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F. W. HARRIS

ELECTRIC DEHYDRATOR

Original Filed Nov. 23, 1921

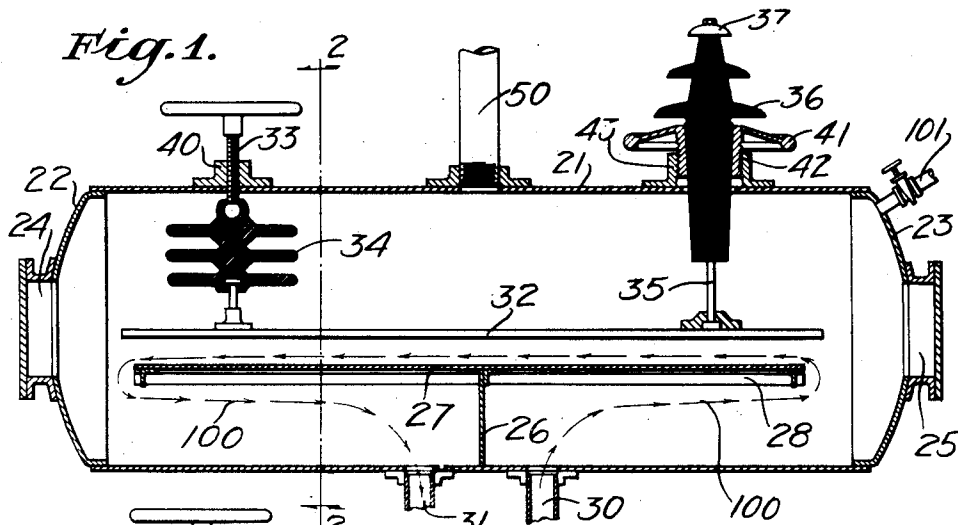
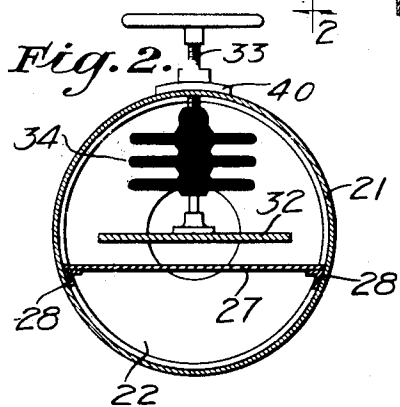
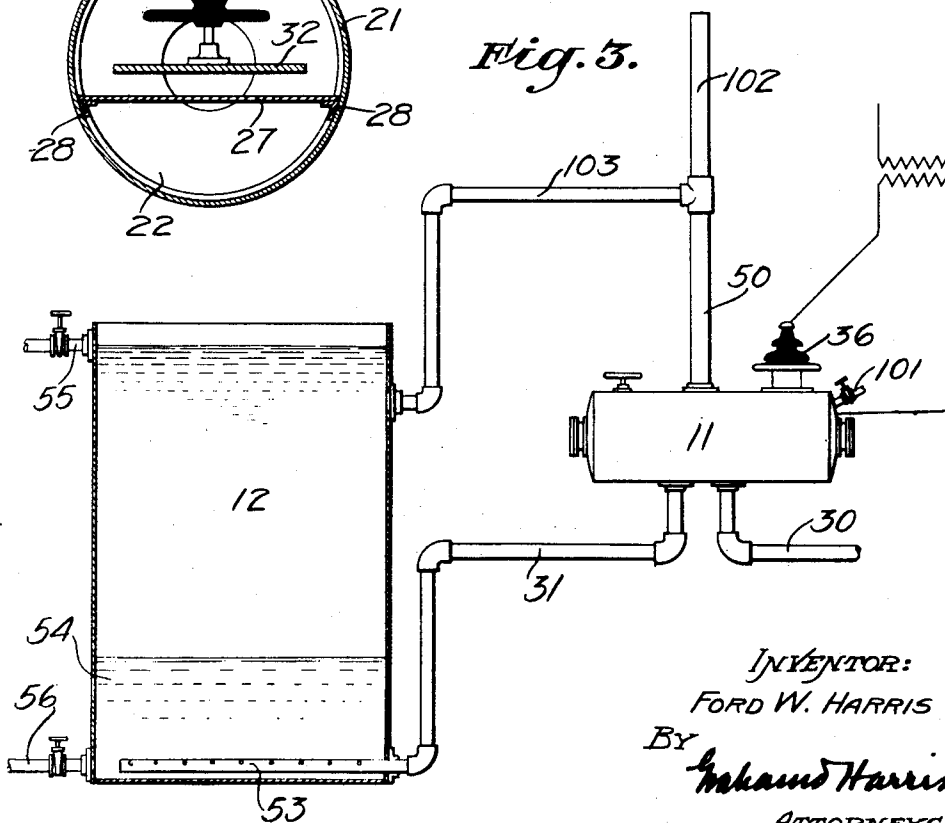


Fig. 3.



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UNITED STATES PATENT OFFICE.

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ELECTRIC DEHYDRATOR.

Application filed November 23, 1921, Serial No. 517,404. Renewed May 9, 1923.

To all whom it may concern:

Be it known that I, FORD W. HARRIS, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Improvement in Electric Dehydrators, of which the following is a specification.

My invention relates to dehydrators in which petroleum emulsions are dehydrated by passing them through an electrostatic field. It has been found that when petroleum emulsion is passed between surfaces having a difference of electrical potential therebetween that, under favorable conditions, an agglomeration of the fine water particles in the emulsion takes place, these fine water particles being combined into large masses which may thereafter be settled out by gravity.

To produce a dehydrator which is efficient in its action, it has been found necessary to maintain a considerable difference of potential between the electrodes, the dehydration apparently being due to an electrostatic rather than an electrolytic action. Owing to the fact that many of the emulsions which are treated contain large quantities of water, it is extremely difficult to maintain electrostatic conditions in a body of emulsion, disruptive discharges readily taking place through the body thereof and conducting chains of water particles being readily formed therein.

The principal object of my invention is to provide a dehydrator which will handle very wet emulsions without breaking down the dielectric strength of the field. This I accomplish by maintaining between the electrodes a layer of liquid of high dielectric strength, this layer of material consisting of thoroughly dehydrated oil produced by the dehydrator itself or introduced to it from an independent source.

Referring to the drawings which are for illustrative purposes only,

Fig. 1 is a cross section through one embodiment of my invention.

Fig. 2 is a section on a plane represented by the line 2—2 of Fig. 1, and

Fig. 3 is a diagrammatic view of the apparatus employed connected to a wash tank.

In the form of the apparatus employed I utilize a dehydrator 11 and a wash tank 12. The dehydrator 11 consists of a tight

tank 21 having closed ends 22 and 23 which are provided with hand holes 24 and 25 closed by suitable covers. A diaphragm 26 extends completely across the dehydrator near its central point and is secured at its upper end to a lower electrode 27. The electrode 27 extends from side to side of the tank and forms a tight closure therewith by means of angle irons 28 but terminates a little short of either end of the tank 21. Emulsion is introduced through an emulsion inlet pipe 30 and treated oil and water are withdrawn through an outlet pipe 31. Suspended above the lower electrode 27 is an upper electrode 32, this electrode being suspended at one end by means of a screw 33 and a series of suspension insulators 34 and being supported on the other end by means of a rod 35 passing through a porcelain insulator 36 and secured in a metal cap 37 carried on the top of that insulator. The screw 33 turns in a flange 40 and the insulator 36 is cemented into a hand wheel casting 41 which is threaded at 42 in a flange 43. The insulator 36 may be turned by means of the hand wheel 41 thus raising and lowering the insulator in the flange 43 and raising and lowering one end of the upper electrode 32. The other end of the electrode 32 may be raised and lowered by turning the screw 33, thus adjusting the vertical length of the electric field. A gas vent pipe 50 is provided in the top of the shell 21.

The apparatus is connected as shown in Fig. 3, emulsion being delivered to the dehydrator 11 through a pipe 30 and the treated material being withdrawn therefrom through a pipe 31. The pipe 31 is connected to a perforated pipe 53 in the bottom of the wash tank 12, the material delivered to the pipe 31 passing upwardly through a body of water 54 in the bottom of the wash tank in which the water which has been separated from the oil is collected, clean oil being taken off through a pipe 55 and water being taken off through a pipe 56. It is to be understood that a gravitational separation also takes place in the wash tank 12.

In starting the apparatus the dehydrator 11 is filled with dry oil having a high dielectric value. Cleaned oil from the pipe 55 will generally be of high enough dielectric value to allow the apparatus to be started, al-

though in some cases it may be advisable to use a transformer oil which is practically free from moisture. A potential of approximately 11,000 volts may be used on the apparatus with a gap between the electrodes 27 and 32 varying from less than 1" up to 6" depending upon the character of the oils to be treated. With a separation of $\frac{1}{2}$ " or over and with a good transformer oil disruptive discharges will not take place between the electrodes 32 and 27. In the ordinary operation of my apparatus a separation of possibly 2" may be used operating upon ordinary California emulsions.

The dehydrator having been filled with a fluid of high dielectric value such as transformer oil or oil which has been previously dehydrated, the emulsion to be treated is forced through the pipe 30 into the interior of the dehydrator 11. This emulsion follows the path 100 shown by dotted lines in Fig. 1, flowing upwardly and around the edge of the lower electrode 27 and flowing in a thin film over the surface of the lower electrode 27. With a proper separation of the electrodes 27 and 32 and a proper rate of flow which can be readily determined experimentally, it is possible to force the emulsion through the electric field between the plates 27 and 32 without entirely displacing the transformer oil or other high dielectric fluid carried therebetween. This fluid should be of lower specific gravity than the oil to be treated so that it naturally occupies the upper portion of the dehydrator. In its passage through the electric field, the emulsion is acted upon electrostatically, very efficient agglomeration of the water particles taking place. These water particles being heavier than the oil to be treated readily fall away, being carried with the treated oil through the pipe 31 and delivered to the wash tank 12.

In some cases, it is desirable to continuously supply small quantities of dried oil through a pipe 101, this material being supplied to replace any of the transformer oil which may be mixed with and carried away through the pipe 31. It is usually unnecessary to supply any such material through the pipe 101 after the dehydrator has been started for the reason that the treated oil which is free from moisture has a much lower specific gravity than the emulsion and naturally tends to rise into the top of the dehydrator 11 which forms a sort of pocket in which the very driest of the treated oil collects. I have found that in the practical operation of my invention after the apparatus is once started, the film of high dielectric strength material is automatically renewed by the action of the apparatus and is, therefore, self-maintaining. The vent 50 is carried up to a point 102 considerably above the level of the pipe 55 and an over-

flow connection is made through a pipe 103 from the pipe 102 well above the level of the pipe 66. The vent 50 is provided for the purpose of releasing any gases which may be formed and the overflow pipe 103 is provided to prevent excessive pressures being built up on the dehydrator 11 in the event that the pipe 31 becomes clogged for any reason.

The method of operating the wash tank 12 is as follows: The oil entering the wash tank 12 contains water particles which are sufficiently large to settle by gravity if the oil is allowed to stand. The tank 12 has considerable capacity and the water therefore has time to settle collecting in the bottom of the tank, the clean oil rising to the top and passing off through the pipe 55. The operator of the device may draw off the water periodically through the pipe 56, and he may set the valve slightly open so that water runs continually. In the latter case, he must change the adjustment from time to time as the water starts to show traces of oil, showing that the rate of water flow is too high or becomes entirely clear showing that the rate of water flow is too low.

I claim as my invention:

1. A method of dehydrating petroleum emulsions which comprises: establishing an electrostatic field between electrically charged surfaces immersed in an insulating fluid of sufficient dielectric strength to prevent disruptive discharges between said surfaces; and passing the emulsion to be treated through said field in such a manner that the envelope of insulating fluid around one of said electrodes is unbroken and the dielectric strength is maintained at a value sufficiently high to prevent disruptive discharge.

2. A method of dehydrating petroleum emulsions which comprises: establishing an electric field between an upper and a lower surface; introducing into said field a fluid of high dielectric value; and introducing the emulsion to be treated into said field in such a manner that its forms a layer parallel to one of the electrodes of the electric field.

3. A method of dehydrating petroleum emulsions which comprises: establishing an electric field in a fluid of high dielectric value and between two electrodes; and passing the emulsion to be treated through said field in such a manner as to maintain an unbroken layer of said fluid of high dielectric value through said field.

4. An apparatus for dehydrating petroleum emulsions comprising: a container; an electrode in the upper part of said container; means for filling said container with a fluid of high dielectric value; a second electrode in the lower portion of said container; means for establishing a difference of electrical potential between said electrodes; and means for passing a thin layer of emulsion

through the lower part of the space between said electrodes.

5 5. An apparatus for dehydrating petroleum emulsions comprising: a container; an upper electrode suspended in said container; a lower electrode below said upper electrode; means for establishing a difference of electrical potential between said electrodes; means for introducing emulsion to said container; means for causing the emulsion so
10 introduced to flow upwardly and over said lower electrode; and means for withdrawing treated oil and water from said container at a point below said lower electrode.

15 6. An apparatus for dehydrating petroleum emulsions which comprises: a container; an upper electrode suspended in but insulated from said container; a diaphragm extending across said container below said
20 upper electrode; means for introducing emulsion into said container on one side of said diaphragm; means for withdrawing treated oil and water from said container on the other side of said diaphragm; and means

for establishing a difference of electric potential between said upper electrode and said diaphragm. 25

7. An apparatus for dehydrating petroleum emulsions which comprises: a container; an upper electrode suspended in but insulated from said container; a diaphragm
30 extending across said container below said upper electrode; means for introducing emulsion into said container on one side of said diaphragm; means for withdrawing treated oil and water from said container
35 on the other side of said diaphragm; a lower electrode extending horizontally across the treator and having its lower surface in fluid tight relationship with the upper edge of said diaphragm which is vertical;
40 and means for impressing an electromotive force between said electrodes.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this
45 16th day of November, 1921.

FORD W. HARRIS.