June 15, 1937. C. H. M. ROBERTS 2,083,799

METHOD OF AND APPARATUS FOR ELECTRICALLY TREATING EMULSIONS

Original Filed Sept. 25, 1933 2 Sheets-Sheet 1

Fig. 1.

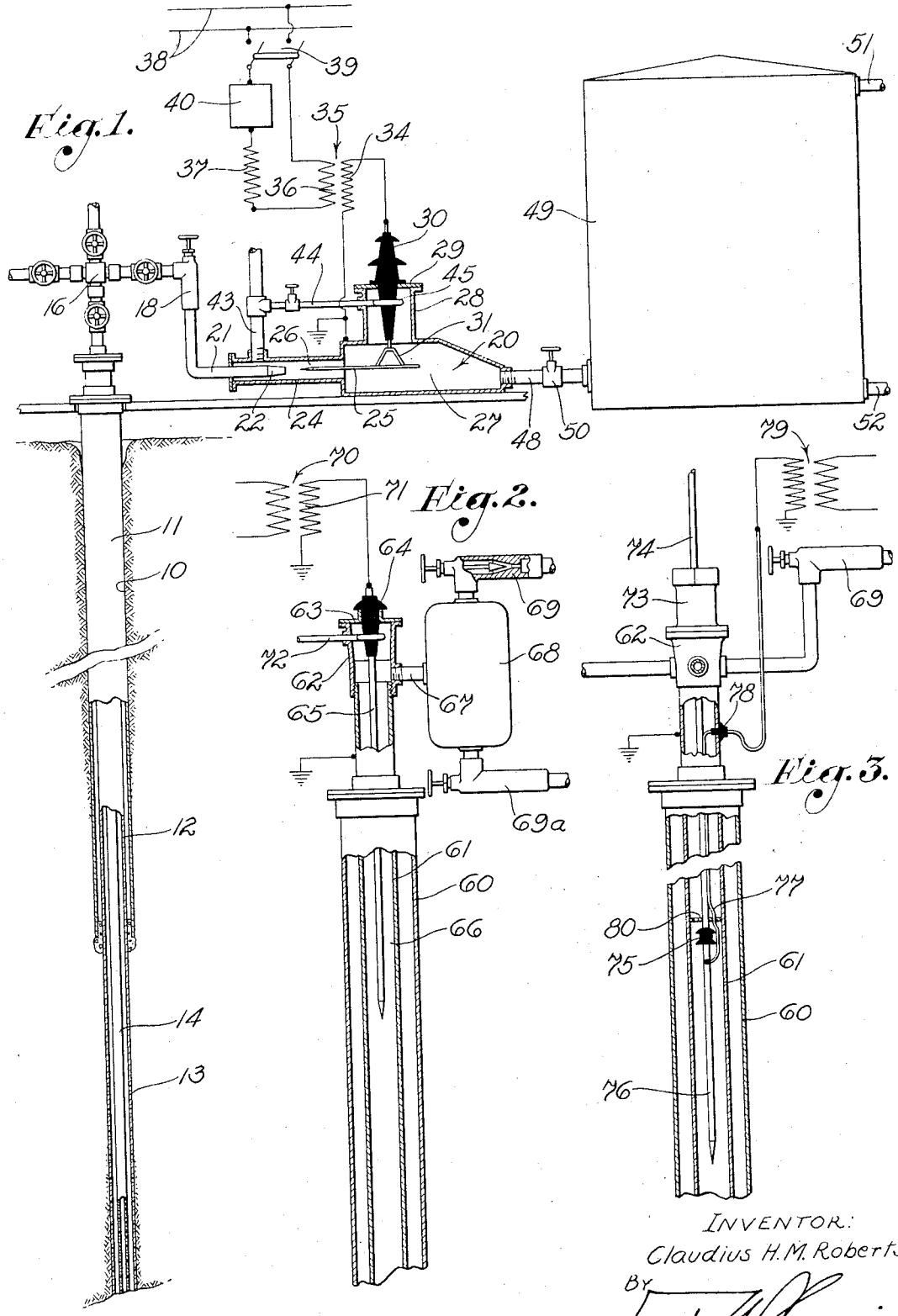



Fig. 2.




Fig. 3.




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Fig. 4.

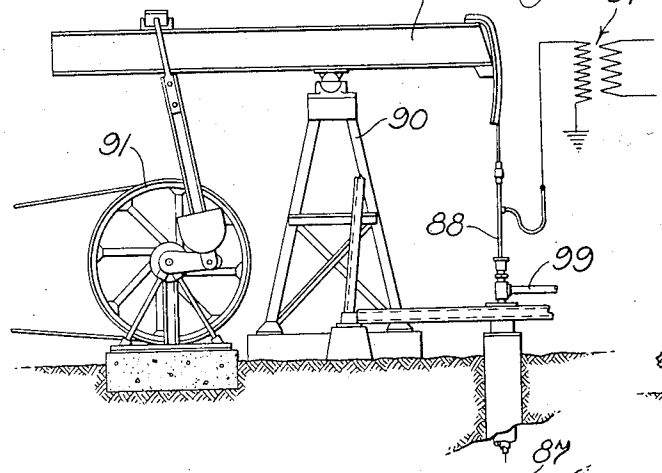



Fig. 5.

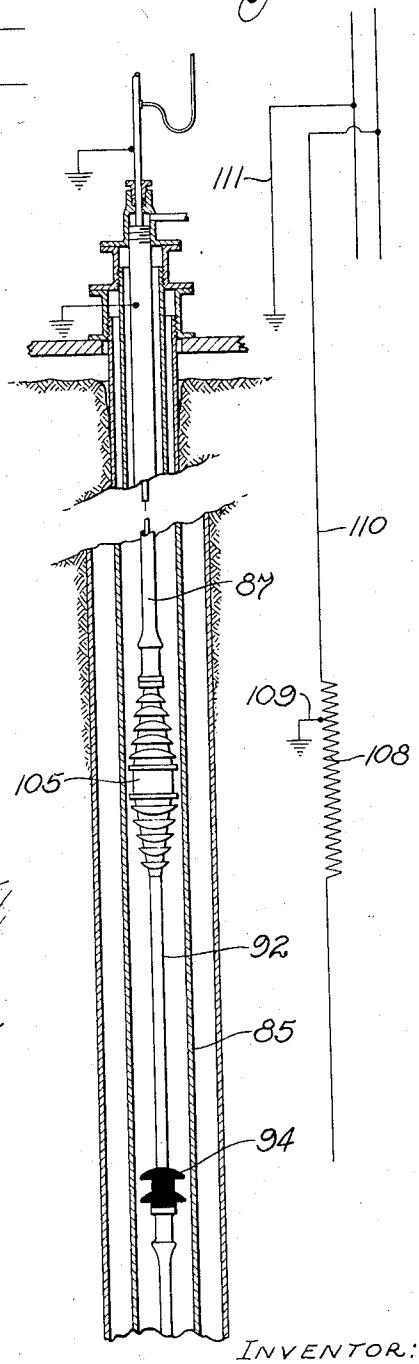
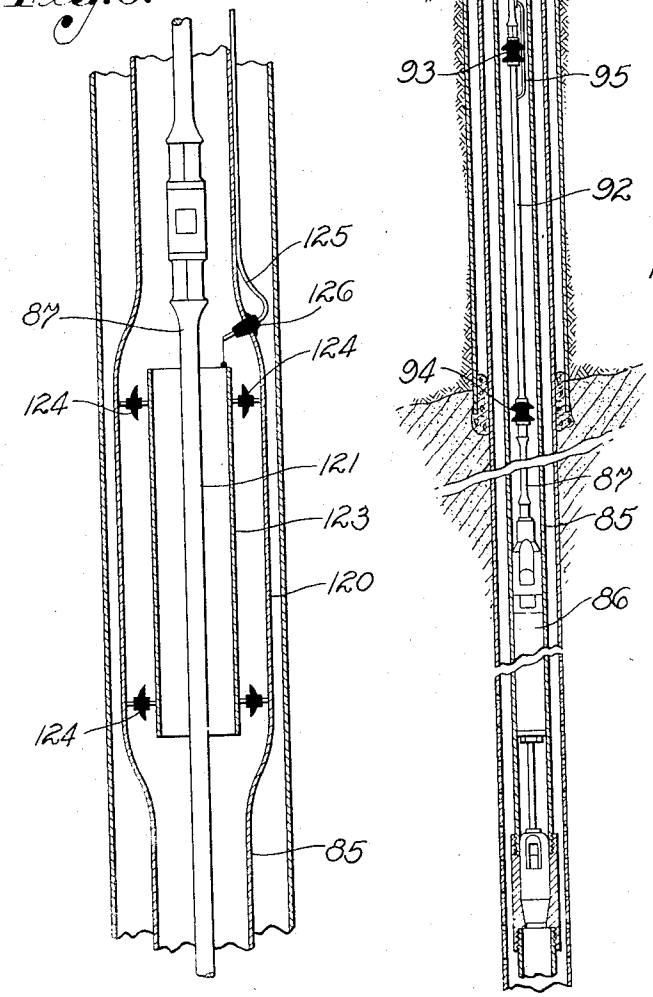



Fig. 6.




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# UNITED STATES PATENT OFFICE

2,083,799

## METHOD OF AND APPARATUS FOR ELECTRICALLY TREATING EMULSIONS

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Application September 25, 1933, Serial No. 690,806
Renewed November 24, 1936

11 Claims. (Cl. 166—21)

My invention relates to a method of and apparatus for treatment of emulsions, and more particularly emulsions of oil and water in which the oil phase is in the form of petroleum or a product thereof.

The conventional process of electrically resolving an emulsion includes withdrawing the emulsion from storage and subjecting this emulsion to the action of a high intensity electric field to agglomerate the particles forming the dispersed phase into masses of sufficient size to gravitate from the oil or be otherwise removed therefrom. This process has gone into wide use in many of the oil fields throughout the world. However, while this process as at present practiced is highly effective in resolving many types of emulsions, it is indifferent or entirely ineffective when applied to certain other types of emulsions. Certain of the Mid-Continent oils, for example, have heretofore been considered as substantially untreatable by electrical processes.

Careful investigation of the properties of both the treatable and untreatable types of emulsion has shown that the dispersed particles of any natural emulsion are electrically charged. With some emulsions this charge may be positive and with others it may be negative. Both the magnitude and sign of charge of these particles may be determined by the measurement of cataphoretic mobility in a unidirectional electric field.

My investigations further indicate that on certain emulsions these charges remain of substantially fixed magnitude, while on other emulsions they change with age, this change being either a change in magnitude or a change carried to a complete reversal of sign. Investigation of the properties of such emulsions definitely indicates that the electrical process of dehydration is highly effective upon emulsions the sign of charge of which does not materially change in magnitude as the emulsion ages. On the other hand, the electrical process decreases in efficiency when applied to emulsions the particles of which carry charges which materially change in magnitude with increase in age, and those emulsions the sign of charge of which reverses upon aging are quite indifferent to electric treatment. From these observations it appears that the efficacy of the electrical process of dehydration is dependent upon the magnitude and sign of charge borne by the particles of the emulsion. Thus, it has been found that certain of the Mid-Continent emulsions, ordinarily considered untreatable by electrical means, are of the type which materially change the charge of the particles either by a change in magnitude or by complete reversal.

However, further investigation has shown that such an emulsion bearing charges which materially change or reverse with age may be treated electrically if subjected to an electric field when the emulsion is still fresh and before the aging process has materially changed or reversed the charges on the particles. Such emulsions, when fresh, appear to have characteristics quite similar to those emulsions which are readily treatable by electrical processes.

It is one of the fundamental objects of the present invention to provide a process for successfully treating by electrical methods those emulsions which are otherwise untreatable or difficult to treat by such methods, the inventive concept including the step of subjecting such emulsions even before they leave the well to the action of an electric field before they become untreatable due to aging. Heretofore all attempts to electrically treat such emulsions have been made only after the emulsion has aged, and such attempts have thus not been successful.

The rate of aging depends upon various factors, and no fixed time limits applicable to all emulsions can be set forth. The age of an emulsion, as the term is used, is not dependent solely upon chronological considerations, i. e., it is not dependent only upon the length of time that has elapsed since the emulsion was formed, it is also dependent in any given emulsion system upon the size of the particles of the dispersed phase, as well as upon the characteristics of the oil and water components of the system. The aging of an emulsion is substantially an adsorption process and careful experiments have shown that the processes of adsorption which take place proceed at a faster rate upon small particles than upon large particles. This has been clearly demonstrated by observing the greater time rate of diminution of charge and the earlier reversal of charge which occurs when small particles are present. Thus the adsorption age of a given emulsion depends upon the chronological age and the particle size.

The aging process may proceed at a relatively fast rate. In such cases it is necessary to treat the emulsion soon after it is formed. In other instances several hours may elapse before the emulsion becomes substantially indifferent to electrical treatment. It thus becomes impossible to set definite time limits within which the emulsion must be subject to electric treatment to secure agglomeration. Certain it is however, that

after such emulsions have aged for a period of from six to forty-eight hours after production and after exposure to air, a condition which usually occurs when emulsified oil is stored in open tanks, the emulsions are quite unsusceptible to electric treatment.

The invention thus comprehends the early treatment of such emulsions, and this may necessitate treatment immediately after the emulsion flows from the well. In other instances, the adsorption process may be carried on at such a rate that it becomes necessary to treat the emulsion even before it issues from the top of the well. Both systems are herein disclosed but the present application relates specifically to the latter system, the former being claimed in my copending application Serial No. 49,857, entitled "Improved method and apparatus for electrically treating emulsions", filed November 14, 1935, that application being a continuation-in-part of the present application. The invention includes various devices whereby this treatment before issuance from the well can be accomplished both with a flowing well and with a well which is being pumped. Separation can effectively take place after the emulsion has been discharged from the top of the well, this being another feature of the present invention.

Numerous factors are present which control the formation of an emulsion in an oil well. In some instances the emulsion may be present in the oil strata itself or may be formed as the oil is flowing through the oil sands and toward the well, assuming that both oil and water are present in these strata. In other instances oil may enter a well at one level and water may enter at another level. Emulsification can take place either through frictional engagement between the fluids and the walls of the pipe through which the liquids are passed, or it can take place when the liquids flow through a flow bean positioned at the bottom or at the top of the well. If the well is being pumped, there is a strong tendency for the emulsion to be formed when the oil and water move through the valves of the pump, and when a portion of this emulsion escapes past the piston as it reciprocates. The age of an emulsion may thus depend upon the place where the emulsion is formed, especially as far as the chronological aspect of aging is concerned. Thus, if an emulsion which ages at a fast rate is produced near the lower end of the well, it may be necessary to use an electric field which is positioned in the well.

Another feature of the present invention is to utilize the properties of the freshly produced emulsion in assisting the dehydrating action regardless of whether or not the emulsion is of such character that upon aging it becomes untreatable by electric means. Thus, by treating the emulsion before or immediately after it issues from the well, all or a portion of the gases in solution in the emulsion can be retained during electric treatment. Material amounts of such gases are in solution in the oil prior to the time that the pressure thereon is entirely relieved. The presence of such dissolved gases materially reduces the viscosity of the emulsion and appears to further contribute to the efficacy of electric treatment.

So also, the temperature in the well is ordinarily somewhat higher than the atmospheric temperature. By subjecting the emulsion to early treatment this heat is retained in the oil and thus sometimes precludes the necessity of supplying auxiliary heat to the oil, as is necessary in certain conventional dehydrating processes. In many instances it is thus possible to dispense with artificial means for heating the emulsion prior to the time it moves into the electric field when using the teachings of the present invention.

Further, the pressure in the well is ordinarily much greater than atmospheric pressure. This is especially true in a flowing well and is true in a somewhat lesser degree in a well which is being pumped. By utilizing this natural pressure, all costly equipment heretofore required to build up the pressure prior to treatment can be eliminated. With a flowing well, pressures many times higher than usually used in electrical dehydration processes are readily available, and it has been found that high pressures materially assist in the electric action on certain types of emulsions. So also, this high pressure, of course, tends to retain in the emulsion the dissolved gases which may be present.

Furthermore, as the invention is usually practiced, the emulsion is not exposed to the air, and the attendant losses of constituents and the tendency toward oxidation of the oil may be entirely eliminated. Furthermore, in certain oils more or less paraffin crystallizes out on standing. An early treatment of the emulsion effectively agglomerates the dispersed particles before such liberation of the paraffin and thus removes one of the difficulties present in conventional dehydrating processes; namely, the difficulty of resolving emulsions after crystallization of paraffin thereon.

So also, treatment inside the well provides a natural agitation of the fluid during this treatment. Further, a free gas moving upward in the electric field increases this agitation as does also the reciprocating motion of the sucker rods if an electric field is set up therearound.

Finally, it has been found that the above factors permit a greater latitude in the choice of potentials and potential gradients in the treating zone than would otherwise be present. Thus, lower potentials may often be used than are required for conventional treating processes, thus decreasing the electrical strain and possibility of failure of insulators, cable, etc., utilized in setting up the field.

Other features of the invention, and advantages thereof, will be apparent to those skilled in the art from the following description.

In the drawings I have illustrated several types of apparatus by which the process can be carried out, it being understood that these forms of apparatus are illustrative only and that the process is not limited thereto.

Referring to these drawings:

Fig. 1 diagrammatically illustrates an electric treater connected directly to the flow line of a well.

Figs. 2 and 3 represent forms of the invention in which treatment is effected inside the well itself, these forms being particularly adapted to use with a flowing well.

Fig. 4 illustrates an apparatus capable of treating in a well which is being pumped.

Figs. 5 and 6 are alternative forms of the invention particularly adapted for treatment in a pumped well.

Referring particularly to Fig. 1, the apparatus therein shown is particularly well adapted to treatment of the emulsion produced by a flowing well, this emulsion sometimes being of a

type which changes or reverses the sign of charge on the particles at a relatively slow rate, the emulsion being electrically treatable immediately upon being discharged from the well, but being untreatable or less effectively treatable after having aged for a period of several minutes or hours thereafter. I have illustrated a well 10 in which the customary well casing 11 is cemented. Extending downward in the well casing is the usual water string 12 carrying a perforated screen casing 13 extending into the oil-bearing strata. The usual oil spring 14 perforated at its lower end extends downward inside the screen casing and conducts the oil upward to a "Christmas tree" 16 at the top of the well. A suitable control means in the form of a flow bean 18 carries the flowing liquid directly to a dehydrator 20 through a pipe 21. This flow bean may be of conventional construction and acts to control the flow of the liquid, and also to control the pressure of the liquid delivered to the dehydrator 20.

Various types of electric dehydrators known in the art may be used. For instance, the dehydrator 20 may comprise the conventional treater in which treatment and separation take place in the same tank. In the form shown, however, this dehydrator 20 is of the flow-line type and merely acts to agglomerate the dispersed particles into masses of sufficient size as to be subsequently separated from the continuous phase of the emulsion undergoing treatment. The particular dehydrator illustrated is not in itself a part of the present invention, being more particularly described and claimed in a co-pending application of William Woelflin, Serial No. 627,910, filed August 8, 1932.

Such a dehydrator 20 includes a nozzle 22 communicating with the pipe 21 and positioned inside a tube 24, this tube acting as an outer electrode. Axially aligned with the nozzle but spaced from the end thereof is a small rod electrode 25, the forward end of this electrode being preferably pointed so as to pierce the stream of liquid moving from the nozzle 22. This rod electrode cooperates with the tube 24 in defining an annular treating space 26 in which an electric field is established and in which most of the treatment takes place.

This rod electrode extends into an enlarged chamber 27 of the dehydrator which carries a dome 28 closed by a cover 29. An insulator bushing 30 extends through this cover and downward in the dome 28 and carries a supporting structure 31 at its lower end and to which the rod electrode 25 is suitably secured. This electrode and its supporting structure is electrically connected to a conductor extending through the bushing 30 and connected to one terminal of a secondary winding 34 of a transformer 35, the other terminal of this secondary winding being grounded to the treater and thus electrically connected to the tube 24 so that an intense electric field is set up in the treating space 26.

The transformer 35 includes a primary winding 36 connected in series with a suitable choke coil 37 to a line 38 which supplies an alternating potential thereto. Any suitable switch 39 may be provided, and in the preferred embodiment of the invention, I prefer to connect a suitable control means 40 in circuit with the transformer. This control means preferably consists of a no-voltage relay provided with automatic re-setting devices to open the circuit should the electrodes 34 and 35 become momentarily short-circuited by water or brine and to close the circuit when this short-circuiting condition is removed. In addition, this control means preferably includes an over-load relay also provided with automatic re-setting devices to prevent the power consumption incident to prolonged short-circuiting, and to protect the transformer 35 and choke coil 37. These relays are well known in the art. They act as auxiliary protecting means to compensate for adverse conditions which may arise should a slug of water rise in the well and be discharged directly into the electric field. Usually, however, such auxiliary means can be dispensed with, if desired, designing the choke coil 37 to prevent excessive current flow through the transformer.

It is usually preferable, though not always necessary, as pointed out in the co-pending application supra, to supply a dielectric oil to the space between the nozzle 22 and the tube 24. Such a dielectric oil can be supplied through a pipe 43 and will prevent excessive current flow between the electrodes. So also, if desired, a portion of this dielectric oil can be moved through a pipe 44 terminating in an annular spray pipe 45 surrounding the bushing 30 and directing a fluid envelope of the dielectric oil downward around the insulator surface, as set forth in the application supra.

The treated emulsion is discharged from the chamber 27 into a pipe 48 which communicates with a suitable separating means shown as being in the form of a settling tank 49. A valve 50 in the pipe 48 controls the back pressure on the dehydrator 20 and also controls the flow into the tank 49. In this tank the constituents separate, the oil being withdrawn from the upper end through a pipe 51 and the water and other foreign matter being withdrawn through a pipe 52 communicating with the lower end of this tank. It will be clear, however, that other separating means may be used, such as separators of the filtration type or the centrifugal type.

With some emulsions, however, it is desirable to effect electric treatment before the emulsion leaves the well, thus preventing aging which might render the emulsion substantially untreatable by electric methods. In Fig. 2, a system suitable for this purpose is shown. Here a well casing 60 and an oil string 61 are shown, the upper end of the oil string being closed by a head 62 including a plate 63. An insulator bushing 64 extends downward through this plate and carries an electrode 65 in the form of a pointed rod. The space between this electrode and the oil string 61 thus comprises a treating space 66 through which the emulsion rising in the oil string must pass before being discharged through a pipe 67 which may be directly connected to a flow bean of conventional construction. However, due to the emulsifying tendency of such a flow bean it is usually preferable to discharge this treated emulsion directly into a settling tank capable of withstanding the pressure developed by the well. Such a settling tank is indicated diagrammatically by the numeral 68 and allows the oil and water to separate. The oil rises to the upper end of this tank and may be withdrawn through a flow bean 69 of conventional construction and which reduces the pressure on the out-flowing oil. The water drops to the lower end of the tank 68 and is withdrawn through a flow bean 69a which reduces the pressure on the water. The relative setting of these flow beans

69 and 69a determines the level of the water in the tank 68.

An electric field is set up in the treating space 66 by the use of a transformer 70 including a secondary winding 71, one terminal of which is connected to the electrode 65 and the other terminal of which is grounded and thus connected to the oil string 61 which is also grounded. Suitable control apparatus similar to that shown in Fig. 1 is preferably used in this form of the invention. So also, if desired, a pipe 72 may be utilized for supplying a dielectric oil to an annular spray pipe 73 around the insulator bushing, thus moving an envelope of dielectric oil around the surface of this bushing, and preventing any deposit of foreign matter thereon.

As the emulsion rises through the treating space 66 the dispersed particles are agglomerated into larger masses and the treated liquid moves to the separating tank 68 without further separation. If the flow bean is used to control the flow through the pipe 67, the treated emulsion may be moved therethrough and directly into a separating means or may be subjected to auxiliary electric treatment if desired. Certain types of flow beans will tend to partially re-emulsify the oil and water which has been already treated, though other types of flow beans produce this re-emulsification to a much smaller degree. The degree of re-emulsification is also dependent upon the velocity of flow and upon the size of the opening in the flow bean through which the liquid must pass. As pointed out above, however, if this re-emulsification takes place to such an extent as to prevent ready separation of the constituents, these constituents can be again subjected to a treating action such as the action of an electric field as by being passed through a treater, such as indicated by the numeral 20 of Fig. 1. The necessary condition is that the emulsion receive its first electric treatment before such aging has taken place as would prevent effective treatment by electric means. Once the emulsion is given a preliminary electric treatment, it is not difficult to separate the constituents of a later-formed emulsion resulting from a partial re-emulsification.

In the form shown in Fig. 2 the electrode is positioned adjacent the upper end of the well. With certain emulsions, however, it is desirable to effect electric treatment prior to the time that the emulsion reaches the top of the well. In Fig. 3 I have shown an apparatus capable of such treatment. Here the head 62 is capped by the member 73 through which a rod 74 extends downward into the oil string 61. The lower end of this rod carries an insulator 75 which supports a pointed rod electrode 76, the point extending downward to pierce the stream of emulsion rising in the oil string 61. This electrode is energized through a high-voltage cable 77 connected thereto and extending around the insulator 75 and upward along the rod 74. A bushing 78 carries this cable from the oil string 61 and to the high-tension winding of a transformer 79, one terminal of this high-tension winding being grounded so as to be connected to the oil string 61. A spacer 80 may be provided around the rod 74 to hold this rod centrally with respect to the oil string and thus maintain the electrode 76 in a central position. This spacer may be in the form of a spider structure which permits upward flow of the emulsion therethrough.

It will be clear that the electrode 76 may be positioned at any desired point in the well by the use of a structure such as shown in Fig. 3. Thus, it becomes possible to treat emulsions the particles of which change in charge at an extremely rapid rate.

With this form of the apparatus, as with the form shown in Fig. 2, the treated emulsion can be moved directly from the flow bean 69 into a separating means, or may be subjected to an additional agglomerating treatment through the action of electrical or other well-known agglomerating means.

Slightly different constructions are sometimes desirable when the invention is used on a well which is being pumped. Thus, in Fig. 4 I have shown a well somewhat similar to those previously described and including a pump tubing 85 extending downward therein and carrying a pump 86 of the reciprocating type at its lower end in the conventional manner. This pump includes a plunger which is reciprocated through the action of a string of sucker rods 87 extending upward to the surface of the ground and carrying a conventional polish rod 88. This polish rod is connected to a walking beam 89 pivoted on a Samson post 90 and driven by a bull wheel 91 in the conventional manner. Rotation of this wheel causes a reciprocation of the sucker rods to operate the pump and force the emulsion upward in a pump tube around the sucker rods.

In this form of the invention I prefer to interpose an electrode 92 in this string of sucker rods so that the electrode will be reciprocated therewith. This can be best accomplished by mounting insulators 93 and 94 in this string of sucker rods and extending the electrode 92 therebetween. Suitable spacers or buffers, not shown, may be installed above the insulator 93 below the insulator 94 to centralize the electrode 92 with respect to the oil string. Current is supplied to this electrode through a high tension cable 95 which may extend upward in the well around the sucker rods. In the form shown, however, the upper sucker rods are hollow as is also the polish rod 88, and the high tension cable 95 extends upward therethrough, extending outward through the polish rod 88 and being connected to one terminal of the high tension winding of a transformer 97, the other terminal thereof being grounded and thus being connected to the pump tubing 85. An intense electric field is thus set up between the electrode 92 and the pump tubing. The stream of emulsion which is moving upward must pass through this electric field and is therein treated to agglomerate the dispersed particles before they have aged sufficiently to become difficult or impossible of electric treatment. The treated emulsion flows from the upper end of a pump tubing through a pipe 99 and to a suitable separating means, or to an auxiliary dehydrator if necessary. It will be clear that any number of treating spaces may be formed in the pump tubing 85 and spaced throughout the length of the well, if such is desirable. Usually, however, a single treating space will suffice.

This form of the invention is particularly valuable in that the oil moves through the field at a relatively high velocity so as to be agitated during this upward movement. This tends to break any low resistance paths which may have formed in the field. So also, the reciprocation of the electrode 92 tends to disrupt such low resistance paths or chains.

Another form of the invention capable of use with a pumping well and which eliminates the use of a high-tension cable is shown in Fig. 5.

Here the electrode 92 is mounted between the insulator 94 and a transformer-bushing 105, the upper end of this bushing being connected to the sucker rods 87 as previously described. This transformer-bushing may be of conventional construction and is of the type wherein a transformer is built inside the bushing itself, this bushing acting to insulate the string of sucker rods 87 from the electrode 92. An auto-transformer circuit may be utilized, as diagrammatically indicated in the right half of Fig. 5. Thus, the bushing 105 may carry a winding 108 formed of a large number of turns, this winding being tapped and grounded through the string of sucker rods 87 at an intermediate point, as indicated by the numeral 109. One end of the winding is connected to a conductor 110 which extends upward around the sucker rods 87, or through these sucker rods if they are hollow, and it is connected to one supply conductor of the line to supply a low tension potential to the transformer. The other supply conductor of the line is grounded as indicated by the numeral 111 so that in effect the line voltage is impressed across one portion of the winding 108. The high tension terminal of this winding is directly connected to the electrode 92, thereby setting up a voltage between this electrode and the pump tubing 85 equal to the potential between the grounded tap of the winding 108 and the high tension terminal of this winding. An electric field is thus established through which the rising emulsion must pass. Suitable spacer means, not shown, may be used for retaining the sucker rods 87 centrally located with respect to the pump tubing 85 and preventing contact between the insulator structures and the pump tubing.

Still another form of the invention is shown in Fig. 6. Here the pump tubing 85 provides an enlarged portion 120 through which the string of sucker rods 87 extends. In this instance the entire string of sucker rods is of conventional construction and one section thereof forms a grounded electrode 121 extending through the enlarged portion 120. This enlarged portion carries a sleeve electrode 123 mounted therein by suitable insulators 124. This sleeve electrode is maintained at high potential by means of a high-voltage cable 125 extending through an insulator 126 and upward along the pump tubing 85 to the surface of the ground where it is connected to the high tension winding of a transformer as previously described. An intense electric field is thus set up between the sleeve electrode 123 and the grounded electrode 121 forming a part of the string of sucker rods. So also an auxiliary field is set up between the sleeve electrode 123 and the enlarged portion 120 of the pump tubing 85. A major portion of the rising emulsion flows through the former field and the balance flows through the latter field. The dispersed phase is thus electrically agglomerated prior to the time that the emulsion reaches the top of the well. This form of the invention has the added advantage that a conventional sucker rod structure can be used.

It should be understood that the method can be performed by other types of apparatus than those specifically shown herein. Further, it will be clear that while I prefer to utilize an alternating potential in effecting this treatment, it is possible in some instances to utilize a direct current potential or potentials of other desired wave form, such as pulsating, interrupted, etc., to obtain desirable results.

In conclusion, it will be clear that the method and apparatus herein shown permits the resolution of an emulsion before the emulsion has aged to such a degree that it becomes substantially untreatable or excessively difficult to treat. Further, the system herein shown permits the treatment of the emulsion while the naturally present gases are retained therein in solution, thus reducing the viscosity of the emulsion and giving a very desirable electric treatment both because of this decreased viscosity and apparently because of the dissolved gases retained therein.

So also, the present system utilizes the naturally elevated temperatures of the fluid in the well and thus usually precludes the necessity of auxiliary heating of the emulsion through artificial means, though such artificial heating can be supplied if desired without departing from the spirit of the invention.

Further, use is made of the natural pressure existing in the well either through pressure developed from the oil-bearing strata or from the pump. This precludes the necessity of auxiliary means for raising the pressure of the liquid, such means being necessary in conventional pressure-type dehydrators. Experiments have shown that many emulsions may be most effectively treated electrically if subjected to relatively high pressures even though they are not easily treatable at atmospheric pressure. Since the pressure in a well varies with the vertical position therein it becomes possible to treat at pressures heretofore impossible with conventional dehydration systems.

Furthermore, the present system involves the treating of the emulsion before it is exposed to air. This prevents the attendant losses of constituents as well as the tendency toward oxidization which detrimentally effects dehydration processes by electric means. So also, treatment takes place before any material amount of paraffin crystallizes out, as previously mentioned.

Furthermore, treatment under such conditions as mentioned above often permits the use of lower potentials than have been heretofore considered necessary in electric treatment of emulsions. This, of course, decreases the tendency to form low resistance paths. However, even if such low resistance paths are formed by a slug of water or brine moving into the field, it is clear that the potential across the field will be immediately reduced due to the action of the choke coil 37. As soon as this slug of water has moved through the field, the potential will be again built up across the electrodes. This momentary decreases in potential of the field is not detrimental, for it is only when emulsion is passed through the field that it becomes desirable to maintain the field to coalesce the dispersed particles. Such a slug of water or brine may move upward and be separated by the separating means at the top of the well.

Finally, the invention comprehends the possibility of successive treatments by electric or other means, at least one treatment being carried out electrically and before the emulsion has changed to such a degree as to be substantially unsusceptible to coalescence by electrical methods.

I claim as my invention:

1. A method of electrically treating an emulsion, which method includes the steps of: establishing an electric field in the well from which

said emulsion is being produced; moving said emulsion through said electric field to agglomerate the dispersed particles therein; and separating said agglomerated particles after the liquid produced by said well has been removed therefrom.

2. A method of treating an emulsion rising in an oil well, which method includes the steps of: positioning a charged electrode in the stream of emulsion rising in said well whereby a field is set up therearound causing the dispersed particles of said emulsion to agglomerate; moving the treated emulsion upward to the top of said well; moving said treated emulsion into a separating chamber after leaving said well; and separately withdrawing the phases of said emulsion from said separating chamber.

3. In combination with a producing oil well: pipe means in said well; means for setting up an electric field in said pipe means and through which the emulsion produced by said well flows, said electric field agglomerating the dispersed particles of said emulsion; separating means receiving the emulsion constituents discharged from said electric field; and means for separately withdrawing said constituents from said separating means.

4. In combination with a producing oil well: pipe means in said well; electrode means in said pipe means; means for insulating said electrode means from said pipe means; means for establishing an electric field between said electrode means and said pipe means, said electric field agglomerating the dispersed particles of said emulsion; separating means receiving the emulsion constituents discharged from said electric field; and means for separately withdrawing said constituents from said separating means.

5. In combination with a producing oil well: pipe means in said well; a string of sucker rods reciprocable in said pipe means and including an electrode means; means for establishing an electric field around said electrode means inside said pipe means; pump means operated by said sucker rods and flowing a stream of emulsion through said electric field, the reciprocations of said electrode means assisting in breaking low-resistance paths tending to form in said electric field; and separating means at the top of said well for separating the constituents of said emulsion.

6. A combination as defined in claim 4 in which said means for establishing said electric field includes a transformer positioned in said well.

7. A combination as defined in claim 4 in which said means for establishing said electric field includes an insulating means in said well and a transformer positioned therein, and means extending downward in said well for energizing said transformer.

8. In combination with a producing oil well: electrode means defining a treating space in said oil well receiving the emulsion being produced in said well; and means for establishing an electric field in said treating space of sufficient intensity to act upon the dispersed particles of said emulsion, said means including conductors extending into said well to establish a potential difference across said treating space.

9. A combination as defined in claim 4 including a spacer means for centralizing said electrode means with respect to said pipe means.

10. A method as defined in claim 1 in which the pressure in said field is maintained above atmospheric pressure, and in which said separation takes place at pressures above atmospheric pressure, and including the step of lowering the pressure on the phase liquids only after separation thereof has taken place.

11. A combination as defined in claim 4 in which said separating means comprises a shell receiving the treated constituents discharged from the top of said well without substantial reduction in pressure whereby the pressure in said separating means is above atmospheric pressure.

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