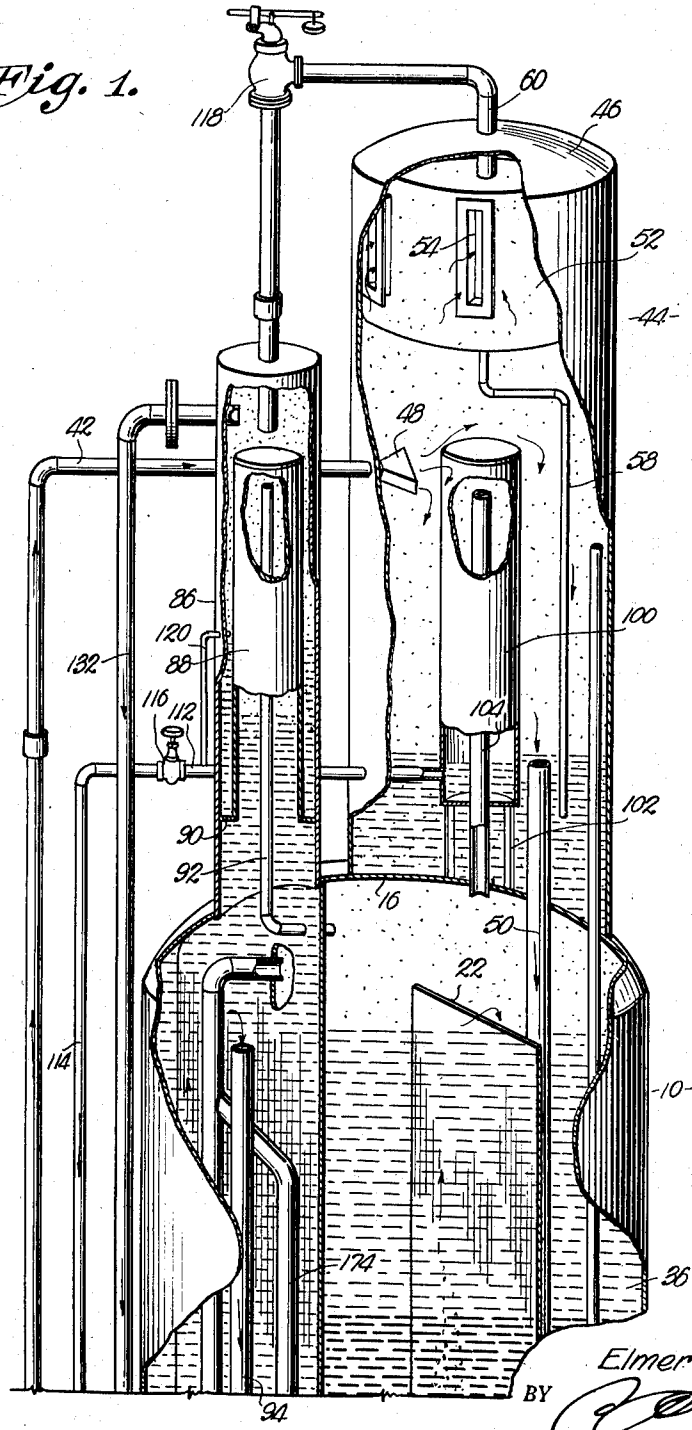
Dec. 2, 1952 E. R. WILLIAMS 2,620,043

APPARATUS FOR TREATING EMULSION EMANATING FROM NATURAL OIL WELLS

Filed Aug. 27, 1948 3 Sheets-Sheet 1

Fig. 1.



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3 Sheets-Sheet 2

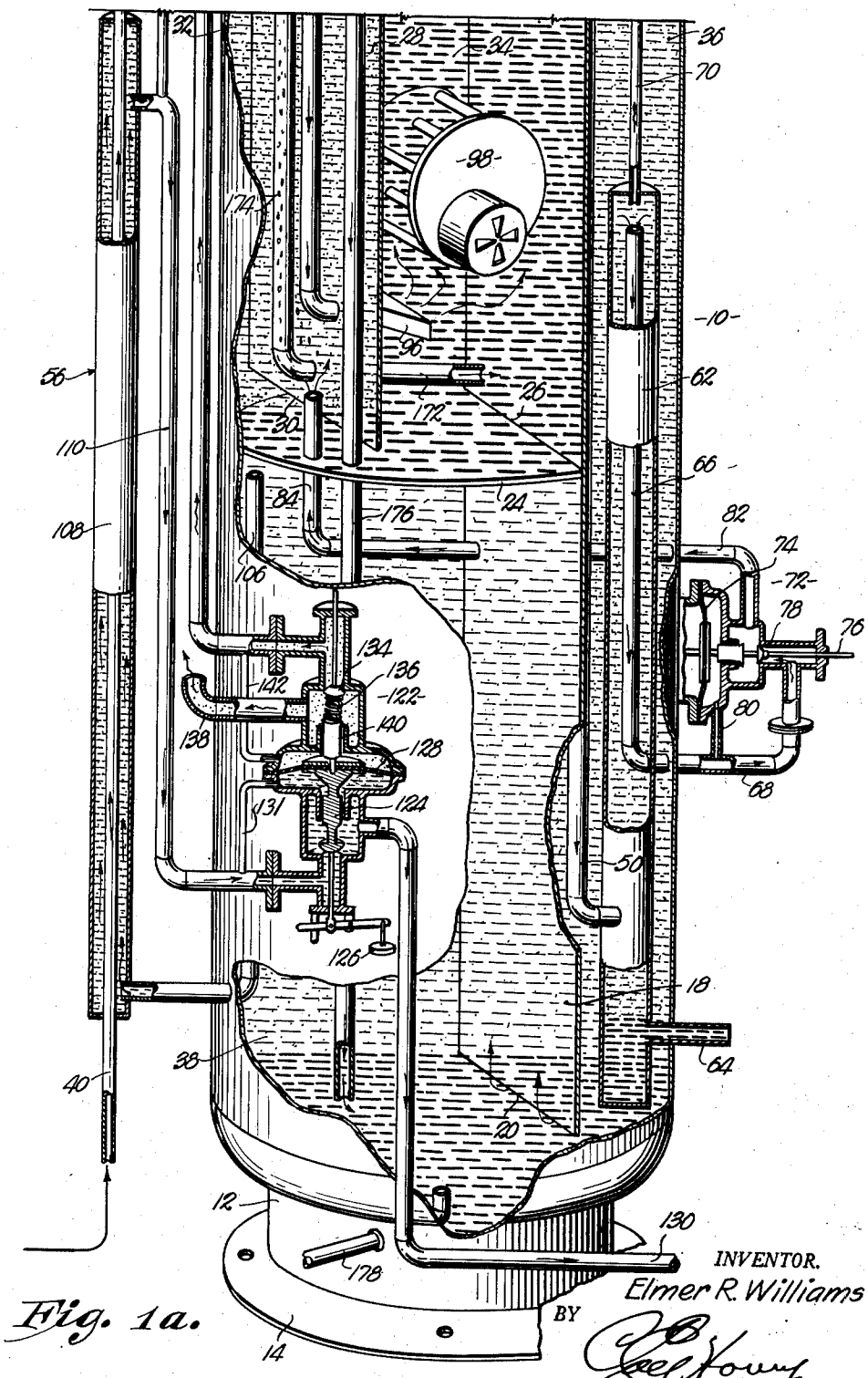


Fig. 1a.

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APPARATUS FOR TREATING EMULSION EMANATING FROM NATURAL OIL WELLS

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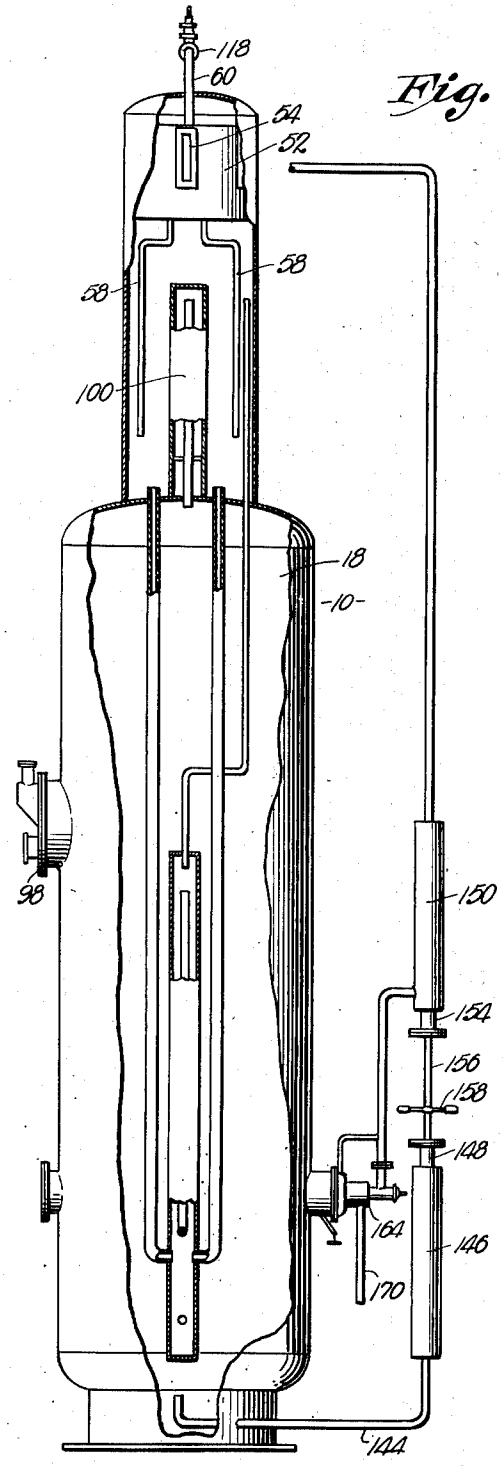


Fig. 2.

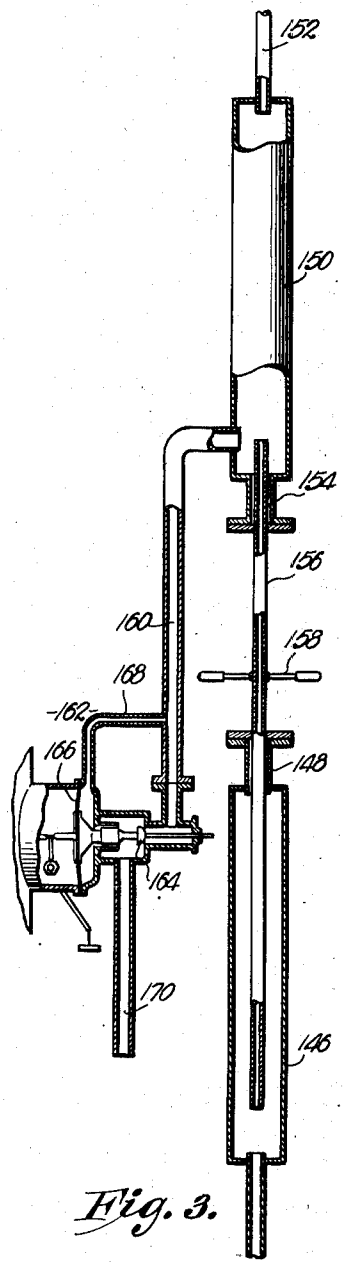


Fig. 3.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR TREATING EMULSION EMANATING FROM NATURAL OIL WELLS

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Application August 27, 1948, Serial No. 46,496

7 Claims. (Cl. 183—2.7)

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This invention relates broadly to the field of petroleum and related products and to the treatment thereof in its crude form as the same emanates from the natural well, the primary aim being to provide improved apparatus for the treating of the same.

The most important object of this invention is to provide apparatus for dehydrating oil in which water is emulsified therein as it emanates from the well, the apparatus consisting of a hollow, upright compartmented shell, one of the compartments being adapted to contain water for receiving the emulsion and there being a furnace disposed in such water, all to the end that the emulsion will bubble upwardly around the furnace and be heated thereby.

Another important object of this invention is the provision of apparatus for treating emulsion having a compartmented shell as stated above and a separate tank disposed on the uppermost end of the shell and in communication therewith for initially removing free gas from the emulsion prior to the "knocking-out" of the water contained thereby, the shell itself being so arranged that as the emulsion travels from the inlet point of the apparatus to the storage tanks for the completely cleaned oil, free gas is completely and positively removed therefrom.

Another object of this invention is to provide equipment for the treating of emulsion capable of directing the same through a circuitous path of travel for removing all gas vapors and all water contained therein with a complete elimination of turbulent movement of the emulsion as the same is conveyed through the apparatus.

A further object of this invention is to provide a treating assembly for emulsified oil wherein pre-heating takes place at several points throughout its path of travel, all to the end that free gas and free water are removed from the emulsion whereby heating of the emulsion itself is kept to a minimum.

A still further object of this invention is to provide treating means of the above mentioned character wherein pre-heating of the emulsion is accomplished by heat exchange elements to the end that separate furnaces or other heating devices are not needed.

A further and very important object of this invention is to provide means forming a part of the assembly for receiving the free gas vapors as well as other gas vapors removed from the emulsion during the process capable of condensing the same and removing such gasoline as the vapors might contain and salvaging the same for redirection back into the oil from which water has been removed, which oil and gasoline are in turn conveyed to storage tanks therefor.

It is another important aim of this invention to provide an assembly for treating oil products emanating from natural wells so arranged and formed as to recover all gas vapors that are removed from the emulsion during its process in

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addition to the free gas initially removed, all to the end that the liquid gasoline contained therein might be salvaged and redirected into the clean treated oil.

This invention has for an additional object, the provision of an apparatus for removing water from oil in which such water is emulsified by inducing coalescence of the water globules and including an upright compartmented shell provided with a large settling area for the water located at the extreme lowermost end of the shell and directly opposite to that end thereof wherein the emulsion itself is initially introduced.

The method of treating petroleum emulsion and the apparatus utilized in carrying forth such method, which apparatus forms the subject matter of this invention, include many other objects and aims, all of which can be more clearly understood and will be made clear as the following specification progresses.

The apparatus per se is illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of substantially the upper half of the apparatus partially in elevation and partially in section for treating emulsion emanating from natural oil wells made in accordance with the present invention.

Fig. 1A is a perspective view also partially in elevation and partially in section, showing the remainder of the apparatus and substantially the lowermost half thereof.

Fig. 2 is a side elevational view, parts being broken away and in section showing on a smaller scale the entire apparatus of Figs. 1 and 1A taken at right angles to said figures; and

Fig. 3 is an enlarged elevation of a portion of the apparatus illustrated in Fig. 2 shown fragmentarily and partially in section.

In Figs. 1 and 1A of the drawings, as well as in Fig. 2, there is shown an elongated, upright, hollow cylindrical shell broadly designated by the numeral 10. A base 12 supports the shell 10 and has an out-turned annular flange 14 serving as a means for securing the entire assembly to a suitable foundation. Except for the various conduits, tanks and other devices about to be described, this shell 10 is closed throughout its length and is provided with a dome-shaped top wall 16. A vertical partition 18, extending substantially the entire length of shell 10, has both of its longitudinal edges secured directly to the innermost face of shell 10. The lowermost edge 20 of this partition 18 terminates in spaced relationship to the bottom of the shell 10 and consequently above the hollow base 12. Likewise, the uppermost end 22 of the partition 18 terminates in spaced relationship below the uppermost wall 16 of shell 10.

A transverse, substantially semi-circular partition 24, disposed well above the center of shell 10, has its arcuate edge welded or otherwise permanently secured to the proximal innermost

face of shell 10 and is also joined directly to the adjacent face of the partition 18 along a straight line 26.

A third partition 28 extends upwardly to join with the uppermost wall 16 of shell 10 and terminates at its lower end 30 in spaced relationship to the uppermost face of the transverse partition 24. As in the case of the partition 18, the partition 28 has its longitudinal edges joined directly with the innermost face of shell 10. Consequently, a plurality of compartments are set off in the shell 10, there being a compartment 32 on one side of the partition 28 and above the partition 24, a second compartment 34 between the two partitions 28 and 18 and above partition 24, and a third compartment 36 that extends downwardly from the uppermost edge 22 of partition 18 to the bottom of shell 10. Another compartment 38 is defined by partition 24, partition 18 and the lowermost end of the shell 10.

The emulsion initially pumped or otherwise received from the natural oil well enters a vertical pipe 40 that extends upwardly to a horizontal portion 42 that is disposed well above the uppermost end 16 of shell 10, as clearly illustrated in Fig. 1.

Portion 42 of the pipe 40 enters the side of a hollow, upright tank broadly designated by the numeral 44 and intermediate the ends of the latter. The tank 44 has a closed top wall 46 and its bottom wall is opened and rests directly upon the wall 16 of shell 10. Tank 44 is welded or otherwise secured directly to wall 16 of shell 10.

A specially formed diverter 48 is secured directly to the innermost end of the horizontal pipe 42 within the tank 44 for receiving the emulsion. Diverter 48 includes a substantially triangular-shaped top plate having a pair of polygonal side walls depending therefrom, all to the end that the emulsion is properly dispersed within the tank 44 for purposes hereinafter more fully defined.

It is seen in Fig. 1 of the drawing that the emulsion entering the diverter 48 flows downwardly within the tank 44 upon the uppermost face of wall 16 of shell 10 and fills tank 44 to a level adjacent the uppermost end of a pair of downcomers 50 (Fig. 1A).

Downcomers 50 project into the shell 10 through wall 16 thereof within the compartment 36 of shell 10 to a point near the bottom edge 20 of partition 18 but spaced thereabove as shown in Fig. 1A.

A tank 44 shown in Fig. 1 of the drawing, constitutes a separator for emulsion and free gas vapors contained therein, such free gas rising from the emulsion within tank 44 and entering a mist extractor 52, disposed adjacent the uppermost end 46 of tank 44.

This mist extractor 52 is of conventional character and has not been detailed and constitutes a hollow, cylindrical tank having a plurality of openings 54 formed therein for receiving the free gas vapors. To the end that such free gas will more readily rise from the emulsion within tank 44, such emulsion is pre-heated by a heat exchanger 56 that surrounds a portion of the vertical pipe 40, as shown in Fig. 1, and as will be more fully hereinafter set forth.

Emulsion that is carried with the free gas and which enters the openings 54 of mist extractor 52 is drained off by a pair of conduits 58 (Fig. 2), that connect at their uppermost end with the bottom wall of mist extractor 52 and terminate at their lowermost ends below the level of emulsion within tank 44 and consequently below the uppermost end of the downcomer 50. The free gas vapors that rise from the mist extractor 52, less the oil which is removed therefrom and discharges through conduit 58 pass from mist extractor 52 through a short pipe 60 that extends upwardly through the uppermost walls 46 of tank 44.

An elongated tube 62 is vertically disposed within the compartment 36 of the shell 10 and has a filling of salt brine for receiving the emulsion from the downcomer 50. As shown in Fig. 1A of the drawing, the lowermost end of downcomer 50 empties directly into the tube 62 adjacent the lowermost end of the latter and spaced slightly above its closed bottom.

A drain 64 communicates with the tube 62 and extends through the shell 10, said drain 64 being provided with a suitable valve and leading to a point of discharge in the usual manner (not shown). The emulsion from which the free gas has initially been removed in the separator tank 44 enters the salt brine within the tube 62 and bubbles upwardly therethrough into the uppermost end of an overflow 66 disposed within this tube 62. The uppermost end of the overflow 66 is adjacent the uppermost end of the tube 62 and projects laterally from the tube 62 intermediate the ends of the latter. This lateral projection 68 of the overflow 66 is shown in Fig. 1A of the drawings, terminating exteriorly of the shell 10. After the emulsion, which has been preheated by heat exchanger 56, reaches the uppermost end of tube 62, additional gas vapors will separate therefrom and such vapors are free to pass upwardly through a pipe 70 within the chamber 36 of shell 10, said pipe 70 passing through the wall 16 of shell 10 as shown in Fig. 1 and terminating within the tank 44 well above the level of emulsion within such tank 44. These free gas vapors that emanate from the vertical pipe 70 also pass into the mist extractor 52 by way of the side openings 54 thereof. As will hereinafter appear, heating of the emulsion that enters the brine tube 62 is attained primarily not from the heat exchanger 56 but by the downcomer 50 being disposed within the relatively hot emulsion in the compartment 36. The downcomer 50, the tube 62 with its contained brine, as well as a portion of the outlet pipe 70 for gas vapors, are all immersed within such heated emulsion, all to the end that virtually all of the gas vapors are knocked out of the emulsion as the same bubbles upwardly through the brine within tube 62.

Accordingly, the emulsion that enters the overflow 66 is virtually free of all gas vapors and their contained gasoline.

A specially formed valve structure, broadly designated by the numeral 72 and disposed exteriorly of the shell 10 near the bottom thereof, receives the emulsion from the horizontal pipe 68. This valve structure includes a diaphragm 74 connected directly to a horizontally reciprocable stem 76 having a normally seated valve 78 secured thereto intermediate its ends. The diaphragm 74 is formed and arranged to open the valve 78 by deflection toward the shell 10 as shown in Fig. 1A, when a predetermined head of emulsion is present within the overflow 66. Diaphragm 74 is disposed within a housing that communicates with the horizontal pipe 68 by a short vertical pipe 80. When the diaphragm 74

is actuated by emulsion entering the short pipe 80 to open the valve 78, such emulsion is free to pass valve 78 and enter a horizontal pipe 82 that passes through the compartment 36 of shell 10 through the partition 18 below horizontal partition 24 and thence upwardly through partition 24 to empty into the chamber 32 of shell 10. The uppermost end of the vertical pipe 84 that projects through the partition 24 and joins with the horizontal pipe 82 is well above the lowermost edge 30 of partition 28 and also above a level of water that is maintained in this compartment 32. Since this edge 30 of partition 28 is spaced above the horizontal partition 24, such water within compartment 32 joins with a filling of such water within the compartment 34. Fig. 1A of the drawings illustrates the water level of compartment 32 as being below the uppermost end of pipe 84 and Fig. 1 of the drawings, illustrates the water level of the compartment 34 as being well above the longitudinal center of such compartment 34. A certain amount of water contained in the emulsion that emanates from the pipe 84 joins with the water within the compartment 32 and the emulsion itself rises within compartment 32 to the wall 16 of shell 10 and also to the level indicated by Fig. 1 of the drawings into a vertically disposed cylinder 86.

Cylinder 86 is disposed next adjacent the tank 44 and has its bottom end communicating directly with the shell 10 and particularly with the compartment 32 thereof as indicated in Fig. 1.

A second cylinder 88 is disposed within the cylinder 86 in spaced relationship to all of the innermost walls of cylinder 86 and held in position by an out-turned flange 90 at its lowermost end that is secured directly to the proximal inner walls of the outer cylinder 86. Cylinder 88 is closed at its top and has its open bottom communicating directly with the cylinder 86 and consequently with the compartment 32 of shell 10.

Gas vapors that rise from the level of emulsion within the inner cylinder 88 are directed into a pipe 92 longitudinally disposed within the cylinder 88 and terminating at its uppermost end adjacent the uppermost end of cylinder 88. The lowermost end of the pipe 92 projects laterally and through the partition 28 to empty directly into compartment 34. When the head of emulsion within the compartment 32, the cylinder 86 and the cylinder 88 becomes sufficient to overcome the head of emulsion within the compartment 34 above the level of the water in compartment 34 as indicated in Fig. 1 of the drawings, the emulsion will empty into a downcomer 94 vertically disposed within the compartment 32. The uppermost end of downcomer 94 is disposed below a transverse plane through the shell 10 and through the uppermost edge 22 of partition 18 while the lowermost end of downcomer 94 terminates above the lowermost edge 30 of partition 28 and extends laterally through this partition 28 terminating within the water within compartment 34. That end of the downcomer 94 within the compartment 34 is provided with a deflector 96 of much the same nature as that indicated by the numeral 48 and disposed within the tank 44 as shown in Fig. 1.

A furnace, broadly designated by the numeral 98, and of the conventional character commonly used in structures of this character, is disposed within the compartment 34 and completely immersed by the water contained therein. Furnace 98 is well above the uppermost face of partition

24 and above the lowermost edge 30 of partition 28. Consequently, the emulsion that enters the compartment 34 and dispersed therein by deflector 96, bubbles upwardly through the water within compartment 34 providing a relatively long wash for the emulsion which also impinges upon the hot surfaces of the furnace 98.

The particular formation and operation of furnace 98 forms no part of this invention and, therefore, such apparatus as extends into the shell 10 for operating the same, is not herein illustrated. A substantial portion of the water contained within the emulsion is removed as the same bubbles upwardly to the level of water within compartment 34 and as such emulsion rises in the compartment 34 to a level adjacent the edge 22 of partition 18, the same will overflow into the compartment 36 of shell 10.

It is to be noted at this point that the flow of the emulsion thus far through the treater and particularly within the compartments 32 and 34, is without any turbulent action whatsoever. After the emulsion has thus been heated by the furnace 98 and as the same overflows into the compartment 36, all of the remaining gas vapors will be knocked therefrom and such vapors will accumulate in the uppermost end of shell 10 and within the space common to both compartments 34 and 36.

A cylindrical, closed condenser 100 is concentrically disposed within the tank 44 and supported above the uppermost face of wall 16 of shell 10 by a plurality of legs 102. A vertical pipe 104 within the condenser 100 terminates in spaced relationship to the uppermost end of condenser 100 and extends downwardly through the bottom of condenser 100 and through the wall 16 of shell 10 to terminate within the latter. The pipe 104 therefore, receives the gas vapors from both compartments 34 and 36 as well as from compartment 32 by way of the pipe 92 that empties into compartment 34. The emulsion that overflows into the compartment 36 travels downwardly and as the same so moves, it will not only heat the conduit 70 but will serve in heating the downcomer 50 as well as the tube 62 as above mentioned.

The compartment 36 and the compartment 38 being joined together because of the partition 18 having its lowermost edge 20 disposed above the bottom of the shell 10, combine to present a relatively large settling area for the remaining water within the emulsion. Prior to passage of the final clean oil from the shell, all water contained in the emulsion will completely settle within the bottom of compartments 36 and 38 as indicated in Fig. 1A of the drawings. The outlet pipe for the finished oil from the compartment 38 of shell 10 is designated by the numeral 106 and has its uppermost end disposed just below the partition 24. Such finished oil passes outwardly from the shell 10 and empties directly into the heat exchanger 56.

This heat exchanger includes the tubular member 108 that surrounds a portion of the vertical pipe 40 and the outlet pipe 106 communicates with the tubular member 108 at the lowermost end of the latter. The finished oil passes upwardly within the tubular member 108 to pre-heat the emulsion flowing through the pipe 40, said finished oil then flowing into a vertical pipe 110 that communicates at its uppermost end with the tubular member 108 adjacent the uppermost end of the latter.

Since the condenser 100 is disposed at the up-

permost end of the shell 10 and at a point where the emulsion is relatively cold, which emulsion is directed to condenser 100 by the deflector 48, the gas vapors that have been knocked from the emulsion and directed thereto by the pipe 104 will condense and be converted into raw gasoline. Such liquid settling to the bottom of condenser 100 is drained therefrom by means of a horizontal pipe 112 that terminates in a vertical pipe 114, the latter of which communicates directly with the outlet pipe 110 for finished oil and next adjacent the outlet end of heat exchanger 56.

A cut-off valve 116 is interposed within the horizontal pipe 112. As shown in Fig. 1 of the drawing, the pipe 60 that connects with mist extractor 52 has a pressure valve 118 interposed therein and empties into the cylinder 86 at the uppermost end of the latter. Such gasoline as might condense from the free gas vapors as they pass from mist extractor 52 to the cylinder 86, will be conveyed from the cylinder 86 to the horizontal pipe 112 by way of a short by-pass 120.

A specially formed valve structure, broadly designated by the numeral 122 preferably mounted exteriorly of the shell 10, receives the dehydrated oil emanating from the heat exchanger 56 together with gasoline passing downwardly through the pipe 114. This mixture of oil and gasoline flowing through the pipe 110 actuates a vertically reciprocable valve 124 that is yieldably held in a seated position at the lowermost end of its path of travel by a weight 126. This valve 124 is also connected to a diaphragm 128 which must be deflected before valve 124 can be opened by the head of oil and gasoline from the pipe 110.

A by-pass 131 permits passage of the oil and gasoline mixture from the pipe 110 to one side of this diaphragm 128.

A conduit 132 has connection at its uppermost end with the cylinder 86 as shown in Fig. 1 and near the uppermost end of the latter. This conduit 132 extends downwardly to join with the valve structure 122 and particularly on one side of a normally closed valve 134. Pressure inherent in the gas vapors emanating from the shell 86 opens the valve 134 against the action of a coil spring 136 permitting passage of such vapors outwardly through a pipe 138. This last mentioned pipe 138 may lead to disposal or to any use desired (not shown). It is to be noted that the spring 136 is interposed between the valve 134 and a reciprocable member 140 joined to the opposite side of the diaphragm 128 to that of the valve 124. Accordingly, whether or not the gasoline and oil mixture from pipe 110 opens the valve 124 against the action of weight 126, depends upon the extent of pressure in the outlet conduit 132 for the gas vapors. Accordingly, when the pressure of the gas vapors becomes sufficiently great to open valve 134 and to maintain the diaphragm 128 in a position where the oil and gasoline pressure of pipe 110 cannot open valve 124, the oil and gas mixture will not flow into the outlet pipe 130 until some of the gas vapor pressure has been relieved by way of the pipe 138. Conversely, when the pressure of the gas vapors emanating from the cylinder 86 is relatively low, valve 134 will remain closed and the gasoline and oil pressure of pipe 110 will easily open the valve 124 either directly or by such liquid acting upon the diaphragm 128 by way of by-pass 131.

As a further means of equalizing the pressure within the entire system, a by-pass 142 connects the conduit 132 directly with the housing for diaphragm 128 on that side of the latter opposite to the valve 124. Accordingly, when there is a substantial amount of pressure and head of the finished product in the pipe 110, valve 124 will open unless the pressure of gas vapors passing through by-pass 142 is too great to prevent upward flexing movement of the diaphragm 128.

It is apparent therefore, that a predetermined amount of pressure may be maintained in the entire assembly and that the pressure needed to convey the finished product to storage tanks by way of outlet pipe 130, can be established.

Structure is also provided for automatically maintaining a predetermined amount of water within the shell 10. Such structure is shown in Fig. 2 of the drawings and detailed at Fig. 3. An outlet pipe for the settled water within the shell 10 and particularly within the chambers 36 and 38 thereof connects with the hollow base 12 and is designated by the numeral 144.

The outermost end of the pipe 144 communicates directly with a relatively large pipe 146, the latter having a stuffing box 148 at the uppermost end thereof. A second relatively large length of pipe 150 communicates at its uppermost end by way of a stand-pipe, the latter communicating in turn with cylinder 86. Pipe 150 also has a stuffing box 154 at its lowermost end. A length of pipe 156 extends into both of the pipe sections 146 and 150 and is reciprocably mounted in the two stuffing boxes 143 and 154. Manual manipulation of this length of pipe 156 is accomplished by means of handle bars 158. Obviously, by shifting of the pipe section 156 longitudinally and disposing the uppermost end thereof at predetermined points along the length of pipe section 150, the desired amount of water can be drained automatically from the shell 10 and manifestly, the level of water therein will thereby be maintained as desired. From the pipe section 150, the drained water passes downwardly through a conduit 160 into a valve structure broadly designated by the numeral 162. This valve structure has a reciprocable weight-loaded valve 164 that is moved from its seat in accordance with the head of water within the pipe 160.

A diaphragm 166 joined to the valve 164 is deflected for opening of valve 164 by the head of water acting upon diaphragm 166 by means of a by-pass 168. Such drained water then passes through outlet 170 for disposal in salt water pits or disposal plants at the necessary pressure. Water is drained from the compartments 32 and 34 and thereby are maintained at a predetermined level therein by means of a horizontal pipe 172 within the compartment 34 below deflector 96. This pipe 172 extends through the partition 28 and thence merges into a vertical length 174 within the compartment 32. At a point spaced below a horizontal plane through the uppermost edge 22 of the partition 18, pipe 174 empties into a second vertical pipe 176 that passes downwardly within the compartment 32, through partition 24 and thence downwardly within the compartment 38 to a point spaced above the bottom of shell 10. The uppermost end of this pipe 176 is turned laterally through the partition 28 and opens within the compartment 34 above a horizontal plane through the uppermost edge of partition 22 as illustrated in Fig. 1. Thus the pipe 174 is sufficiently vented to permit flow of water from the compartment 34 into pipes 172 and 174. When

the level of water within compartment 34 reaches a height corresponding to the height of the point of merger between pipes 174 and 176, then such water will flow downwardly into pipe 176 and thence into the compartments 36 and 38 where the same is in turn siphoned out by the structure above described and shown in Figs. 2 and 3.

For cleaning purposes, shell 10 is drained by means of an outlet 178 provided with a suitable shut-off valve, not shown.

While the operation of the apparatus forming the subject matter of this invention has been intermittently set forth as the above description of the parts thereof was set forth, a summary of the flow of material through the treater is as follows:

The crude oil that has water emulsified therein and to be treated by the assembly, is directed into the tank 44 by way of pipe 40, the latter passing through the heat exchanger 56 for pre-heating of the emulsion because of the surrounding relatively hot treated oil within the conduit 108.

Emulsion entering tank 44 settles to the bottom of the latter for flow into the downcomers 50 after the level rises a predetermined distance within tank 44. Free gas will readily rise from such emulsion within the tank 44 because of the pre-heating within heat exchanger 56, such free gas passing directly into the mist extractor 52. Oil that is separated from the free gas vapors within extractor 52 will return to tank 48 by way of pipes 58.

Pressure within the entire structure is predetermined by pressure valve 118 that governs the control of the vapors from mist extractor 52 to the outermost cylinder 86.

The emulsion that leaves the tank 44 by way of downcomers 50 is again heated because of the downcomers 50 being within the heated emulsion within the compartment 36 and when such emulsion enters the tube 62, virtually all of the free gas will be knocked therefrom by reason of the emulsion bubbling upwardly through the heated brine within tube 62. In other words, the emulsion is directed upwardly within the tube 62, downwardly within the pipe 66, back upwardly through the control valve 72 and thence upwardly again into the compartment 32 by way of pipe 84. Whether or not the emulsion will pass from the compartment 32 to the compartment 34, depends upon the extent of the head thereof within the inner cylinder 88. Gas vapors are again permitted to rise from the emulsion when the same is within the compartment 32, such vapors passing directly into the cylinder 88 and thence into the space above chambers 34 and 36. No turbulent action is present as the emulsion receives the long wash within the compartment 34 and as such emulsion impinges upon furnace 98 in its bubbling action upwardly. Deflector 96 provides the necessary diffusion of the emulsion into the water within compartment 34 and turbulent action is further prevented by permitting such emulsion to flow easily from compartment 34 into compartment 36 by overflowing the uppermost edge 22 of partition 18. At this point, all loose ends of the vapors are removed and permitted to enter condenser 100 by way of pipe 104, together with the vapors emanating from pipe 92. Since such vapors are relatively hot, the cool emulsion directed to condenser 100 by the diverter 46 will cause condensation of the vapors and the liquid gasoline that is salvaged therefrom is re-directed into the dehydrated oil that passes to the valve structure 122.

The relatively large settling area across the entire shell 10 at its lowermost end which extends into both compartments 36 and 38 is advantageous for removing the globules of water and manifestly, there will be a certain amount of surging of the water between the two compartments 36 and 38. By means of the automatic water syphoning means shown in Fig. 3 of the drawings, the level of water utilized for the process is maintained at desirable points throughout the various compartments of the shell 10 and there will at no time be any of such water pass outwardly through the pipe 106. By the same token, no water within the compartment 34 can flow into compartment 36 because of the internal syphoning means including pipes 174 and 176. Likewise, the water level within compartment 32 will always be below the uppermost end of pipe 84 and consequently only oil will flow from compartment 32 to compartment 34 by way of the pipe 94.

It is evident that all of the aims and objects initially set forth herein are attained by the apparatus above set forth. The treater is a two-pressure system resulting from the initial pressure of the emulsion entering the structure and from the pressure that is built up adjacent adjustable valve 118.

The tank 44 and its component parts operates as a gas and oil separator and additionally serves as a condensing compartment so arranged that the gas vapor end points rising from the heated emulsion, can escape from the treater only by going through the condenser per se.

The condenser is located at the coldest area within the treater and the incoming emulsion creates refrigeration around the condenser unit 100. Similarly, the condensed gasoline cannot escape but is directed into the pipe line oil at a point where the latter and the condensed liquid are at approximately the same temperature. Free gas and all other gas vapors are completely eliminated from the emulsion prior to the last downward movement thereof into the water separating portion of the shell 10. As in the case of removing gas vapors, free water is initially knocked from the emulsion before the primary heating step and also prior to the settling process forming a part of the dehydration step. Since the separator unit 44 and its component parts is provided with an automatic oil valve 72 together with the anti-back pressure gas valve 118, the pressure upon the unit 44 is maintained at maximum working pressure as desired. The combination control gas and oil valve assembly 122 permits the necessary pressure to deliver the pipe line oil to stock tanks automatically. The inside water syphon structure, together with the automatic water valve assembly 162, cause delivery of the water to disposal at desired pressures.

All of the natural laws of nature have been followed in designing the treater above described, the emulsion being directed initially to the very top of the treater and the heating means being disposed well above the center of the tank 10 permitting upward bubbling movement of the emulsion therearound. Thus, heating is accomplished near the top of the unit whereas the finished pipe line oil is conveyed from the treater adjacent the bottom thereof. Upward travel of the oil is permitted following natural laws of gravitation throughout virtually the entire unit

and obviously, taking advantage of the difference in weights between the component parts of the emulsion eliminates many of the complicated and expensive auxiliary assemblies heretofore used and needed in treaters of this character.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In apparatus for treating petroleum having water emulsified therein, a hollow, upright shell having a compartment formed therein adjacent its top, said compartment being provided with an opening at its uppermost end for placing the same into communication with the bottom of the shell; a furnace in the shell; structure for directing petroleum emulsion to be treated into said compartment at a point where the emulsion is free to flow upwardly in washing contact with the furnace and for overflowing through said opening after heating by the furnace; means for conveying from said shell the oil that remains after settling of water from the emulsion that overflows into said bottom of the shell; means within said structure for receiving free gas vapors from the emulsion prior to introduction thereof into said compartment; and an assembly within said shell for knocking additional free gas vapors from the emulsion prior to passage thereof into said compartment, said assembly comprising a chamber adapted to contain a filling of salt brine and having an outlet for directing said additional free gas vapors into said receiving means, the emulsion being directed into the chamber near the bottom thereof for upward bubbling through the salt brine.

2. In apparatus for treating petroleum having water emulsified therein, a hollow, upright shell having a compartment formed therein adjacent its top, said compartment being provided with an opening at its uppermost end for placing the same into communication with the bottom of the shell; a furnace in the shell; structure for directing petroleum emulsion to be treated into said compartment at a point where the emulsion is free to flow upwardly in washing contact with the furnace and for overflowing through said opening after heating by the furnace; means for conveying from said shell the oil that remains after settling of water from the emulsion that overflows into said bottom of the shell; means within said structure for receiving free gas vapors from the emulsion prior to introduction thereof into said compartment; and an assembly within said shell for knocking additional free gas vapors from the emulsion prior to passage thereof into said compartment, said assembly comprising a chamber adapted to contain a filling of salt brine and having an outlet for directing said additional free gas vapors into said receiving means, the emulsion being directed into the chamber near the bottom thereof for upward bubbling through the salt brine, said chamber being disposed in the path of travel of said heated emulsion for heating the salt brine contained therein.

3. In apparatus for treating petroleum having water emulsified therein, a hollow shell having a plurality of compartments formed therein, one of said compartments having an inlet opening adjacent the bottom thereof for receiving petroleum emulsion to be treated and being adapted to contain free water separating from the emulsion as the latter flows toward the top of said one compartment; a conduit for conveying the emulsion from a point near the top of said one compartment into a second of said compartments near the bottom thereof; a heater for the emulsion in said second compartment, said second compartment communicating with a third of said compartments above said heating means; and structure for conveying from the third compartment oil forming a part of the emulsion after water settles therefrom in the third compartment, said one compartment and said second compartment communicating at said bottoms thereof whereby flow of emulsion into the second compartment is controlled by the head of emulsion and water in the one compartment.

4. In apparatus as set forth in claim 3 wherein said emulsion is directed into the one compartment at a point above the said connection between the one compartment and the second compartment.

5. In apparatus as set forth in claim 3 wherein is provided syphoning means for automatically maintaining water in all the compartments at predetermined levels.

6. In apparatus as set forth in claim 3 wherein is provided syphoning means for automatically maintaining water in all the compartments at predetermined levels, and passage means for directing fluid under pressure to the water syphoned from the shell and oil conveyed therefrom to move the same to a point of collection.

7. In apparatus for treating petroleum having water emulsified therein, a hollow, upright shell having a compartment formed therein adjacent its top, said compartment being provided with an opening at its uppermost end for placing the same into communication with the bottom of the shell; a furnace in the shell; structure for directing petroleum emulsion to be treated into said compartment at a point where the emulsion is free to flow upwardly in washing contact with the furnace and for overflowing through said opening after heating by the furnace; means for conveying from said shell the oil that remains after settling of water from the emulsion that overflows into said bottom of the shell; and means within said structure for receiving free gas vapors from the emulsion prior to introduction thereof into said compartment, said structure being provided with a heating means for receiving the emulsion prior to passage thereof into said receiving means for free gas vapors for encouraging separation of the free gas vapors from the emulsion, said heater comprising a pair of relatively telescoped, hollow bodies forming a part of said structure and said oil conveying means respectively.

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