontal sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a transverse sectional view taken along the line 4—4 of Fig. 1;

Fig. 5 is a transverse sectional view taken along the line 5—5 of Fig. 1;

Fig. 6 is a longitudinal sectional view of an alternative embodiment of the invention; and

Fig. 7 is a transverse sectional view taken along the line 7—7 of Fig. 6.

Referring particularly to Figs. 1–5, the electric treater includes a horizontally-elongated container 10, typically a tank having a cylindrical side wall 11 closed by two end walls 12 and 13. By any suitable means, not shown, the container 10 is mounted with its longitudinal axis substantially horizontal. The length of the container is preferably several times the diameter or height thereof, the container providing an entrance zone 14 adjacent one end thereof and an exit zone 15 adjacent the other end thereof, there being an intermediate zone therebetween. These zones are adapted to be substantially filled with oil-continuous material from which the coalesced dispersed material may gravitationally separate. In the use of the invention to be exemplified, namely, in the resolution of water-in-oil type emulsions, the coalesced water will gravitationally separate in the container 10 to form a thin layer of water 16 disposed below the line A—A of Fig. 1. The depth of the separated water may be substantially the same in each of the zones 14 or 15 or there may be a slight difference in depth if the longitudinal axis of the container is not exactly horizontal.

Mounted in the entrance zone 14 and adapted to be submerged in the oil-continuous material,

is an electrode structure comprising a pair of substantially flat electrodes shown as including an upper electrode 20 and a lower electrode 21. As best shown in Fig. 2, the lower electrode is substantially rectangular and includes a frame 22 to which is secured an electrode sheet 23 which may be an imperforate plate but which preferably is foraminous. Best results have been obtained from use of a foraminous electrode formed of expanded metal. To prevent any sagging of the expanded metal, braces 24 traverse the interior of the frame 22, being secured thereto and being in supporting relationship with the expanded metal. The lower electrode 21 is supported and electrically connected to the container 10 by brackets 25 welded or otherwise secured to the container and by slotted legs 26 which are clamped to the brackets 25 by any suitable clamping means, such as a nut and bolt 27. By loosening such clamping means, the vertical position of the electrode 21 can be adjusted.

The upper electrode 20 may be constructed in an identical manner, preferably with a frame 28 covered with an electrode plate 29 which, again, is best made of foraminous material such as expanded metal. An inlet bushing 30, depending in a hood 31, carries four diverging arms 32 which support the upper electrode 20, the bushing 30 insulating the upper electrode 30 from the container 10. The upper electrode is adapted to be connected to a high voltage source, typically to one terminal of a secondary winding 33 of a transformer 34, the other terminal of the secondary winding being grounded and connected to the container 10 as shown.

The upper and lower electrodes 20 and 21 are spaced to define a treating space 35 open at each of its four sides. Energization of the transformer 34 will establish an alternating electric field in the treating space 35 of sufficient intensity to coalesce the dispersed water droplets of a water-in-oil emulsion.

The invention contemplates that the emulsion to be treated shall be introduced into an entrance side of the treating space 35. Preferably, the emulsion discharges substantially as a flat sheet into this side of the treating space. In the embodiment of Fig. 1 this is accomplished by use of an elongated nozzle structure, indicated generally by the numeral 36 and shown as including three axially-aligned nozzle members 37, cooperating in defining a pipe means, each nozzle member being closed at its ends and each providing a slot means forming an emulsion-discharge orifice means 38 extending in a direction substantially parallel to the electrodes and facing to direct emulsion toward the center of the treating space 35. As best shown in Fig. 3, each nozzle member 37 includes a slot 39, preferably adjustable in width to control the thickness of the stream discharged into the treating space 35. While various means can be employed for changing the width of the slot 39, Fig. 3 shows an arrangement whereby this can be accomplished through use of one or two orifice members or plates 40 curved to conform to the nozzle member 37 and adjustably clamped to its periphery by cap screws 41 extending through elongated slots 42. The plates 40 provide edges 43 cooperating in defining the emulsion-discharge orifice means 38. It will be understood that the walls of the slot 39 can be employed to define the orifice means if adjustment through use of the plates 40 is not desired.

Each nozzle member 37 is supported by a pipe 45 secured in the end wall 12 of the container 10 and carrying a T fitting 46. The emulsion to be treated may be supplied to a manifold pipe 47 with branches 48 communicating respectively with the T fittings 46, the flow through each branch being controlled by a valve 49. Similarly, dry oil may be supplied to a manifold pipe 50 with branches 51 communicating respectively with the T fittings 46, the flow being controlled by valves 52. In some instances, it is desirable to mix dry oil or other liquid with the incoming emulsion before discharge into the treating space 35 and this can be accomplished by use of the structure shown.

With the apparatus thus far described, a water-in-oil emulsion can be resolved in the container 10, the electric field coalescing the dispersed water particles into masses of sufficient size to gravitate to the bottom of the container. The jet velocity from the emulsion-discharge orifice 38 will usually be about 1–15 ft. per second and some of the coalesced masses can gravitate from the treating space 35 through the interstices of the lower electrode 21. Similarly, some of the oil may rise through the interstices of the upper electrode 20 before reaching the far end or exit side of the treating space 35. The jetting of the emulsion into the treating space 35 will tend to aspirate some of the oil-continuous material into the treating space from above and below the midsection of the container, as indicated, respectively, by arrows 54 and 55.

The separated water should be withdrawn from the container 10 at such rate that only a shallow body thereof remains in the container. This water is withdrawn from the exit zone 15 through pipes 57 and 58 which extend to an auxiliary container 60 spaced below the main container 10. As shown, the auxiliary container 60 slopes downwardly to a lower end 61 from which water is drawn through a bleeder pipe 62 equipped with a valve 63, the water being discharged into a funnel 64 communicating with a suitable drain. If desired, the valve 63 may be automatically controlled by any suitable level-control system known in the art, thereby controlling the effluent liquid to maintain the level of the water in the container 10 substantially at the line A—A. The use of a separate container 60 to receive the water is of particular advantage in this connection as it increases the height of the bleeder pipe 62 and makes possible better control of the water level.

The auxiliary container 60 provides, in addition, an auxiliary settling zone. In the event that small quantities of oil are removed from the container 10 with the water, such oil will rise to the uppermost portion of the container 60 and can be returned to the main container 10 through a pipe 65 which terminates above the water level in the main container at a position ahead of any auxiliary electrode structure in the exit zone 15.

The separated oil is removed from the upper end of the exit zone 15 through a pipe 66 equipped with a valve 67. The valves 63 and 67 serve to maintain a pressure in the container 10 by throttling the effluent streams of water and oil.

Disposed in the exit zone 15 is shown an auxiliary electrode means which receives and further treats the oil to reduce additionally its water content before discharge through the pipe 66. This auxiliary electrode means is best shown in Figs. 1 and 5 as comprising a plurality of foraminous electrodes 70 each comprising a frame 71 hung from a rod 72 and covered with expanded metal.

These electrodes are substantially semicircular in shape and terminate near the midsection of the container 10. The rod 72 is supported by insulators 74 extending into hoods 75, being adjustably supported by adjusting units 76. A bushing 77 disposed in a hood 78 carries a conductor which is electrically connected to the rod 72 and to the secondary of a high-voltage transformer 79, one terminal of the secondary being grounded and connected to the container 10 as shown.

Extending upwardly between the depending electrodes 70 are grounded electrodes 80, each providing a frame 81 shaped generally as shown in Fig. 5 with an arcuate depression 86 to provide clearance for the rod 72. Expanded metal is stretched across and secured to these frames so that the oil can flow successively through treating spaces 87 between the live and grounded electrodes in its travel to the outlet pipe 66. The electrodes 80 are supported by rods 88 extending longitudinally of the container 10 and held by standards 89 secured to the container.

It has been found in practice that the use of the auxiliary electrodes in the exit zone 15 effects further treatment of the oil with the result that there is some further coalescence of water droplets and separation thereof, whereby the effluent oil is further reduced in water content to a value well below pipe line requirements. The arrangement shown in Fig. 1 permits application of potentials and adjustment of the distances across the auxiliary treating spaces 87 to produce the most effective treatment of the oil. Additionally, such adjustments are possible independently of the treating action between the electrodes 20 and 21.

One advantage of the treater thus far described is that the water masses need settle only a relatively short distance before reaching the body of the water in the container 10. In addition, the general flow of liquid in the container 10 is from left to right, namely, in a direction transverse to the direction of movement of the water masses in settling from the oil. Correspondingly, the oil moves through the container 10 in a direction which does not substantially impede separation of the water, thus tending to result in better treatment.

In the alternative embodiment shown in Figs. 6 and 7, the incoming emulsion discharges into the main treating space from a different side thereof, namely, from an entrance side paralleling the side wall 11 of the container 10. The entrance zone 14 here extends for about two-thirds the length of the container, while the intermediate and exit zones occupy the remaining one-third.

In this embodiment the upper and lower electrodes 90 and 91 are constructed substantially as previously described except that they are substantially longer. A pair of insulators 92 support the upper electrode 90 and the bushing 30 serves merely to energize the upper electrode through a conductor 93.

A pipe means 95 extends along the side wall 11 of the container and provides a slot means 96 extending substantially the complete length of the treating space 35, measured longitudinally of the container. The innermost end of the pipe means 95 is plugged at 97 so that any emulsion delivered to the other end of this pipe means, exterior of the container, is caused to be discharged horizontally into the treating space 35. The slot means 96 may comprise a single slot extending through the entire length of the treating space, but is

preferably a series of slots disposed end to end, as suggested in Fig. 6. If desired, the slot means may be equipped with an arrangement similar to that in Fig. 3 to permit adjustment of width of the emulsion discharge orifice.

In addition, another pipe means 100 may be extended along the side wall of the container 10 on the opposite side of the treating space 35, as suggested in Fig. 7. This pipe means can be equipped with a slot means 101 differing slightly in width from the slot means 96. Each of the pipe means is provided with a corresponding valve 102 and extends to a manifold 103 which receives the emulsion under pressure. The discharge velocity can be controlled by opening the appropriate one of the valves 102. Thus, if it is desired that the velocity of jetting into the field be made higher, the emulsion is sent to the pipe means with the narrower slot means and vice versa.

The emulsion jetting into the side of the treating space 35, as indicated by the arrow 105, aspirates oil-continuous material into the treating space from above and below the electrodes and establishes closed recirculation paths in the oil-continuous material above and below the electrodes. For example, there is established an upper circulation of oil-continuous material, indicated by arrows 106 which substantially encircles the upper electrode 90 and a lower circulation, indicated by the arrows 107, which substantially encircles the lower electrode 91. In this embodiment of the invention the upper and lower circulations follow substantially helical paths due to the fact that the general direction of flow through the container 10 is longitudinal thereof and toward the exit zone 15. Such circulations are desirable in that they repeatedly deliver to the electric field any water droplets which have not previously been coalesced to such extent as to gravitate from the oil, such droplets being carried with the recirculating streams until coalescence has proceeded to this extent. In this embodiment of the invention, however, a given particle carried by the circulation will not be returned to the same portion of the field. Rather, it will next enter the field at a position closer to the exit zone 15 due to the fact that the entire body of oil-continuous material in the container 10 is advancing in this direction because of the continued supply of emulsion. This action has been found very beneficial in the treatment of emulsions.

It is preferable, although not always essential, to use the auxiliary electrodes 70 and 80 in the exit zone 15 of the container, these being constructed substantially as previously described except for a different placement of the hood 78. In addition, the auxiliary container 60 in this embodiment is shown as extending substantially horizontally, an expedient which can be used either in this embodiment or in the embodiment of Fig. 1. Aside from the differences described, the various elements of the embodiment of Fig. 6 are substantially the same as those of Fig. 1 and are indicated by the same numerals, where applicable.

Various changes can be made without departing from the spirit of the invention as defined in the appended claims.

I claim as my invention:

1. In an electric treater for resolving emulsions of the water-in-oil type and adapted for connection to a high-voltage source, the combination of: a substantially horizontally disposed

container much greater in horizontal length than height, said container being adapted to contain an oil-continuous material; a pair of substantially flat-surfaced and substantially rectangular electrodes; means for electrically insulating said electrodes from each other and for mounting same in face-to-face and substantially parallel relationship in said oil-continuous material to define a four-sided treating space open at each of its four sides, said means including means for electrically connecting said electrodes to said high-voltage source to establish an electric field in said treating space; an elongated nozzle structure comprising a pipe means adjacent and extending along one of said sides of said treating space, said pipe means including a plurality of orifices arranged longitudinally of said pipe means in a direction parallel to said electrodes, the axes of said orifices being substantially parallel to said electrodes so that said orifices discharge emulsion into said side of said treating space toward the center thereof and toward that side of said treating space opposite said one side thereof; and means for delivering the emulsion to be treated to said elongated nozzle structure for discharging same into said one side of said treating space, said discharge drawing into said treating space by aspiration some of said oil-continuous material.

2. In an electric treater for resolving emulsions of the water-in-oil type and adapted for connection to a high-voltage source, the combination of: a substantially horizontally disposed container much greater in horizontal length than height, said container being adapted to contain an oil-continuous material; a pair of substantially flat-surfaced electrodes; means for electrically insulating said electrodes from each other and for mounting same in face-to-face and substantially parallel relationship in said oil-continuous material to define a treating space open at each of its sides, said means including means for electrically connecting said electrodes to said high-voltage source to establish an electric field in said treating space; an elongated pipe and means for mounting same adjacent and extending along one of said sides of said treating space, said pipe including a slot means elongated in a direction parallel to said electrodes and parallel to the longitudinal axis of said pipe, said slot means defining an emulsion-discharge orifice facing said treating space to direct emulsion toward the center of said treating space; and means for delivering the emulsion to be treated to said elongated pipe for discharging same into said one side of said treating space, said discharge drawing into said treating space by aspiration some of said oil-continuous material.

3. An electrode structure for an emulsion-resolving electric treater and adapted to be energized from a high-voltage source while positioned in an oil-continuous material, said electrode structure including, in combination: a pair of substantially flat-surfaced electrodes; means for electrically insulating said electrodes from each other and for mounting same in face-to-face and substantially parallel relationship in said oil-continuous material to define a treating space open at each of its sides, said means including means for electrically connecting said electrodes to said high-voltage source to establish an electric field in said treating space; an elongated pipe means adjacent and extending along one of said sides of said treating space, said pipe means including a slot means elongated

in a direction parallel to said electrodes and parallel to the longitudinal axis of said pipe means, said slot means defining an emulsion-discharge orifice means facing to direct emulsion toward the center of said treating space; means for delivering the emulsion to be treated to said elongated pipe means for discharging same into said one side of said treating space, said discharge drawing into said treating space by aspiration some of said oil-continuous material; and means for changing the width of said orifice means to control the thickness and jet velocity of the stream of emulsion jetted into said treating space.

4. An electrode structure as defined in claim 3, in which said last named means includes an orifice member on said pipe means and providing an edge bounding one side of said slot means, and including means for adjusting the position of said orifice member to vary the thickness of the stream of emulsion jetting from said orifice means.

5. An electrode structure for an emulsion-resolving electric treater and adapted to be energized from a high-voltage source while positioned in an oil-continuous material, said electrode structure including, in combination: a pair of substantially flat-surfaced and substantially rectangular electrodes; means for electrically insulating said electrodes from each other and for mounting same in face-to-face and substantially parallel relationship in said oil-continuous material to define a four-sided treating space open at each of its four sides, said means including means for electrically connecting said electrodes to said high-voltage source to establish an electric field in said treating space, each of said substantially flat-surfaced electrodes comprising a substantially horizontal peripheral frame and a sheet of foraminous material secured to said frame and extending across the space therewithin, the sheets facing each other to define the boundaries of said treating space; an elongated nozzle structure comprising a pipe means adjacent and extending along one of said sides of said treating space, said pipe means including a plurality of orifices arranged longitudinally of said pipe means in a direction parallel to said electrodes, the axes of said orifices being substantially parallel to said electrodes so that said orifices discharge emulsion into said side of said treating space toward the center thereof and toward that side of said treating space opposite said one side thereof; and means for delivering the emulsion to be treated to said elongated nozzle structure for discharging same into said one side of said treating space, said discharge drawing into said treating space by aspiration some of said oil-continuous material.

6. In an electric treater for resolving emulsions of the water-in-oil type and adapted for connection to a high-voltage source, the combination of: a substantially horizontally disposed container much greater in horizontal length than height, said container being adapted to contain an oil-continuous material, said container providing an entrance zone adjacent one end thereof and an exit zone spaced from said entrance zone in a direction longitudinally of said container, there being an intermediate zone between said entrance and exit zones; a pair of substantially flat-surfaced electrodes; means for insulating said electrodes from each other and for mounting same to extend longitudinally of said container in said entrance zone in face-to-face and sub-

stantially parallel relationship to define therebetween a four-sided treating space open at each of its four sides, one of said sides being an entrance side and another of said sides being an exit side, said exit side facing said intermediate zone, said means including means for electrically connecting said electrodes to said high-voltage source to establish an emulsion-treating electric field in said treating space of sufficient intensity to coalesce the dispersed aqueous droplets of the emulsion into masses of sufficient size to gravitate from the oil; an elongated nozzle structure in said entrance zone adjacent and extending along said entrance side of said treating space, said elongated nozzle structure providing a plurality of emulsion-discharge orifices disposed along said elongated nozzle structure in a direction substantially parallel to said electrodes and facing said entrance side of said treating space to direct emulsion into said side of said treating space and toward the center thereof, at least a portion of the treated emulsion constituents flowing from said exit side of said treating space in a generally horizontal exit direction away from said exit side; means for delivering the emulsion to be treated to said elongated nozzle structure; and means for establishing a generally-horizontal flow of oil-continuous material from said exit side of said treating space and in the same generally-horizontal exit direction as the treated emulsion constituents move when issuing from said exit side, said flow of oil-continuous material being longitudinally of said container through said intermediate zone to said exit zone, said coalesced masses gravitating from such generally-horizontal flow of oil-continuous material in said intermediate and exit zones to form a relatively shallow layer of water-continuous material in the lowermost portion of said container, said flow-establishing means including a treated-oil withdrawal means communicating with the upper end of said exit zone, said flow-establishing means also including a coalesced-phase withdrawal means communicating with the lower portion of said container to withdraw water-continuous material from said layer thereof.

7. An electric treater as defined in claim 6 in which said entrance and exit sides are aligned substantially longitudinally of said container and in which said emulsion-discharge orifices face longitudinally of said container whereby said streams of emulsion flow from said elongated nozzle structure in said generally-horizontal exit direction so that the incoming and treated emulsion flow in the same general direction longitudinally of said container from the elongated nozzle structure through the intermediate zone and into the exit zone.

8. An electric treater as defined in claim 6 in which said container provides side and end walls and in which said entrance side faces a side wall of said container, said emulsion-discharge orifices being directed laterally of said container.

9. In an electric treater for resolving emulsions of the water-in-oil type, the combination of: a substantially horizontally disposed container much greater in horizontal length than height, said container having an entrance zone near one end, and an exit zone near the other end, said zones being in uninterrupted communication with each other, a main electrode means comprising a pair of substantially plane-surfaced electrodes spaced in substantially parallel relationship in said entrance zone and extending substantially parallel to the longitudinal axis of said container, said electrodes enclosing a treating space therebetween, an auxiliary electrode means comprising another pair of spaced electrodes positioned in said exit zone and enclosing a treating space therebetween, means for establishing an electric field in each of said treating spaces, discharge means for discharging the emulsion to be treated into said treating space in said entrance zone, and means for separately withdrawing from said exit zone streams of oil and separated material.

10. An electric treater as defined in claim 9 in which said auxiliary electrode means includes a plurality of foraminous electrodes extending substantially vertically and transversely to said longitudinal axis and disposed between said main electrode means and said withdrawal means to be in the path of flow of the partially treated oil from said main electrode means.

11. A high voltage emulsion treater for electrically resolving emulsions of the water-in-oil type, comprising in combination: a substantially cylindrical container with its longitudinal axis substantially horizontal, said container being much greater in horizontal length than height and containing an entrance zone and an exit zone longitudinally spaced in said container and separated by an intermediate zone, a pair of electrodes insulated from one another and mounted in said entrance zone in substantially parallel relationship and substantially parallel to said longitudinal axis and defining therebetween a treating space, means to establish a high voltage electric field in said treating space capable of treating the emulsion to produce treated emulsion constituents containing coalesced aqueous masses, said container including a transversely unobstructed longitudinal trough interconnecting the lower portions of said entrance, intermediate and exit zones, said trough being adapted to receive the coalesced aqueous masses gravitating from the treated emulsion constituents, means for discharging a stream of emulsion into said treating space, means for withdrawing coalesced aqueous material from said trough at an exit position downstream from said entrance zone to establish a flow of coalesced material along said trough in a longitudinal direction from said entrance zone to said exit position, and means for flowing the treated emulsion constituents substantially in the same longitudinal direction above the coalesced material in said trough, said last-named means including a treated-oil withdrawal means communicating with the upper end of said exit zone.

12. In an electric treater for resolving emulsions of the water-in-oil type, the combination of: a substantially horizontally disposed container much greater in horizontal length than height, said container being adapted to contain an oil continuous material, and having an entrance zone adjacent one end and an exit zone adjacent the other end, a pair of substantially flat-surfaced electrodes insulated from one another and mounted in said entrance zone in face to face and substantially parallel relationship to extend longitudinally of said container and to define therebetween a treating space, said electrodes having a pair of substantially parallel edges in a plane substantially transverse to the longitudinal axis of said container, means to establish a high voltage electric field in said treating space, an elongated nozzle structure in said entrance zone adjacent and extending along said pair of edges, said elongated nozzle structure

having a plurality of emulsion discharge orifices spaced from each other in a direction substantially parallel to said edges, said orifices facing said treating space and directing emulsion into said treating space toward the center thereof, and flow establishing means for creating a substantially horizontal flow of oil continuous material within said container from said entrance zone toward said other end of said container, said last-named means including means for delivering the emulsion to be treated to the nozzle structure, treated-oil withdrawal means downstream of said electrodes and coalesced-phase withdrawal means communicating with the lower portion of said container.

13. In an electric treater for resolving emulsions of the water-in-oil type, the combination of: a substantially horizontally disposed container greater in horizontal length than height, said container comprising an emulsion bounding zone, a plurality of sets of electrodes mounted in said zone, said electrodes being substantially flat-surfaced, insulated from one another and mounted in face to face substantially parallel relationship to define treating spaces between facing surfaces, at least one set of said electrodes extending substantially longitudinally of said container, said electrodes in each set having substantially parallel groups of edges, means to establish high voltage fields in said treating spaces, elongated discharge means adjacent and extending along at least one of said groups of edges, said elongated discharge means having a plurality of emulsion discharge orifices spaced from each other in a direction substantially parallel to said one group of edges, said orifices facing said treating space and directing emulsion into said treating space toward the center thereof, means for delivering emulsion to the discharge means, treated-oil withdrawal means communicating with the upper portion of said zone and coalesced-phase withdrawal means communicating with the lower portion of said zone.

14. In an electric treater for resolving emulsions of the water-in-oil type, the combination of: a container having a longitudinal axis and forming a zone for oil-continuous material bounded by opposed side and end walls, a pair of substantially plane-surfaced electrodes near one end of said container, means mounting said electrodes in said zone substantially parallel to said axis and in spaced relationship to define a treating space therebetween, said electrodes having a pair of substantially parallel edges of substantial length extending longitudinally of said container and facing one of said side walls, means to establish an electric field in said treating space, an elongated emulsion-delivery means in said zone extending substantially parallel to said axis opposite said pair of edges, said last-named means having an emulsion discharge orifice means directed into an open side of said treating space substantially transverse to said axis, and means to cause the treated emulsion constituents to move generally longitudinally of said container and transversely of the direction of feed of said emulsion from said orifice means, said last-named means including withdrawal means for separately withdrawing the separated oil and coalesced material from said container, at least one of said withdrawal means being spaced from said electrodes towards the opposite end of said container.

15. An electric treater as defined in claim 14 in which said emulsion delivery means is spaced from each of said electrodes in a direction transverse to said longitudinal axis to cause aspiration induced helical circulation of oil-continuous material around at least a portion of each electrode.

16. An electric treater as defined in claim 15 in which the axis of said container is substantially horizontal and in which both withdrawal means are positioned near the end of said container opposite said electrode end.

17. In an electric treater for resolving emulsions of the water-in-oil type and adapted for connection to a high voltage source, the combination of: a main substantially horizontally disposed container much greater in horizontal length than height, said main container providing a zone for oil-continuous material, a pair of electrodes insulated from one another and mounted in said zone in spaced relationship to define a treating space therebetween, means for establishing an electric field in said treating space, means for delivering the emulsion to be treated to said treating space, the lowermost portion of said main container comprising a shallow channel to receive a relatively shallow layer of coalesced material, a small auxiliary container closed from the atmosphere and positioned entirely below said main container, conduit means for conducting said separated coalesced liquid from said shallow channel to said auxiliary container, an oil withdrawal pipe for withdrawing oil from the upper portion of said main container, and another withdrawal pipe communicating with said auxiliary container for withdrawing therefrom a stream of coalesced liquid, and an oil return pipe having a lower end portion below any portion of said main container and opening on the upper portion of said auxiliary container, said return pipe having an upper end opening on the interior of said main container to return thereto any oil separating from the coalesced liquid in said auxiliary container.

18. An electric treater as defined in claim 17 in which said return pipe opens on the interior of said main container at a position above said layer of coalesced liquid therein.

19. In an electric treater for resolving emulsions of the water-in-oil type, the combination of: a substantially horizontally disposed cylindrical container much greater in horizontal length than height, said container having an entrance zone near one end and an exit zone near the other end, said zones being in open communication with each other, a main electrode means comprising a pair of substantially plane electrodes spaced in substantially parallel relationship in said entrance zone and extending substantially parallel to the longitudinal axis of said container, an auxiliary electrode means comprising another pair of spaced electrodes positioned in said exit zone, said auxiliary electrode means including at least one live electrode and at least one grounded electrode spaced from said live electrode in a direction longitudinally of said container, said live and grounded electrodes comprising foraminous flat members extending in planes substantially transverse to the longitudinal axis of said container, said live electrode being substantially semicircular to provide a lower edge, said grounded electrode being substantially circular but of a size greater than a semicircle and having a lower non-circular portion, said electric treater including means for insulating said live electrode from said container and for mounting same in said exit zone with its

periphery spaced substantially uniformly from said container and with its lower edge extending substantially horizontally adjacent the longitudinal axis of said container, and means for mounting said grounded electrode in said exit zone with its periphery spaced substantially uniformly from said container and with its lower non-circular portion below said lower edge of said live electrode and above the bottom of said container to provide a space between such non-circular portion and said bottom of said container for receiving and conducting the coalesced material as it flows to its withdrawal means, means for establishing electric fields in each of said zones, means for discharging the emulsion to be treated into said entrance zone for treatment by said main electrode means to coalesce a portion of the dispersed phase of the emulsion into masses of sufficient size to gravitate from

the oil to the lower portion of said container, the oil flowing longitudinally of said container to said auxiliary electrode means for further treatment and additional coalescence and separation of any residual dispersed phase; and means for separately withdrawing from said exit zone streams of oil and separated material.

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