

Dec. 6, 1960

L. C. WATERMAN  
ELECTRIC EMULSION TREATER

2,963,414

Filed July 22, 1957

2 Sheets-Sheet 1

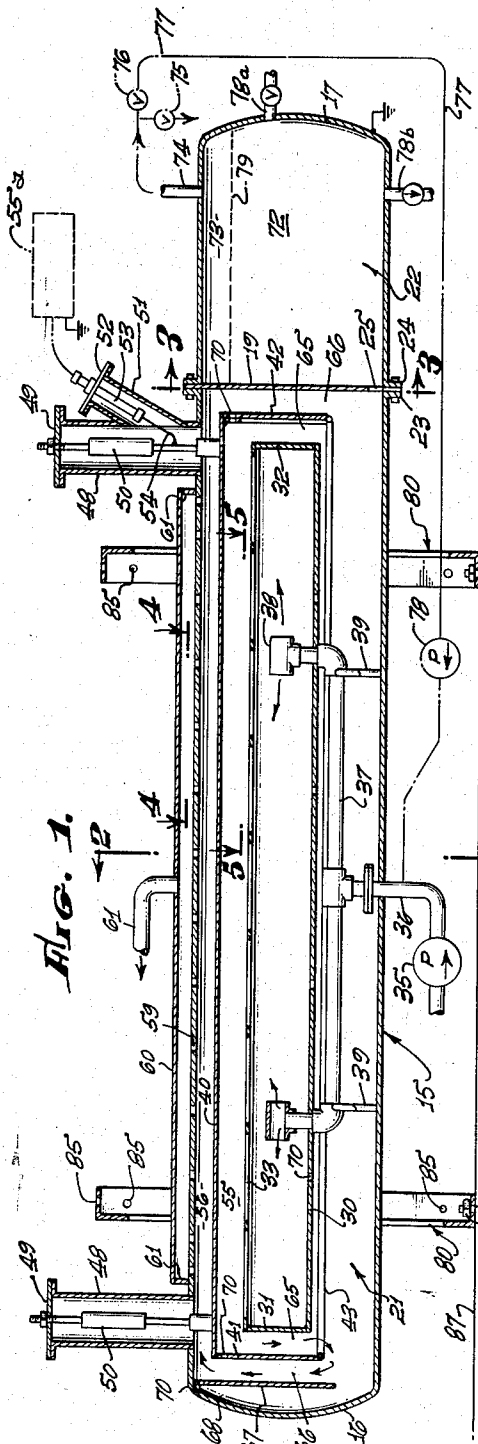


FIG. 1.

FIG. 2.

FIG. 6.

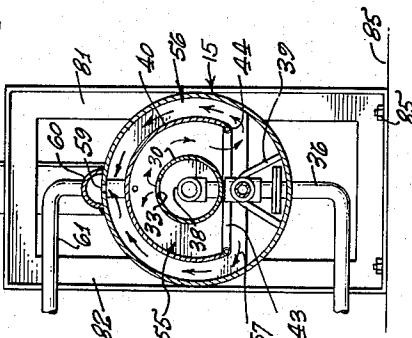
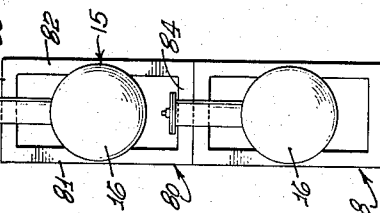
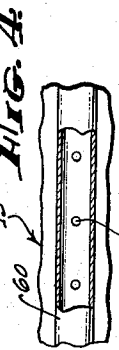


FIG. 3.

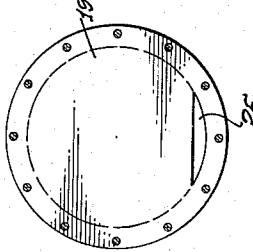
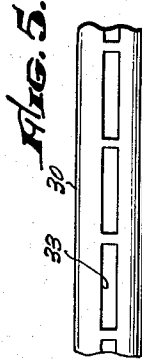


FIG. 5.

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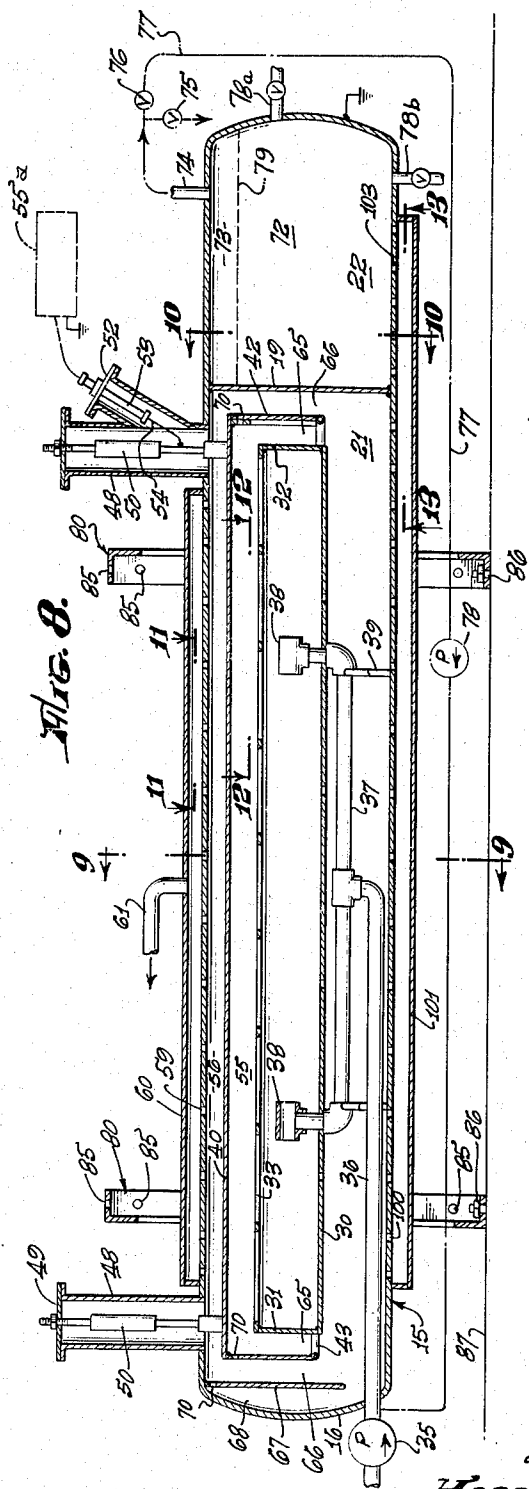
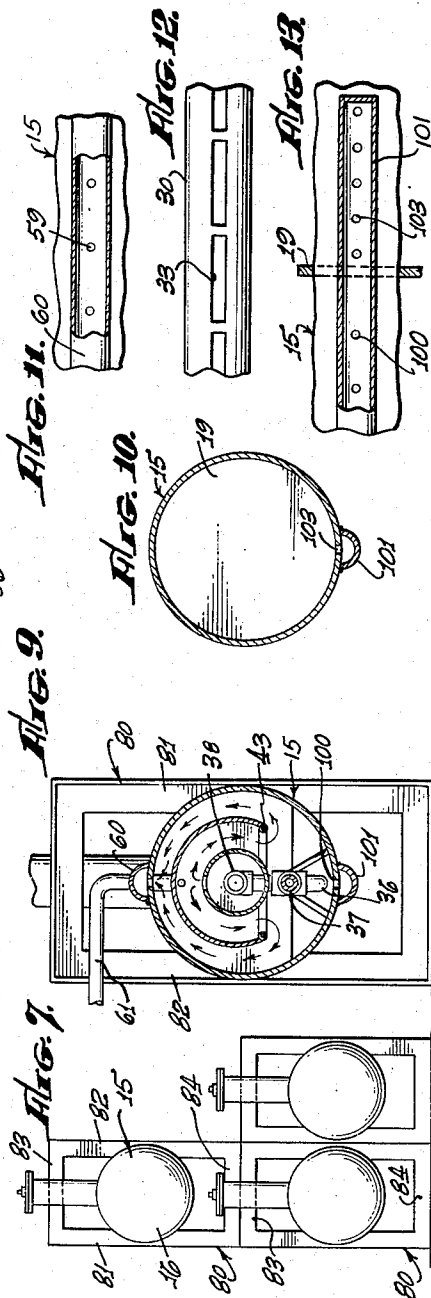
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By His Attorneys.  
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2,963,414

## ELECTRIC EMULSION TREATER

Logan C. Waterman, Houston, Tex., assignor to Petrolite Corporation, Wilmington, Del., a corporation of Delaware

Filed July 22, 1957, Ser. No. 673,346

18 Claims. (Cl. 204—302)

My invention relates to electric treaters for dispersions and more particularly to compact high-voltage treaters useful alone or with other identical units to process crude oil or refinery streams containing liquid or solid particles dispersed in a continuous oil phase of mineral or animal origin, typically crude mineral oil or a distillate obtained therefrom. Such systems are herein referred to as dispersions, which term is inclusive of emulsions.

In recent years there has been developed a process for the treatment of such dispersions by the use of unidirectional electric fields between extensive-surface electrodes to coalesce or agglomerate the dispersed particles into masses which settle from the oil to the bottom of the treater container, the treated oil containing residual amounts of dispersed phase material measured in hundredths or thousandths of a percent. The treater of the invention is applicable to such treatment but it can also be employed with alternating current fields to dehydrate these or other dispersions to the lesser degree permitted by such A.-C. operation.

There is a need for electrically treating certain streams at relatively low rates or at minimum cost. Present electric treaters of conventional capacity, measured in thousands of barrels per day, sometimes cannot be justified on such streams. It is an object of the invention to provide a relatively small, cheap electric treater for dispersions, having a throughput capacity measured in hundreds of barrels per day.

Also there is need for a compact treater, irrespective of throughput, in which internal space can be used to maximum advantage. It is an object of the invention to provide a unique electrode arrangement in an electric treater, giving rise to a flow pattern differing radically from previous treaters by providing streams which reverse in direction when flowing through treating passages which are disposed side by side and separated by a relatively thin member.

A further object is to treat a dispersion while flowing through arcuate paths formed about an axis. Another and important object is to provide a treater in which two tubular members are respectively orificed on only one side but in rather extensive longitudinal zones thereof, these members being assembled one within the other so that their orifices face in opposite directions.

Another object is to provide a new arrangement of treating and withdrawal zones in a horizontal electric treater with unique communications therebetween.

A further object is to provide treater units that can be stacked, horizontally or vertically or both, to provide treater assemblies that can be connected serially or in parallel to accommodate the treating needs of diverse streams. Other objects reside in the provision of peripheral frames by which adjoining units can be secured together in stacked relation.

Further objects and advantages will be apparent to those skilled in the art from the embodiments described herein and illustrated in the drawings, in which:

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

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

Figs. 3—5 inclusive are fragmental sectional views taken along correspondingly numbered lines of Fig. 1;

Fig. 6 is a view diagrammatically illustrating how pairs of the treaters of the invention can be vertically stacked;

Fig. 7 is a view similar to Fig. 6 showing how treaters of the invention can be stacked both vertically and horizontally.

Figs. 8—12 inclusive illustrates a modified embodiment of the invention in views respectively similar to Figs. 1—5 inclusive; and

Fig. 13 is a fragmentary sectional view taken along the line 13—13 of Fig. 8.

The treater of Figs. 1—5 includes a long and narrow closed container 15 which may have any suitable cross-sectional configuration but which is preferably a cylinder having a diameter of about 1.5—5 feet, for example, and a length several times its width. A section of pipe closed by heads 16 and 17 welded thereto is a satisfactory container, preferably equipped with a partition 19 dividing the interior into a main treating zone 21 and a withdrawal zone 22. In Figs. 1 and 3, the partition is bolted between flanges 23 and 24 of two sections of the container and provides a shallow opening 25 interconnecting the lower interiors of the zones 21 and 22 for transfer of settled dispersed phase material, as will be described. If desired, the partition 19 can be welded in place, similar to Fig. 8.

Mounted within the container 15 near the center thereof is a dispersion distributor in the form of an inner tubular member 30 closed at its ends by plates 31 and 32 and orificed throughout a major portion of its length to discharge the dispersion exclusively on one side thereof, here the uppermost side. The orifice means is preferably formed by slots 33 aligned end to end. The dispersion to be treated is introduced into the interior of the tubular member 30 at a plurality of positions spaced therealong so that the radial stream from the orifice means will be of substantially equal outward velocity at different positions along the length of the distributor. As shown, the incoming dispersion is pressured by a pump 35 and delivered through a pipe 36 to a manifold which contains branch pipes entering the distributor at a plurality of spaced positions, these branch pipes terminating in pipe T's 38 each providing two orifices aligned with the axis of the tubular member 30. Any number of branch pipes can be employed. The manifold 37 is supported by brackets 39 which serve to support and position the inner tubular member 30.

An outer tubular member 40 closed at its ends by plates 41 and 42 provides an orifice means or slot 43 facing in a direction substantially opposite the orifice means formed by the slots 33. The outer member 40 may be a length of pipe with its lower section cut away to form the slot 43, the width of the slot being preferably somewhat greater than the diameter of the member 30, the member 40 being so placed that the lip of the slot 43 is disposed a substantial distance below the center of the inner member 30, preferably at a position near or below the lowermost portion thereof. A slot-of angular dimension of about 90—120° will usually be found best, the one illustrated being a 120° slot. The rectangular outline of the lip of the slot is preferably framed by a bead 44 of circular cross-section welded thereto to decrease field gradients thereadjacent. The plate 42 may be made removable to facilitate installation of or access to the inner member 30.

The outer member 40 is supported by a suitable in-

ulator means and serves as the live electrode of the treater. Near the opposite ends of the outer member 40 the container 15 provides upwardly extending housings 48 closed by covers 49 adjustably supporting through the nut means shown, stick insulators 50 from which the outer member 40 hangs. One of the housing members 48 provides a side housing 51 closed by a plate 52 supporting a bushing 53 through which extends a lead 54 connected to one of the hangers for the outer member 40. The other end of this lead is electrically connected to one terminal of a source of high-voltage potential 55a, usually a unidirectional or direct current source although sometimes a step-up transformer. The other terminal of such source is connected to the inner member 30 and the container 15 through ground.

As best shown in Figs. 1 and 2, the inner member 30 has a diameter which is a substantial fraction of the diameter of the outer member 40 so as to minimize concentration of voltage gradient thereadjacent in a preliminary annular treating space 55 between the two members. In practice, it is desirable to have the inner member 30 of a diameter of about  $\frac{1}{4}$ – $\frac{1}{2}$  the diameter of the container 15. As shown, the member 30 is of a diameter about  $\frac{1}{3}$  that of the container. Likewise, the outer member 40 is desirably of a diameter somewhat greater than the difference in the diameters of the inner and outer members 30 and 40 so that the width of the main treating space 56 between the outer member 40 and the container 15 will be on the average somewhat less than the width of the preliminary treating space 55. In some instances, however, the diameter of the outer electrode can be midway between the diameters of the inner member 30 and the container 15 so that the treating spaces 55 and 56 are of substantially equal width.

The flow pattern of the dispersion is best shown in Fig. 2. The stream rising throughout the length of the inner member 30 through the slots 33 is directed toward a closed side of the outer member 40 and is divided into two streams flowing circumferentially and downwardly through the preliminary treating space 55. During this flow, much of the dispersed phase material will be coalesced into masses which drop from the streams as they turn outwardly and upwardly into the main treating space 56 as indicated by the arrows 57. The remaining dispersed phase material is further coalesced during upward flow of the two side streams through the main treating space 56 before joining and being withdrawn through the exit means, shown as a large number of aligned openings 59 through the top of the container 15 communicating with the interior of a manifold 60 formed by longitudinally bisecting a pipe and welding one half-section to the exterior of the container 15, with closure plates 61 closing the ends, the treated oil being withdrawn from the manifold 60 through a pipe 61. It is desirable that the maximum throughput of the treater be determined by the composite cross-sectional area of the openings 59 rather than the slots 33 of the distributor, wherefore the former is made smaller.

The flow pattern in the outer or main treating space 56 is particularly desirable in the super-treatment of dispersions by unidirectional high-voltage fields to reduce the residual content of dispersed phase material to the low values previously indicated. For example, when treating petroleum distillates by unidirectional fields of substantially uniform voltage gradient between generally parallel electrodes spaced less than about six inches, best results are obtained if the dispersion entering the bottom of the main treating space 56 contains no more than about 2% dispersed phase material, preferably considerably less. The action of the field is primarily one of coalescing the dispersed and widely separated particles. A tranquil or laminar flow through the main treating space 56 is desirable, particularly if the dispersion contains particles differing in electrophoretic mobility, as explained in the application of Richard W. Stenzel, Serial

281,541. The coalesced masses should gravitate from the oil before leaving the treater and such gravitational separation is facilitated by decreased upward velocity of the treated oil. When flowing upwardly and inwardly through the main treating space 56, the upward component of velocity progressively decreases toward the exit openings 59, giving increased opportunity for the coalesced material to settle. In addition, the material need settle only a relatively short distance before coming into contact with the exterior surface of the outer electrode 40 which becomes coated with the dispersed phase material, the settling masses joining the coating and flowing peripherally downwardly to drip from the bead 44 which preferably lies in a horizontal plane to distribute the dripping throughout the length of the outer member 40. The bead 44 broadens the lip to facilitate dripping and to reduce the field gradient thereadjacent.

If, as is preferred, the container 15 and the inner and outer members 30 and 40 are cylindrical, they may be strictly concentric. However it is often preferred to dispose the central axis of the inner member 30 above the central axis of the outer member 40, as shown in Fig. 2. This makes the preliminary treating space 55 narrower at the top and wider toward the bead 44 thus applying higher voltage gradients initially rather than after initial coalescence has taken place. In addition, it is often desirable to mount the outer member 40 with its axis above that of the container 15 as in Fig. 9. This makes the width of the main treating space 56 somewhat narrower toward the top, a desirable feature as the oil can stand higher gradients when some of the dispersed material coalesced in the main field has separated. Such higher gradients serve better to coalesce the last traces of the dispersed phase material. The nut means associated with the covers 49 permit adjustment in vertical position of the outer member 40 relative to the container 15 and the inner member 30. Raising the member 40 narrows the treating space 56 at its upper portion and lowering this member 40 narrows the annular treating space 55 at its upper portion. A setting often desirable is to dispose the axis of the inner member 30 above the axis of the container and adjust the outer member 40 so that both treating spaces are narrower at their respective upper portions.

Practically all of the dispersion flows through the circular paths previously described. However, a very small portion of the emulsion flows downwardly through an end zone 65 at each of the inner member 30 between the heads 31, 41 and 32, 42. Most of this downwardly-flowing stream will rise into the main treating space 56 but a small portion will rise to the exit openings 59 through passages 66 formed at one end of the container between the plate 42 and the partition 19 and at the other end of the container between the plate 41 and a baffle 67 parallel thereto. The baffle 67 may partially or completely close the end of the container 15. As shown, it forms a dead space 68 open at its lower end. Small weep holes 70, greatly exaggerated in size in the drawings, are preferably formed through the upper portions of the plates 41, 42 and the baffle 67; also through the lowermost wall of the inner member 30 to permit draining or venting when it is desired that all of the liquid material be removed from the treater.

The masses of dispersed phase material settle to a shallow channel formed by the lower interior of the container 15, flowing therealong through the opening 25 of the partition 19 into the withdrawal zone 22. Here a body of the dispersed phase material is permitted to collect, indicated by the numeral 72. If the rate of flow through the opening 25 is such as to carry therethrough a portion of oil or sludge, this will rise in the withdrawal zone 22, forming a body 73 in the extreme upper end thereof. Oil from this body may be withdrawn through a pipe 74 and sent to storage through a valve 75 or it

may be delivered through a valve 76 and a pipe 77 to the intake of a pump 78 which returns the thus-pressured material to the pipe 36. The dispersed phase material is normally withdrawn from the withdrawal zone through a valved pipe 78a communicating therewith at a level above the center of the container but below the interface 79 between the bodies 72 and 73. A supplementary valved pipe 78b assists in drainage of the system. During normal use, however, the pipe 78b is not used. Even if the treater is depressured, e.g., to permit inspection of the insulators 50 or the bushing 53 upon removal of the covers 49 or 52 respectively, the hydrostatic head from the column of liquid in the withdrawal zone 22 balances the head in the main treating zone.

It is a feature of the invention that treaters of the type herein shown can be stacked vertically or horizontally, permitting treatment to be effected in a plurality of standard units connected serially for successive treatments or connected in parallel with each other to treat portions of a larger stream. To facilitate such stacking, each treater includes two frames 80 spaced longitudinally of the container and suitably secured thereto, as by welding. Each frame is rectangular and provides opposed parallel side members 81, 82 extending vertically, and opposed side members 83, 84 extending horizontally. The outer faces of these side members are disposed beyond the periphery of the container for attachment to similar side members of an adjacent treater to permit stacking either vertically or horizontally or both, see Figs. 6 and 7. Each side member provides openings 85 for receiving bolts securing adjoining side members of stacked units together. The openings 85 of the lowermost side member 84 may receive anchor bolts 86 securing the treater or a stack of treaters to a suitable foundation 87 (Fig. 1).

The embodiment of Figs. 8-12 is generally similar to the embodiment previously described except for the manner in which the dispersed phase material is conducted from the main treating chamber 21 to the withdrawal zone 22, necessitating also a slightly different positioning of the inlet pipe 36, which enters through the head 16 in Fig. 8. In the alternative embodiment, the coalesced dispersed phase material settling to the bottom of the main treating zone 21 is withdrawn at positions along the length thereof through aligned openings 100 which communicate with the interior of a manifold 101 traversing the zone of the partition 19 to a position beneath the withdrawal zone 22. Openings 103 in this section of the container 15 permit the coalesced dispersed phase material to rise into the withdrawal zone 22. The manifold 101 is preferably constructed in the manner of the manifold 60 previously described and serves to by-pass the partition 19 so that the latter may extend completely across the interior of the container 15, being directly welded thereto with no opening 25 therein.

In both embodiments of the invention, a major portion of the main treating zone 21 can comprise active treating zones in which electric fields are established. If desired, much of the separating function can be transferred to the withdrawal zone 22, as by drawing a concentrated mixture of oil and dispersed phase material, sometimes termed a sludge, into the withdrawal zone for separation therein. The employment of one end of an elongated container as the separation zone is a feature of the present invention.

While the illustrated embodiment of the invention employs two tubular electrodes with the container 15 acting as a third electrode, it will be apparent that a larger number of inner and surrounding electrodes can be employed within the container to repeat the flow pattern indicated by the arrows of Fig. 2. It will be apparent also that other modifications are possible within the scope of the invention and will be apparent to those skilled

in the art from the foregoing description of exemplary embodiments.

I claim as my invention:

1. An electric treater for dispersions including: two long and narrow tubular members of different size measured transversely to the longitudinal axes thereof, each providing orifice means exclusively along one side thereof extending substantially throughout the complete length thereof but each tubular member being otherwise enclosed; means for mounting the smaller-size tubular member longitudinally within the larger-size tubular member with the orifice means of said members facing in substantially opposite directions and the orifice means in the smaller-size tubular member facing upwardly to provide a treating space outside the inner member and inside the outer member, said mounting means including means for electrically insulating said tubular members from each other; means for establishing a high-voltage electric field in said treating space; and means for delivering the dispersion to be treated to the inside of said inner tubular member for passage through the inner of said orifice means to flow through said electric field and discharge from the other of said orifice means.
2. An electric treater as defined in claim 1 in which each of said tubular members has opposite ends, and including end members closing the opposite ends of each of said tubular members, the end members of the inner member being spaced from the end members of the outer member.
3. An electric treater as defined in claim 1 in which the cross-sectional area of the orifice means of the inner member is substantially less than the cross-sectional area of the orifice means of the outer member.
4. An electric treater as defined in claim 1 in which the longitudinal axis of said inner member is parallel to but displaced from the longitudinal axis of said outer member to provide an arcuate treating space narrow in width toward the orificed side of one of the members than at the opposite side.
5. An electric treater for dispersions, said treater being adapted to be connected to a source of potential, said treater including: a closed tubular dispersion distributor having a substantially horizontal longitudinal axis and having orifice means exclusively on the upper side thereof along a line parallel to said longitudinal axis, said orifice means communicating between the interior and exterior of said tubular distributor substantially throughout the length thereof; means for supplying the dispersion to be treated to the interior of said distributor to flow in an upward direction from said orifice means; a closed elongated electrode having a longitudinal slot; means for mounting said electrode at a position around, spaced from and electrically insulated from said distributor with said slot downward, an upper wall of said electrode lying opposite said orifice means of said distributor in the path of flow of said dispersion therefrom, there being a treating space between said distributor and said electrode around the former and within the latter; and means for electrically connecting said distributor and said electrode to said source of potential to establish an electric field in said treating space.
6. An electric treater for dispersions, said treater being adapted to be connected to a source of potential, said treater including: a long and narrow closed substantially horizontal container; two long and narrow tubular members each substantially impervious except for orifice means therethrough exclusively along one side thereof extending substantially throughout the length thereof; means for horizontally mounting said tubular members in said container with one member within the other and with the orifice means of the inner member facing upward and the orifice means of the outer member facing downward and opening on the lower interior of said container, said means including means for electrically insulating the outer of said members from the inner member to form

an inner treating space therebetween and for insulating such outer member from the container to form an outer treating space between the outer member and the container, said treating spaces being in communication through the orifice means of the outer member; exit orifice means communicating with said outer treating space at positions substantially throughout the length thereof and opposite the orifice means of said inner member but separated from the latter by said outer member; means for supplying the dispersion to be treated to the interior of said inner member to establish a flow from the orifice means thereof sequentially through the inner and outer treating spaces and the exit orifice means; means for connecting said outer member to one terminal of said potential source and said container and inner member to the other terminal of said source to establish electric fields in said treating spaces acting on said dispersion; and means for withdrawing settled material from the lower interior of said container.

7. An electric treater as defined in claim 6 in which the orifice means of said outer member is of greater width than the transverse dimension of said inner member.

8. An electric treater as defined in claim 6 in which said dispersion supply means includes pipe means extending into the interior of said inner member, said pipe means providing a plurality of discharge orifices spaced longitudinally therealong discharging the dispersion at a plurality of positions within said inner member.

9. An electric treater as defined in claim 6 in which said container, said outer member and said inner member are substantially cylindrical, and including plates closing the ends of said inner and outer members and additional plates of said container spaced from the end plates of said outer member to form end treating spaces at the ends of said outer member.

10. An electric treater for oil-continuous dispersions, including: a long and narrow closed container; means for mounting said container in a substantially horizontal position with its axis substantially horizontal; an upright partition mounted in said container traversing the interior thereof and dividing same into a main treating zone and a withdrawal zone; means for electrically treating said oil-continuous dispersion and separating the electrically treated constituents in said main treating zone into treated oil on the one hand and dispersed phase material still containing some residual oil on the other hand and for further separating said dispersed phase material from its residual oil in said withdrawal zone, said last-named means including spaced electrodes in said main treating zone, means for insulating such electrodes from each other, means connected to said electrodes developing a high potential difference therebetween and establishing a high-voltage electric field therebetween, means for delivering the dispersion to be treated to said electric field for producing said electrically treated constituents, and walls defining a passage means traversing said partition openly interconnecting the lower interiors of said zones and delivering all of said dispersed phase material containing residual oil from the lower interior of said main treating zone to the lower interior of said withdrawal zone for separation therein to form superimposed bodies of separated oil and dispersed phase material in said withdrawal zone, the internal height of said main and withdrawal zones being substantially equal whereby the hydrostatic head of said superimposed bodies in said withdrawal zone balances the hydrostatic head of the liquid in said main treating zone; oil withdrawal means for withdrawing oil from the upper interiors of said zones, such oil withdrawal means including an oil effluent pipe communicating with the upper interior of said withdrawal zone; and means for withdrawing said separated dispersed phase material exclusively from said withdrawal zone comprising a withdrawal pipe opening on the interior of said withdrawal zone at a level below the point at which said oil effluent pipe communicates therewith.

11. An electric treater as defined in claim 10 in which said emulsion delivery means includes an inlet pipe and a pump forcing the dispersion to be treated therethrough to said field, and including a return pipe means communicating at one of its ends with said oil effluent pipe and at the other of its ends with said inlet pipe, and a second pump in said return pipe means forcing oil from said oil effluent pipe to said inlet pipe for return to said electric field.

12. An electric treater as defined in claim 10, in which said container is of substantially uniform area at different cross-sections along its length, said container being closed by end walls, and in which said partition is an upright partition nearer one end wall of said container than the other end wall thereof to form a large main treating zone between said partition and said other end wall and a smaller withdrawal zone between said partition and said one end wall.

13. An electric treater as defined in claim 10 in which said passage means comprises an opening through a lower portion of said partition, said opening directly interconnecting said lower interiors of said zones.

14. An electric treater for dispersions, including: a long and narrow closed container; means for mounting said container in a substantially horizontal position with its axis substantially horizontal; a partition mounted in said container traversing the interior thereof and dividing same into a main treating zone and a withdrawal zone; walls defining a passage means exterior of said container and parallel thereto, said passage means openly interconnecting the lower interiors of said zones, said walls including a manifold below said container having portions respectively below said main treating zone and said withdrawal zone, there being openings through the bottom of said container opening on the interior of said manifold, said openings being in two groups respectively opening on the main treating zone and on said withdrawal zone, said groups respectively receiving dispersed phase material from said main treating zone and delivering same to said withdrawal zone; spaced electrodes in said main treating zone for establishing an electric field therein; means for delivering the dispersion to be treated to said electric field, the dispersed phase material of the dispersion settling to the lower interior of said main treating zone and flowing into said withdrawal zone through said passage means to form a body of dispersed phase material in said withdrawal zone; means for withdrawing treated material from the upper interior of said main treating zone; and means for withdrawing dispersed phase material from said body thereof in said withdrawal zone.

15. An electric treater for dispersions, including: a zones including a semitubular member below said bottom wall; means for mounting said container in a substantially horizontal position with its axis substantially horizontal; a partition mounted in said container traversing the interior thereof and dividing same into a main treating zone and a withdrawal zone; walls defining a passage means openly interconnecting the lower interiors of said zones including a semitubular member below said bottom wall having edges welded thereto and closure plates closing the ends of said semitubular member, the space within said semitubular member between said closure plates constituting said passage means, said bottom wall having a first group of openings spaced from each other longitudinally of said container and interconnecting said passage means with said lower interior of said main treating zone to receive dispersed phase material therefrom, said bottom wall having a second group of openings spaced from each other longitudinally of said container connecting said passage means with said lower interior of said withdrawal zone for delivering said dispersed phase material thereto; spaced electrodes in said main treating zone for establishing an electric field therein; means for delivering the dispersion to be treated to said electric field, the dispersed phase material of the dis-

persion settling to the lower interior of said main treating zone and flowing into said withdrawal zone through said passage means to form a body of dispersed phase material in said withdrawal zone; means for withdrawing treated material from the upper interior of said main treating zone; and means for withdrawing dispersed phase material from said body thereof in said withdrawal zone.

16. An electric treater for dispersions including: two long tubular members of circular cross section and means for mounting one of said members within, spaced from and electrically insulated from the other of said members to form an arcuate inner treating space therebetween, halves of said inner treating space lying respectively on opposite sides of a longitudinal vertical plane passing through the central axis of said inner member, said inner member being closed except for an upwardly facing orifice means extending substantially throughout the length thereof having a center line in said plane on one side of said axis, said outer member having an orifice means having a center line in said plane on the opposite side of said longitudinal axis, the interior surface of said outer member having a longitudinally extending deflection zone opposite the entire length of the orifice means of said inner member but spaced outwardly therefrom to divert any stream therefrom to form two streams moving in opposite directions away from the orifice means of the inner member and along the respective halves of said arcuate inner treating space; a container surrounding said spaced tubular members; means for establishing a high-voltage electric field in said halves of said inner treating space; means for delivering the dispersion to be treated to the interior of said inner member to flow from its orifice means, said stream dividing between said halves of said inner treating space for electric treatment therein and discharging through said orifice means of said outer member into the interior of said container for separation therein into lighter and heavier components; and means for respectively withdrawing said lighter and heavier components from the upper interior and lower interior of said container.

17. An electric treater as defined in claim 16 in which said outer member is spaced from said container to define therebetween halves of an outer treating space respectively outwardly beyond said halves of said inner treating space and separated therefrom by said outer member, said treater including means for electrically insulating said outer member from said container, said field-establishing means establishing electric fields in said halves of said outer treating space, said streams discharging through said orifice means of said outer member turning and flowing along said halves of said outer treating spaces to an exit position in said plane opposite said orifice means of said inner member but separated therefrom by said outer member, one of said withdrawal means for one of said components being located at said exit position and having exit orifice means elongated in the direction of said plane.

18. An electric treater as defined in claim 17 in which said container has a plurality of exit openings there-through at said exit position aligned in the direction of said plane, and in which said one of said withdrawal means includes a manifold outside said container communicating with said outer treating spaces through said exit openings of said container.

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UNITED STATES PATENT OFFICE  
CERTIFICATION OF CORRECTION

Patent No. 2,963,414

December 6, 1960

Logan C. Waterman

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 48, after "at each" insert -- end --;  
column 6, line 37, for "narrow" read -- narrower --;  
column 8, line 52, for "zones including a semitubular member below said" read -- long and narrow closed container providing a --.

Signed and sealed this 9th day of May 1961.

(SEAL)

Attest:

ERNEST W. SWIDER  
Attesting Officer

DAVID L. LADD  
Commissioner of Patents