April 6, 1926.

1,579,515

D. K. CASON, JR

ELECTRICAL DEHYDRATOR

Filed August 16, 1924

2 Sheets-Sheet 1

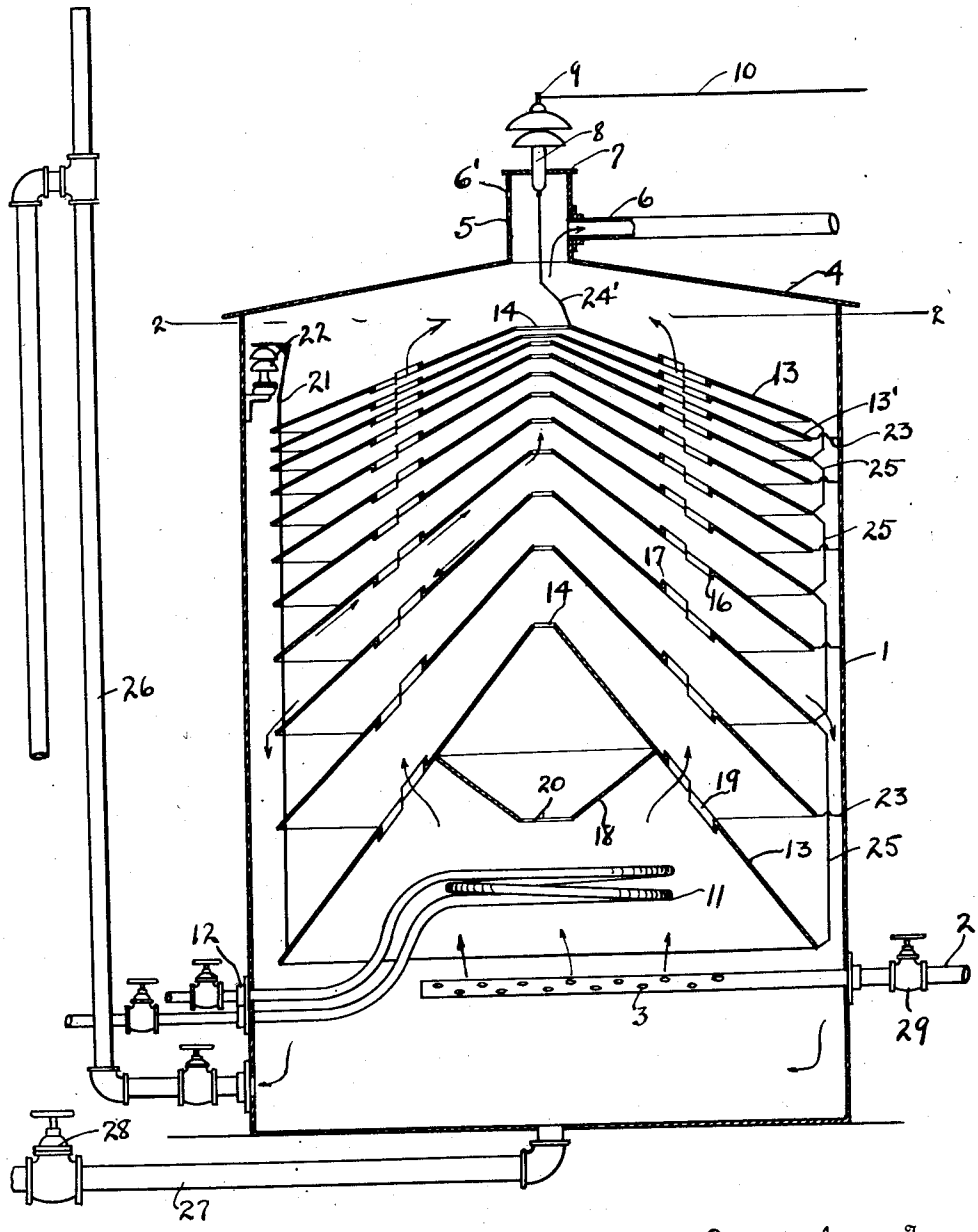

Fig. 1.

D. K. Cason Jr. Inventor

By Jesse R. Stone

Attorney

April 6, 1926. 1,579,515

D. K. CASON, JR

ELECTRICAL DEHYDRATOR

Filed August 16, 1924 2 Sheets-Sheet 2

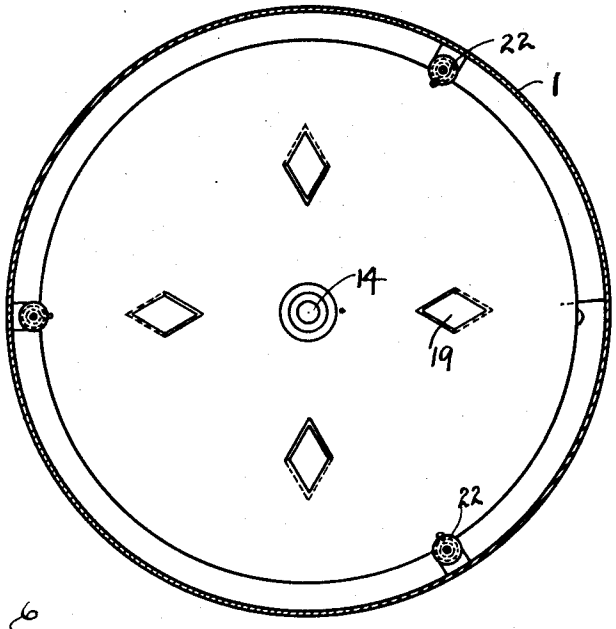

Fig. 2.

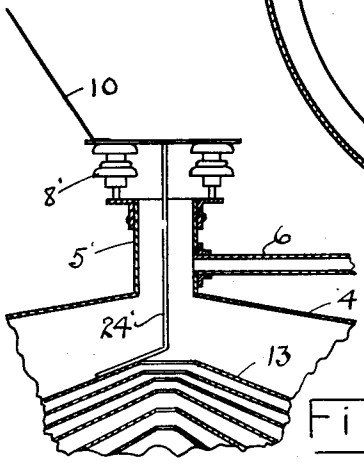

Fig. 4.

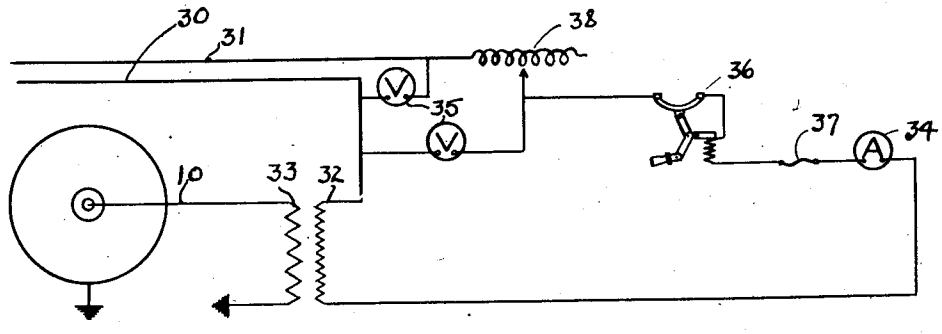

Fig. 3.

D. K. Cason, Jr. Inventor

By Jesse R. Stone

Attorney

Patented Apr. 6, 1926. 1,579,515

UNITED STATES PATENT OFFICE

DICK KENDALL CASON, JR., OF NACOGDOCHES, TEXAS.

ELECTRICAL DEHYDRATOR.

Application filed August 16, 1924. Serial No. 732,418.

To all whom it may concern:

Be it known that I, DICK K. CASON, Jr., a citizen of the United States, residing at Nacogdoches, Nacogdoches County, Texas, have invented a certain new and useful Improvement in Electrical Dehydrators, of which the following is a specification.

My invention relates to an apparatus for dehydrating crude oil with which is mixed water, or water and basic sediment, in an emulsified state. It is applied particularly to electrical dehydrators wherein a current of electricity is employed in causing the settling out of the water.

Electrical dehydrators are now in use and, as ordinarily assembled, consist of a tank, which is grounded, and a series of parallel plates therein constituting electrodes, some of which are insulated from the tank and some alternate ones of which are grounded through connection with the tank. The insulated electrodes are connected with a source of alternating current under high tension, whereby a field of electrical stress is set up between the plates. The fluid circulates up through the tank and passes through a field of electrical stress between the electrodes which are plates ordinarily arranged vertically in parallel relation. The particles of water emulsified with oil will not ordinarily settle out from the oil because of their fine state of subdivision. The effect of the field of stress set up in the fluid passing between the electrodes is to cause the fine particles of water to become charged and to migrate toward each other and gradually combine to form drops of sufficient weight to settle out of the oil.

The difficulty with the present system lies in the fact that the fluid in the tank in which the dehydration takes place is largely water toward the lower end of the tank and has an increasing proportion of oil toward the upper end of the tank. As the oil is a poorer conductor of electricity than the water, it is found that the current passes between the electrodes more freely at the lower ends of the electrodes than at the upper ends, so that it is necessary to regulate the amount of voltage employed to a lower charge that would otherwise be advisable to prevent the total charge from short circuiting at the lower ends of the plates.

It is an object of my invention to provide electrodes for use in the dehydrator of this character which will be so arranged as to allow the use of a larger unit voltage between the electrodes so that the process may be carried out more rapidly and still maintain a comparatively equal current between the plates at all points.

Another object is to so form the plates that the circulation upwardly past the said plates will allow the separation of the water and the oil in the most efficient manner.

Referring to the drawing herewith, Fig. 1 is a central vertical section through an apparatus employing my invention. Fig. 2 is a horizontal section on the plane 2—2 of Fig. 1. Fig. 3 is a diagrammatic representation of the electrical wiring which may be employed in operating my device. Fig. 4 is a broken vertical section showing a slightly different electrical connection. Like numerals of reference are employed to designate like parts in all the views.

In the drawing, the tank 1 is of the usual construction, being a cylindrical container of sufficient height so that the separation may take place between water and oil as the fluid is circulated through the same. Said fluid comes into the lower end of the tank through an inlet pipe 2 having openings 3 therein within the tank. The upper end of the tank is closed by an upwardly inclined closure 4 terminating at its upper end in a short length of pipe 5 to which a laterally directed outlet pipe 6 is connected. The pipe 5 is closed by a cap 7 in which is mounted an insulator 8 through the centre of which passes a conductor 9 connected with the high tension wire 10.

The oil as it comes into the lower end of the tank passes over a heating coil 11 which is extended through the side of the tank at 12 and has connection with a source of steam supply not shown.

The electrodes which I have devised are conical in shape and consist of plates 13 of metal or other good conducting material. As will be seen in the drawing, the said plates are arranged one beneath the other and spaced apart by unequal distances gradally increasing from top to the bottom. It will also be noted that the electrodes 13 at the upper end of the tank are inclined at a more obtuse angle toward the apex. Each of the plates has a central opening 14 at its upper end through which the oil may circulate. These openings at the extreme up-

per end of the tank are made slightly larger to allow a more free outlet of the oil toward the discharge pipe.

Each of the plates is also formed with a plurality of openings spaced about midway between the apex and the base of each of the plates. I have shown four of these openings on each plate and such openings are diamond shaped. The edges of these openings are formed by bending the sheet metal downwardly along the lower edges 16 and upwardly along the upper margins of the openings as shown at 17. The lower plate 13 is also preferably formed with a frusto-conical plate 18 set in an inverted position against the lower side of the plate 13 and connecting therewith at a point slightly above the openings 19 therein. This plate 18 has an opening 20 therein at its apex to allow the passage of oil upwardly therethrough. Each of the plates is suspended from a supporting rod or wire 21 on an insulator 22 mounted on brackets within the upper end of the container.

I have shown three of such brackets and it is contemplated that the plates shall also be insulated from each other. It will be obvious that each of the alternate plates 13′ may be connected by conductors 23 to the tank and in fact may be supported in this manner if desired. The upper plate 13 is connected by the wire 24 with the conductor 9 at the upper end of the tank and each alternate plate below the upper one is connected electrically by wires 25, as shown in the drawing.

The water which settles out of the oil finds an outlet through the gooseneck 26 connected at the lower end of the tank and extending to a point about the level of the oil outlet pipe 6. I also provide a drainpipe 27 connected with the bottom of the tank for use as desired. A hand operated valve 28 therein is normally closed. An opening 6′ in pipe 5 forms a vent in the tank. In the operation of the device, the cut or emulsified oil is fed into the lower end of the tank through the pipe 2. The valve 29 therein allows the regulation of the flow of oil and water as desired. The oil is heated somewhat by contact with the heating coil 11. The larger portion of the fluid will circulate upwardly through the openings 19 in the plates. As the fluid is acted upon by the field of electrical stress between the electrodes, the water will tend to form in droplets and will gravitate back toward the lower end of the tank. It is contemplated that it will flow down the upper surfaces of the plates 13, and the upwardly bent margins 17 of the opening 19 will direct the water past the said openings. The oil, on the other hand, will tend to rise toward the upper end of the tank, due to its lighter specific gravity, and will be directed toward the central openings 14 in the plates. The downwardly bent margins 16 of the openings 19 will cause the oil to flow past the said openings without interfering with the main flow of the fluid upwardly through the same. In this way it will be noted that the oil will be directed into a central stream passing upwardly to the discharge pipe 6 and the water will be caused to flow downwardly along the plates and pass off at the outer edges thereof toward the bottom of the tank.

As the plates or electrodes are closer together toward the upper end of the tank where the proportion of oil is greater, the passage of current will be practically equal throughout the tank and the field of stress between the electrodes will be at its most efficient value. This will allow the use of a higher unit voltage in the operation of the process, so that the passage of fluid through the tank may be operated more rapidly without any decrease in efficiency.

The electrical connections may be constructed to better accommodate the high tension currents sometimes employed, and in Fig. 4 the pipe 5′ is shown open at its upper end and two insulators 8′ are employed instead of one. The high tension wire 10 connects with a heavy conductor 24′ mounted on said insulators and connecting with the upper plate 13, as previously described.

In Fig. 3, I have shown the electrical apparatus by means of which the device may be connected within the ordinary electric light circuit of about 220 volts, said circuit being indicated by the wires 30 and 31. The said wire 30 is connected with a step up transformer 32, the secondary winding 33 of which is connected to the wire 10 at the upper end of the tank.

The usual ammeter 34 and voltmeter 35 are connected in the line together with the switch 36, fuse 37, and reactance regulator 38. This is the ordinary installation, however, not forming a part of my invention.

The advantages of my invention lie in the arrangement of the electrodes, whereby the plates are spaced apart in such manner as to allow equal stress in the electrical field between the different plates and also whereby the separation of the water and oil is further facilitated in the shape of the plates. Further objects will be apparent to one skilled in the art without more description.

What I claim as new and desire to protect by Letters Patent is:

1. In an electrical dehydrator for crude oil, a series of conical shaped plates, alternate ones of which are grounded and the intervening plates being electrically insulated and connected in a high tension circuit, said plates being spaced apart by gradually increasing distances from top to bottom of said dehydrator, and having openings therein in the manner described.

2. In an electrical dehydrator for oil, a tank, a series of conical-shaped electrodes mounted in said tank and spaced apart by increasing distances from top to bottom of said tank, means to connect alternate ones of said electrodes into an electrical high tension circuit, means to circulate crude oil upwardly through said electrodes from the lower end of said tank, means to draw off the oil, and means to draw off said water from said tank.

3. In an electrical dehydrator for oil and water emulsion, a series of electrode plates spaced vertically one above the other, the distance between successive adjacent plates gradually increasing from top to bottom, means to connect alternate plates in a high tension circuit, means to circulate the said emulsion upwardly between said plates, and means to heat said emulsion.

4. In an electrical dehydrator, a series of conical electrodes spaced apart and having a field of electrical stress between adjacent electrodes, said electrodes having central oil openings therethrough, and a plurality of additional openings the margins of which are upturned on the upper sides and downturned on the lower sides for the purpose described.

5. In an electrical dehydrator, a series of vertically spaced conical electrodes having the distance between adjacent electrodes gradually increasing from the upper to the lower electrodes, means to connect alternate electrodes in an electrical circuit, and means to circulate the water and oil through said electrodes, said electrodes having openings arranged to assist in separating the oil from the water.

6. An electrical dehydrater comprising a tank, a series of charged electrodes spaced apart vertically, the distance between successive plates varying approximately inversely as the specific resistance of the substance between electrodes.

7. In an electrical dehydrator, a container having an emulsion inlet and an outlet, a series of electrodes spaced apart in said container the distance between successive plates decreasing gradually from the inlet end to the outlet end, means to charge alternate electrodes with opposite potential, whereby the voltage gradient between successive electrodes will increase from the emulsion inlet to outlet of said container.

8. In an apparatus of the character described, a tank, a series of electrically charged electrodes spaced apart in said container in such manner that the current flow between successive electrodes will be uniform.

In testimony whereof I hereunto affix my signature this 23 day of July A. D. 1924.

DICK KENDALL CASON, JR.