R. E. LAIRD & J. H. RANEY.

APPARATUS FOR TREATING EMULSIONS.

APPLICATION FILED JULY 22, 1914.

1,142,760.

Patented June 8, 1915.

3 SHEETS—SHEET 1.

Fig. 1.

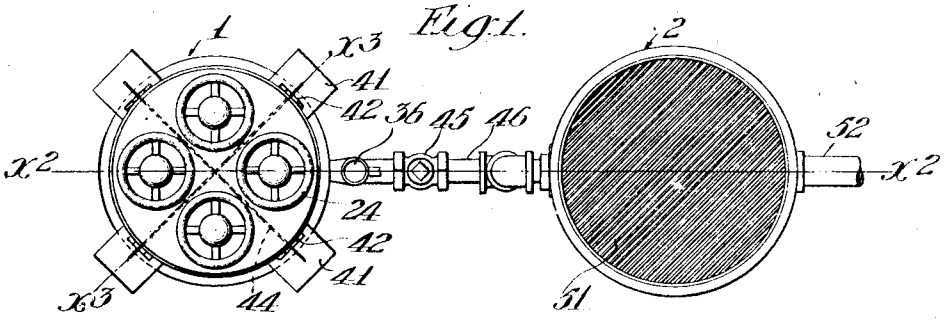


Fig. 2.

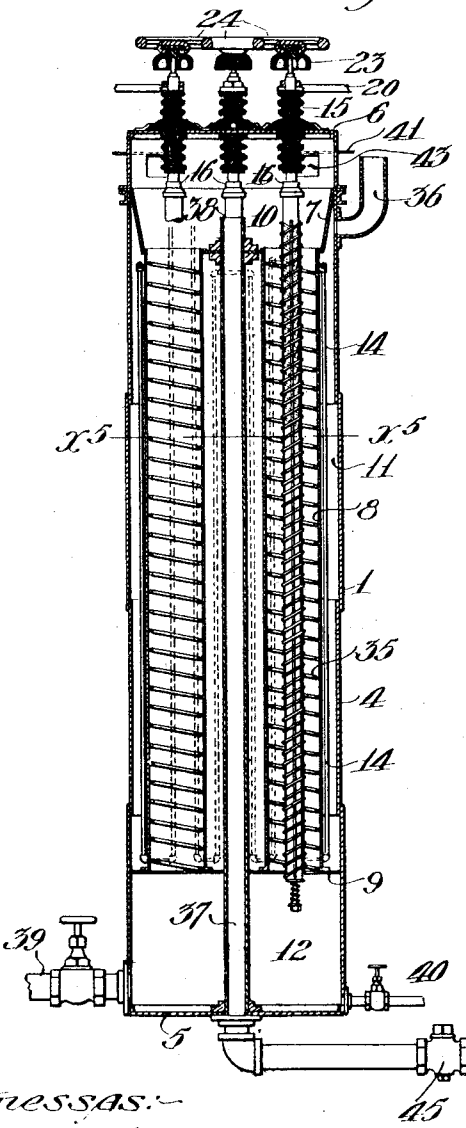
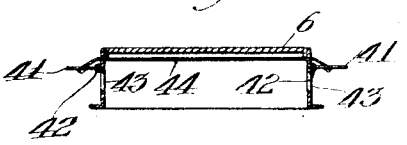
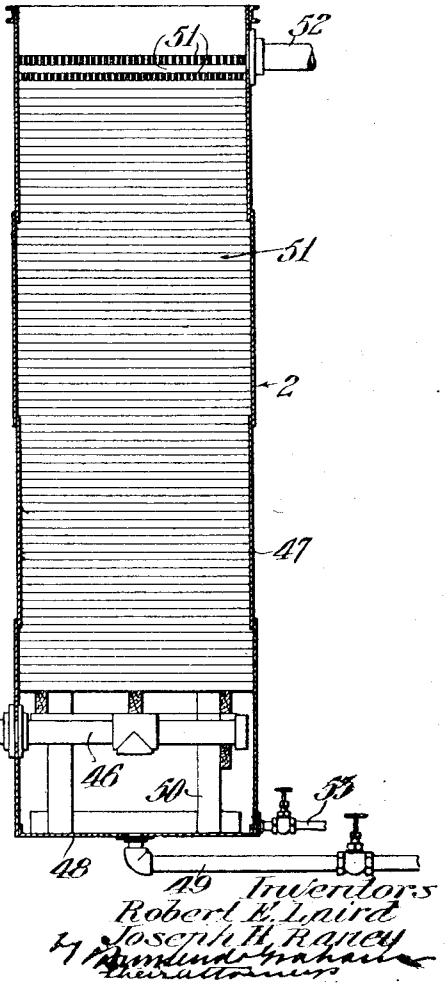


Fig. 3.





Witnesses:—
Louis W. Gratz
Jno. A. Mansfield

Inventors
Robert E. Laird
Joseph H. Raney
by Bamford & Bamford
their attorneys

R. E. LAIRD & J. H. RANEY.

APPARATUS FOR TREATING EMULSIONS.

APPLICATION FILED JULY 22, 1914.

1,142,760.

Patented June 8, 1915.

3 SHEETS—SHEET 2.

Fig. 5.

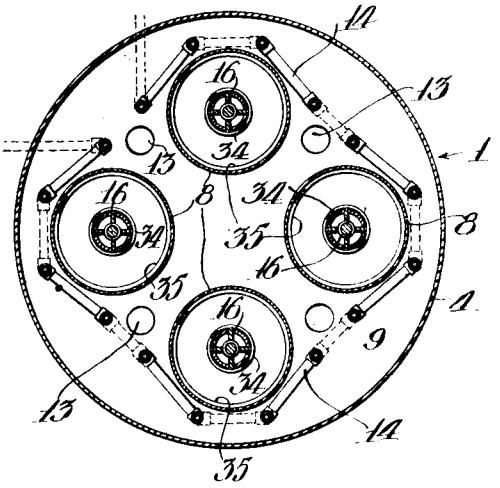


Fig. 4.

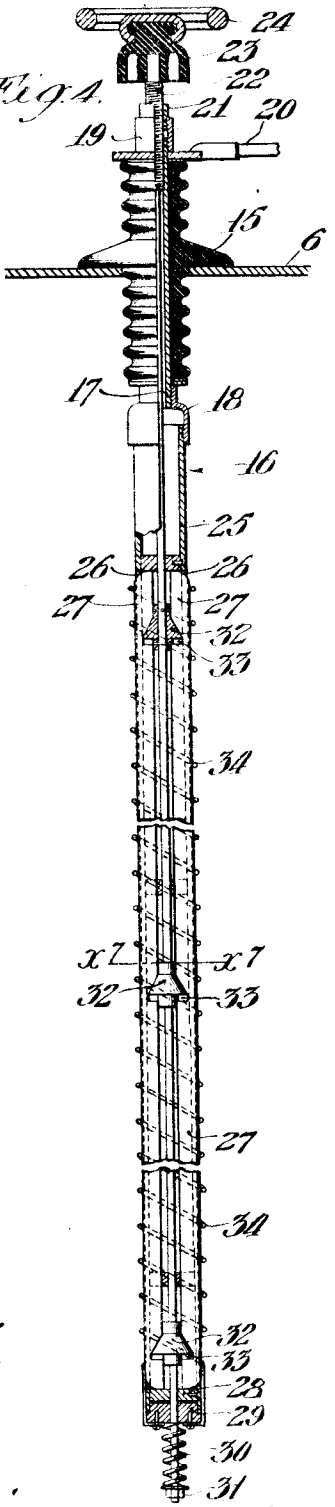


Fig. 6.

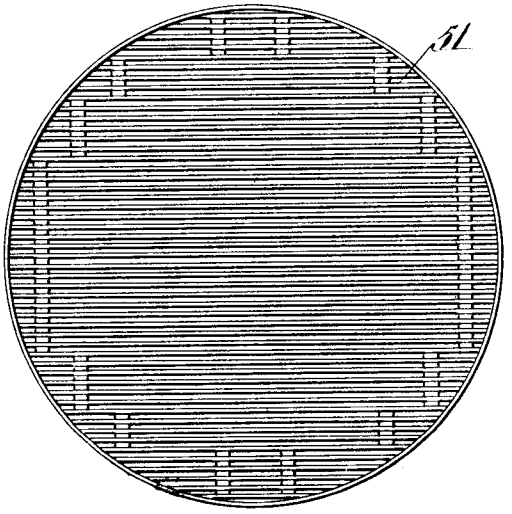
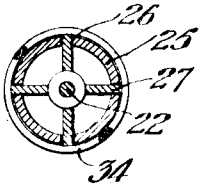


Fig. 7.



Witnesses:
Louis W. Gratz
Fred A. Mansfield

Inventors:
Robert E. Laird
Joseph H. Raney
by Bronaugh & Graham
their attorneys

R. E. LAIRD & J. H. RANEY.

APPARATUS FOR TREATING EMULSIONS.

APPLICATION FILED JULY 22, 1914.

1,142,760.

Patented June 8, 1915.

3 SHEETS—SHEET 3.

Fig. 9.

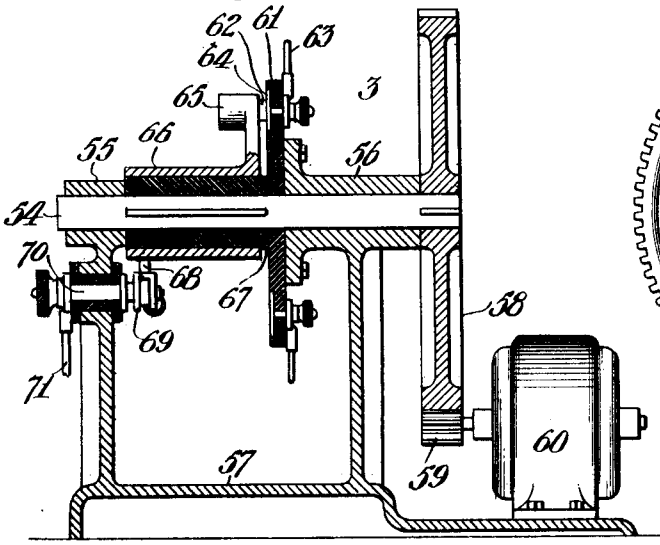


Fig. 8.

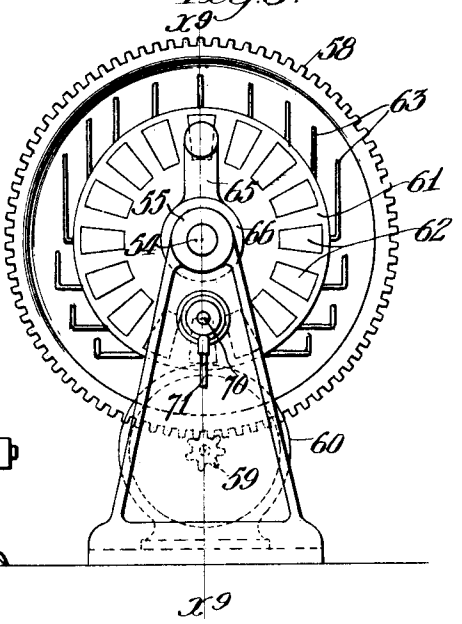
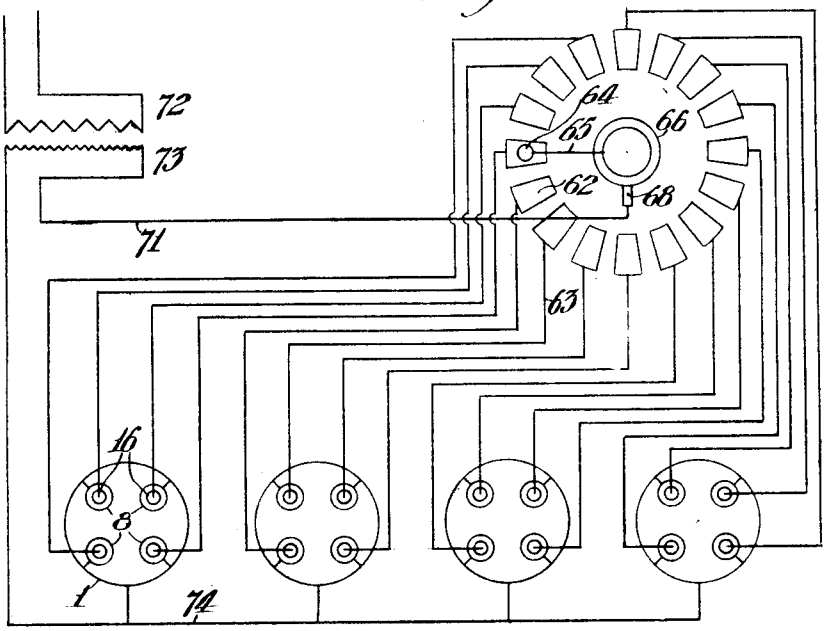


Fig. 10.



Witnesses:-
Louis W. Gratz.
Fred Appanfield

Inventors
Robert E. Laird
Joseph H. Raney
by Richards & Graham
their Attorneys

UNITED STATES PATENT OFFICE.

ROBERT E. LAIRD AND JOSEPH H. RANEY, OF TAFT, CALIFORNIA, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO RANEY-LAIRD PETROLEUM DEHYDRATING COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

APPARATUS FOR TREATING EMULSIONS.

1,142,760. Specification of Letters Patent. Patented June 8, 1915.

Application filed July 22, 1914. Serial No. 852,483.

To all whom it may concern:

Be it known that we, ROBERT E. LAIRD and JOSEPH H. RANEY, citizens of the United States, both residing at Taft, in the county of Kern, State of California, have invented a new and useful Apparatus for Treating Emulsions.

Our invention relates to apparatus for treating emulsions and is particularly applicable to emulsions of petroleum oil and water.

In the production and transportation of crude petroleum water is often accidentally mixed with the oil and it is desirable to remove this water before refining the oil. Such water is present in two forms, first, as free water appearing as relatively large globules which will settle out under the action of gravity, and second, appearing as trapped water in the form of minute particles forming an emulsion with the oil which will not separate under the action of gravity even if allowed to stand for long periods.

The principal object of our invention is to provide apparatus for breaking up the oil walls between the particles of trapped water and allowing them to coalesce into globules of free water.

A further object of our invention is to provide means for separating this free water from the oil after it has been changed from trapped water to free water.

We have found that water may be changed from trapped to free water by the action of electrical discharges thereon, and our invention provides means for producing and directing such discharges to the best advantage. It is necessary for such treatment of oils to provide electrodes of opposite polarity between which the discharges take place. In the treatment of commercial emulsions wide variations will be found in the amount of free and trapped water, and a further object of our invention is to provide means whereby the effective distance between the electrodes may be varied to suit the character of the oil to be treated, such means being manually adjustable while in operation. The free water will settle out if allowed to stand, but we find it more economical to allow a small proportion to pass through the treater and to supply an auxiliary separator for removing this small portion. A further object of our invention is to provide such an auxiliary separator.

There is further some small liability of fire in the treater and a still further object of our invention is to provide openings in the top of the treater through which the gases generated in the treater may escape and at the same time to provide automatic means for closing these doors if combustion occurs in the top of the treater.

Referring to the drawings, which are for illustrative purposes only: Figure 1 is a plan view of a treater and separator. Fig. 2 is an elevation, partly in section, on the plane x^2—x^2 of Fig. 1. Fig. 3 is a partial section on the plane x^3—x^3 of Fig. 1, certain of the parts being omitted for the sake of clearness. Fig. 4 is an enlarged section on the plane x^2—x^2 of Fig. 1 of the inner electrode. Fig. 5 is an enlarged section on the plane x^5—x^5 of Fig. 2. Fig. 6 is a plan of one of the lath members of the separator. Fig. 7 is an enlarged section on the plane x^7—x^7 of Fig. 4. Fig. 8 is an end elevation of one form of interrupter used in our invention. Fig. 9 is a section on the plane x^9—x^9 of Fig. 8. Fig. 10 is a diagram of connections.

In these drawings, 1 is a treater, 2 is a separator, and 3 is an interrupter. The treater 1 consists of a cylindrical shell 4 provided with a tight bottom 5 and a top 6. A pan 7 forms a tight closure with the shell 4 and a series of outer electrodes 8 are tightly secured in the pan 7 extending downwardly and being tightly secured at their lower ends in a plate 9. The pan 7 and the plate 9 divide the treater into three compartments, an upper compartment 10, a central compartment 11, and a lower compartment 12, the outer electrodes 8 forming an open passageway between the compartments 10 and 12 and a series of holes 13 providing a passageway between the compartments 11 and 12. A series of steam coils 14 are placed in the compartment 11 for the purpose of heating oil as it passes therethrough, being supplied with steam from any convenient source not shown. Secured to the top 6 and projecting therethrough are a series of insulators 15 in which are secured inner electrodes 16. The construction of the inner electrodes 16 may be best understood by re-

ferring to Fig. 4. Secured in the insulators 15 is a tube 17 having a reducer 18 secured to its lower end and a collar 19 secured to its upper end. Connectors 20 are provided suitably clamped between the insulator 15 and the collar 19. A nipple 21 is secured in the upper end of the collar 19 and a rod 22 is threaded therein, an insulator 23 being rigidly secured on the upper end of the rod 22 having a hand wheel 24 secured to the top thereof. Secured in the reducer 18 is a pipe 25 which has four slots cut therein as shown at 26, in each of which is a blade 27. The rod 22 extends downwardly through the center of the tube 25 and into a bearing 28 secured in the lower end of said tube, a movable cap 29 being secured outside the bearing 28 and a compression spring 30 being provided about the rod 22 acting against the nut 31 on the lower end of the rod 22 and tending to hold the rod 22 in its lower position. Mounted on the rod 22 are a series of cones 32 which coöperate with a series of angular openings 33 in the blades 27. A spring 34 is provided entirely encircling the blades 27 and the pipe 25 being secured at their lower ends to the head 29. That portion of the rod 22 which passes through the head 29 is square and the opening in the head 29 through which the rod 22 passes is also square. The inner electrodes 16 are therefore supported from the top 6 and extend downwardly through the center of the outer electrodes 8. A spring 35 is expanded into the inside of each of the outer electrodes 8 for the purpose of making a continuous small projection from which the electrical discharges can readily take place.

An inlet pipe 36 communicates with the chamber 11 near the top thereof. A central pipe 37 passes through the bottom 5, the plate 9, and the pan 7, extending upwardly in the pan 7 as shown at 38. A water outlet pipe 39 is located near the bottom of the chamber 12 for removing the free water that collects therein. A blow out pipe 40 through which steam or water may be injected for cleaning the treater is secured near the lower end of the chamber 12.

Four doors 41 are suitably hinged as shown at 42 to the top 6 and are provided with weights or springs which normally tend to cause them to close four openings 43 cut in the top 6, these openings being provided to allow for the escape of any gases formed in the treater. An inflammable string 44 passes across the top of the treater through the interior thereof and either end of the string 44 is secured to one of the doors 41 tending to hold them in pairs in the open position as plainly shown in Fig. 3. Should the oil in the treater for any reason take fire the strings 44 are burned off and the springs or weights cause the doors 41 to close the openings or ports 43. The pipe 37 communicates through a valve 45 with an inlet pipe 46 in the separator 2. The separator 2 consists of an outer shell 47 having a tight bottom 48 in which is placed a water outlet pipe 49. Suitably supported on the frame work 50 are a series of lath members 51 which are formed of wood or other material which will be wetted by water. An oil outlet pipe 52 communicates with the top of the separator above the lath members 51 and an inlet pipe 53 is provided through which water or steam may be introduced into the separator for cleaning purposes.

The interrupter 3 consists of a shaft 54 supported in bearings 55 and 56 formed on a bed plate 57. The shaft 54 is rotated by means of a gear 58 and a pinion 59 from an electric motor 60 which is secured to the bed plate 57. Rigidly secured to the bearing 56 is an insulated plate 61 upon which are secured a series of contacts 62 to each of which is connected a wire 63. A movable brush 64 is carried in a brush arm 65 formed on a sleeve 66 which is rigidly secured to the shaft 54 by means of an insulating bushing 67. A stationary brush 68 carried in a brush holder 69 presses against the sleeve 66. The brush holder 69 is carried on a brush stud 70 which is connected to a wire 71.

A diagram of connections is shown in Fig. 10. In this figure primary windings 72 of a transformer are suitably energized from any convenient source of alternating current. A secondary winding 73 is connected through the wire 71 with the brush 68 and through the brush 68 with the sleeve 66. The sleeve 66 is connected through the brush arm 65 with the brush 64 which successively makes contact with the segments 62, each of which is connected to a wire 63. The wires 63 are connected to inner electrodes 16, the current passing through the emulsion therefrom to the outer electrodes 8 and from thence by means of a wire 74 to the other side of the secondary 73 of the transformer.

The method of operation of the invention is as follows: The emulsion to be treated is admitted to the chamber 11 through the pipe 36 passing into this chamber and surrounding the outer electrodes 8 and being heated by the steam coils 14 to any desired temperature and viscosity. The emulsion then passes through openings 13 into the chamber 12 and upwardly between the outer electrodes 8 and the inner electrodes 16. A potential being impressed on the primary 72 a suitable potential is generated in the secondary 73 and a current flows through the wires 71, the brush 68, the sleeve 66, the arm 65, the brush 64, and the segments 62 into the wires 63 passing through these wires to the inner electrodes 16. The current then forms an electrical discharge from the wire 34 to the wire 35 and passes through the wires 74

back to the secondary of the transformer 73. As the discharge acts upon the emulsion it tends to line the particles of trapped water up into chains and to force heavy currents through these chains breaking down the walls of oil between the different particles and causing these particles to coalesce into globules of free water. The greater portion of this free water settles downwardly into the bottom of the tank 12 from which it is withdrawn through the pipe 39. The remaining free water, free oil, and a small percentage of emulsion passes upwardly into the pan 7 and overflows into the pipe 38 passing through the valve 45 into the interior of the separator 2. If it is desired to change the effective distance between the wires 34 and 35 the operator turns the hand wheel 24 thus turning the rod 22 and raising or lowering the cones 32. The cones 32 force the blades 27 outwardly against the action of the spring 34. At the same time the squared end of the rod 22 turns the movable cap 29 and unwinds the spring 34. By suitably rotating the hand wheel 24 the effective diameter of the spring 34 can be varied at will. The treated liquid passes into the interior of the separator 2 and passes upwardly therethrough between the lath members 51, these members having been previously moistened with water so that the small proportion of free water therein is caught on these wetted surfaces and trickles down into the bottom of the separator 2 from which it may be removed by the pipe 53.

We claim as our invention:

1. A treater for emulsions of petroleum and water comprising a tank, a plurality of cylindrical outer electrodes in said tank through which the emulsion may be passed, an inner electrode in each of said outer electrodes, and means for varying the effective diameter of the said inner electrode.

2. In a treater for emulsions of petroleum oil and water, an inner electrode comprising a tube, a spring surrounding said tube, and means for expanding said spring to increase the effective diameter of said electrode.

3. In a treater for emulsions of petroleum oil and water, an electrode comprising a slotted pipe, a spring surrounding said pipe, a series of blades projecting through the slots in said pipe and engaging the inner side of said spring, and means for expanding said blades to distend the spring and increase the effective diameter of said electrode.

4. In a treater for emulsions of petroleum oil and water an electrode comprising a slotted pipe, a spring surrounding said pipe, a series of blades projecting through the slots in said pipe and engaging the inner side of said spring, a rod passing through the center of said pipe inside said blades, a series of cones on said rod adapted to expand said blades, and means for actuating said rod to expand said blades and increase the effective diameter of said electrode.

5. A treating apparatus comprising a treater, means for admitting an emulsion of oil and water to said treater, means for withdrawing the oil and water from said treater, a plurality of electrodes in said treater, means for producing a high alternating potential, and means for impressing this potential successively on said electrodes so as to cause a disruptive discharge to pass therebetween.

6. A treating apparatus comprising a treater, means for admitting an emulsion of oil and water to said treater, means for withdrawing the oil and water from said treater, electrodes arranged in pairs in said treater, means for producing a high alternating potential, and means for successively impressing said potential between the electrodes of each pair so as to cause a disruptive discharge to pass therebetween.

7. A treating apparatus comprising a treater, means for admitting an emulsion of oil and water to said treater, means for withdrawing the oil and water from said treater, electrodes arranged in pairs in said treater, a source of high alternating potential, and means for successively connecting said source with each pair of electrodes so as to cause a disruptive discharge to pass therebetween.

8. A treating apparatus comprising a treater, means for admitting an emulsion of oil and water to said treater, means for withdrawing the oil and water from said treater, electrodes arranged in pairs in said treater, a source of high alternating potential, and a moving distributer adapted to successively connect said source to each pair of electrodes so as to cause a disruptive discharge to pass therebetween.

9. A treating apparatus comprising a treater, means for admitting an emulsion of oil and water to said treater, means for withdrawing the oil and water from said treater, electrodes arranged in pairs in said treater, a source of alternating electric current, a transformer having its primary connected to said source, and means for successively connecting the secondary of said transformer to each pair of electrodes.

10. A treating apparatus comprising a treater, means for admitting an emulsion of oil and water to said treater, means for withdrawing the oil and water from said treater, electrodes arranged in pairs in said treater, a source of alternating electric current, a transformer having its primary connected to said source, a distributer for successively connecting the secondary of said transformer to each pair of said electrodes, and means for driving said distributer.

11. A treating apparatus for petroleum

emulsions comprising a treating chamber, means for passing a petroleum emulsion upwardly through said chamber, a series of electrodes arranged in pairs in said treating chamber, and an interrupter adapted to make and break a disruptive electrical discharge through the emulsion established between each pair of electrodes.

In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 15th day of July, 1914.

ROBERT E. LAIRD.
JOSEPH H. RANEY.

In presence of—
FRED A. MANSFIELD,
FORD W. HARRIS.