Dec. 29, 1931. W. O. EDDY 1,838,918

ROTATING DISK DEHYDRATOR

Filed Nov. 29, 1926

Fig. 1.

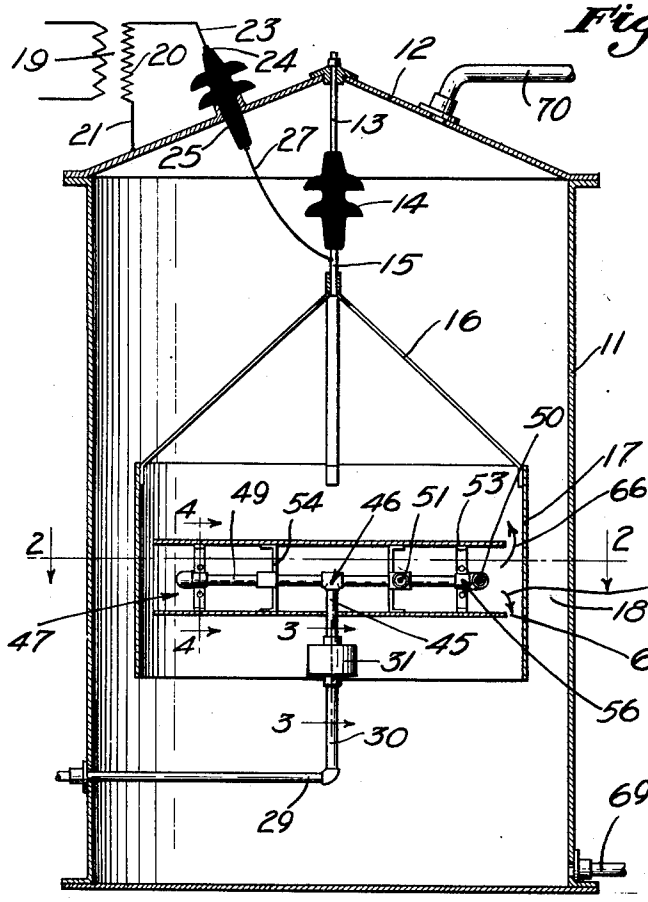


Fig. 3.

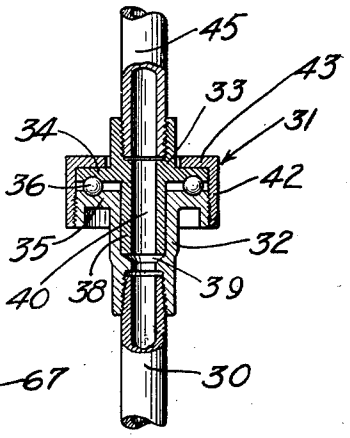


Fig. 4.

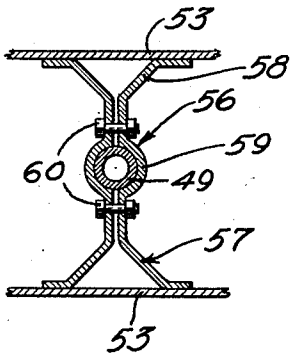
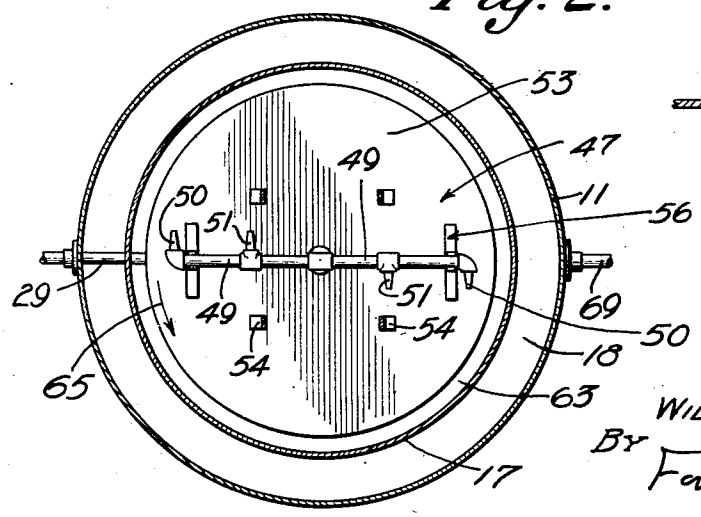


Fig. 2.



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UNITED STATES PATENT OFFICE

WILLIAM O. EDDY, OF LONG BEACH, CALIFORNIA, ASSIGNOR TO PETROLEUM RECTIFYING COMPANY OF CALIFORNIA, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA

ROTATING DISK DEHYDRATOR

Application filed November 29, 1926. Serial No. 151,418.

This invention relates to the art of dehydrating oil and water emulsion and is particularly applicable to the dehydration of petroleum emulsion in which the water appears in the form of small particles suspended in the petroleum. It has been found that these water particles are often so fine that they will not settle out of the petroleum even though it is allowed to stand for a considerable length of time. If, however, the petroleum is passed between electrodes charged with a suitable high electromotive force, the water particles are collected into larger masses which tend to settle rapidly from the petroleum. It has been found that in many cases the water particles tend to form short-circuiting chains between the electrodes in such a manner as to form conducting paths which short-circuit the electrodes and prevent further treatment of the emulsion.

It is an object of this invention to provide an electrical dehydrator in which petroleum emulsions may be dehydrated and in which short-circuiting chains of water are prevented from being formed between the electrodes.

Another object of my invention is to provide an electrical dehydrator having an electrode having a reaction element which is supplied with petroleum emulsion, the issuance of the petroleum emulsion therefrom causing the electrode to rotate. The rotation of the electrode breaks any chains which tend to form between the electrodes of the dehydrator.

Further objects and advantages of the invention will be made evident hereinafter.

Referring to the drawings in which I illustrate a preferred embodiment of my invention,

Fig. 1 is a vertical section through the invention.

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged section of a bearing of the invention, this view being taken on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary section taken on the line 4—4 of Fig. 1.

Referring in detail to the drawings, the dehydrator has a tank 11. Extending into the tank 11 through a top 12 thereof is a rod 13. The rod 13 supports an insulator 14. Supported below the insulator 14 is a lower rod 15 from which a plurality of arms 16 extend. The lower ends of the arms 16 are connected to a live electrode 17. The live electrode is cylindrical in form, being slightly smaller in diameter than the shell of the tank 11 so as to provide a secondary treating space 18. In Fig. 1 I show a transformer 19 having a secondary 20, one terminal of which is connected to the tank 11 by means of a conductor 21, the other terminal of which is connected by a wire 23 to a rod 24 which extends through an inlet bushing 25. Connected to the inner end of the rod 24 is a conductor 27 which is extended to the rod 15. In this manner one side of the secondary is connected to the tank and the other side is connected to the live electrode 17.

Extended into the tank 11 near the lower part thereof is an emulsion inlet pipe 29 having a vertical leg 30. As shown best in Fig. 3 a lower member 32 of a bearing 31 is connected to the upper end of the leg 30. Cooperating with the lower member 32 is an upper member 33. The upper and lower members 33 and 32 have flanges 34 and 35 respectively which serve as bearing races. Between these bearing races are balls 36. Extended downward from the upper member 33 is a projection 38 which extends into a socket 39 of the lower member 32. This arrangement centralizes the upper and lower members 33 and 32. The cylindrical projection 38 has an opening 40 formed therethrough. For attaching the upper and lower members together in a working relationship there is a nut 42 which is threadedly secured to the lower member 32 and which has an annular flange 43 which extends above the flange 34 of the upper member.

Secured to the upper member 33 and extended upward therefrom is a standard 45 of a reaction element 46. The reaction element 46 forms a part of a grounded electrode 47. The standard 45 is formed of pipe, as shown, and the passage therethrough connects with the passage 40 of the cylindrical projection

38. Extended outward from the upper end of the standard 45 in radial directions and forming a part of the reaction element 46 are arms 49 which are formed from pipe. Secured to the arms 49, as illustrated best in Fig. 2, are outer nozzles 50 and inner nozzles 51. The grounded electrode 47 also has electrode plates in the form of disks 53. The disks 53 are spaced above and below the arms of the reaction element and are spaced apart by spacer arms 54 and are connected to the arms 49 of the reaction element 46 by brackets 56, shown best in Fig. 4. The brackets 56 consist of strap members 57 which have oppositely extending arms 58 and central channels 59. The central channels 59 surround the arms 49 and the outer ends of the arms 58 are attached to the inner faces of the disks 53. The members 57 are clamped to the arms 49 by bolts 60. As shown clearly in Fig. 1, the grounded electrode 47 is placed inside the live electrode 17 so that the walls of said electrodes define a reaction chamber which directly receives all of the emulsion entering the dehydrator. The disks 53 are of smaller diameter than the diameter of the live electrode 17 so that there is an annular primary treating space 63 formed between the perimeter of each disk and the live electrode.

The operation of the invention is substantially as follows:

The emulsion to be dehydrated is passed through the emulsion inlet pipe 29. This emulsion passes upward through the vertical leg 30 and into the passage 40 of the cylindrical projection 38 of the upper member 33. The emulsion thereafter passes into the standard 45 and outward through the arms 49 and is delivered into the reaction chamber. The nozzles 50 and 51 are directed at right angles to the arms 49 and are therefore tangential with circles generated around the center of the reaction element on radii equivalent to the distance of the nozzles from this center point. The emulsion is forced from the nozzles 50 and 51, the reaction being established which causes the grounded electrode 47 to rotate slowly in the direction indicated by the arrow 65 of Fig. 2. This projection of the emulsion tends to rotate the liquid between the disks in a direction opposite to the rotation of these disks, but this tendency is small and is nullified by the tendency of the rotating electrode to carry the liquid between the disks therewith. The net result is that the emulsion flows substantially radially toward the live electrode 17.

The emulsion passes outward into and through the primary treating spaces 63. The grounded electrode 47, since it is connected to the shell 11, is joined to one side of the secondary 20 of the transformer 19. When the transformer 19 is supplied with energy an electric field is set up in the primary treating space 63 and also in the secondary treating space 18. The emulsion passes outward from the reaction chamber and is turned upward and downward through the respective treating spaces 63, as indicated by arrows 66 and 67 when it comes in contact with the live electrode 17. In passing between the edges of the disks and the live electrode 17 the emulsion is subjected to a high intensity field which agglomerates the water particles into masses of sufficient size to gravitate therefrom. A part of the oil, principally that oil which passes downward as indicated by the lower arrow 67, will pass through the treating space 18 and be subjected to further treatment.

The water agglomerated, as previously mentioned, falls to the bottom of the tank 11 and may be withdrawn through a pipe 69. Dehydrated oil is withdrawn from the upper end of the tank 11 through an oil outlet pipe 70. The slow rotation of the grounded electrode 47 prevents the formation of short-circuiting chains. As far as any masses of water tend to chain up, these chains will be broken.

The principal part of the invention is the rotating electrode 47 and also the use of a reaction element which utilizes the emulsion as power and directs a flow toward the electrode 17. The particular bearing construction which I employ is important, since it supports the grounded electrode with a minimum of friction and is so designed that there will be no leakage of emulsion at this point.

The present application is an improvement on the apparatus disclosed in an application filed by Harmon F. Fisher, Serial No. 135,803, in which is claimed the general combination of a dehydrator in which a flow takes place between baffles and through fields at the edges of these baffles.

I claim as my invention:

1. In a dehydrator of the class described, the combination of: a tank; a live electrode supported in said tank; a grounded electrode having a reaction element, and an electrode plate supported above and below said reaction element; means for rotatably supporting said grounded electrode; and means for supplying emulsion to said reaction element, said grounded electrode being revolved and said emulsion passing into a treating space between said grounded and live electrodes.

2. In a dehydrator of the class described, the combination of: a tank; a live electrode supported in said tank; a grounded electrode having a reaction element, and an electrode plate supported above and below said reaction element; a bearing attached to said reaction element for rotatably supporting said grounded electrode; and an emulsion inlet pipe extended into said tank for supporting said bearing and for supplying emulsion to said reaction element, said grounded electrode

being revolved and said emulsion passing into a treating space between said grounded and live electrodes.

3. In a dehydrator of the class described, the combination of: a primary electrode providing a substantially cylindrical chamber; a secondary electrode including a pair of spaced plates rotatably disposed in said chamber; and means for passing an emulsion into the space between said plates so it will escape in opposite directions between said electrodes.

4. In a dehydrator of the class described, the combination of: a primary electrode providing a substantially cylindrical chamber; a secondary electrode including a pair of spaced plates rotatably disposed in said chamber so that a relatively small space lies between the surface of said primary electrode and the peripheries of said plates; and means for discharging an emulsion to be treated between said plates, the reaction of said discharge rotating said plates.

5. In a dehydrator of the class described, the combination of: a primary electrode providing a substantially cylindrical chamber; a secondary electrode including a pair of spaced plates rotatably disposed in said chamber so that a relatively small space lies between the surface of said primary electrode and the peripheries of said plates; reaction means provided upon said secondary electrode between said plates; and means for supplying an emulsion to be treated to said reaction means to cause the rotation of said plates.

6. In a dehydrator of the class described, the combination of: a primary electrode providing a chamber; a secondary electrode disposed in said chamber, there being a chamber formed in said secondary electrode having a substantially annular outlet disposed adjacent to the surface of said primary electrode; means for rotating one of said electrodes relative to the other; and means for introducing emulsion to be treated into said secondary electrode chamber so that it passes out therefrom through said annular outlet and between said electrodes.

7. In a dehydrator of the class described, the combination of: a primary electrode providing a chamber; a secondary electrode disposed in said chamber, there being a chamber formed in said secondary electrode having a substantially annular outlet disposed adjacent to the surface of said primary electrode; reaction means provided upon said secondary electrode in the chamber thereof; and means for supplying an emulsion to be treated to said reaction means to rotate said secondary electrode.

8. In a dehydrator of the class described, the combination of: a primary electrode providing a chamber; a secondary electrode disposed in said chamber, there being a chamber formed in said secondary electrode having a substantially annular outlet disposed adjacent to the surface of said primary electrode; means for rotating one of said electrodes relative to the other; means for introducing emulsion to be treated into said secondary electrode chamber so that it passes out therefrom through said annular outlet and between said electrodes; and a tertiary electrode surrounding said primary electrode to provide a secondary treating space through which certain separated phases of said emulsion pass after being discharged from between said primary and secondary electrodes.

9. In a dehydrator of the class described, the combination of: a primary electrode having an annular surface; a secondary electrode having a pair of annular edges disposed in relative proximity to the annular surface of said primary electrode, there being a pair of high intensity treating spaces between said primary electrode and said annular edges; and means for introducing the emulsion to be treated tangentially into the space between said pair of annular edges, said emulsion moving in opposite directions through said high intensity treating spaces.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 22nd day of November, 1926.

WILLIAM O. EDDY.