June 25, 1968 H. R. BULL 3,389,536

EMULSION TREATER TANK

Filed Sept. 27, 1966 2 Sheets-Sheet 1

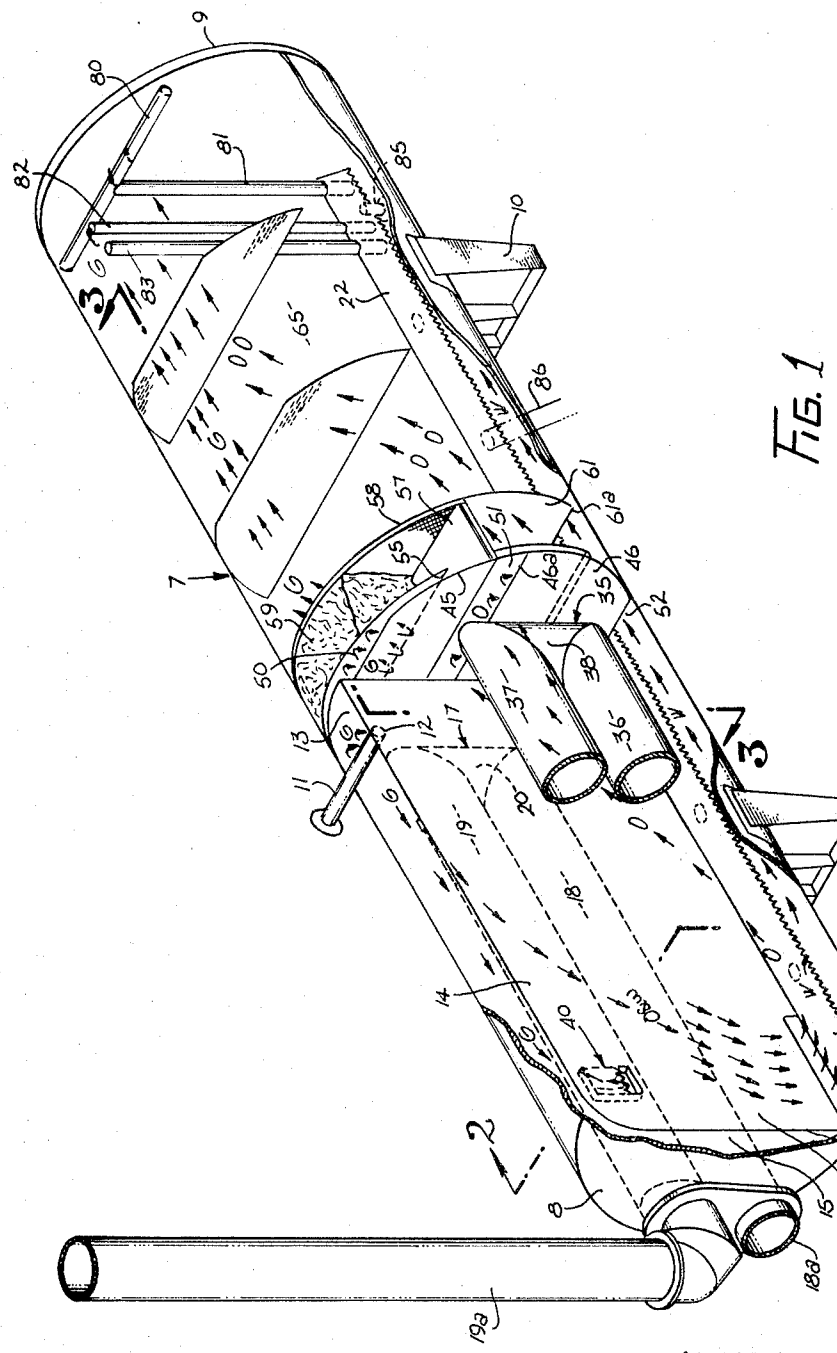


FIG. 1

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FIG. 2

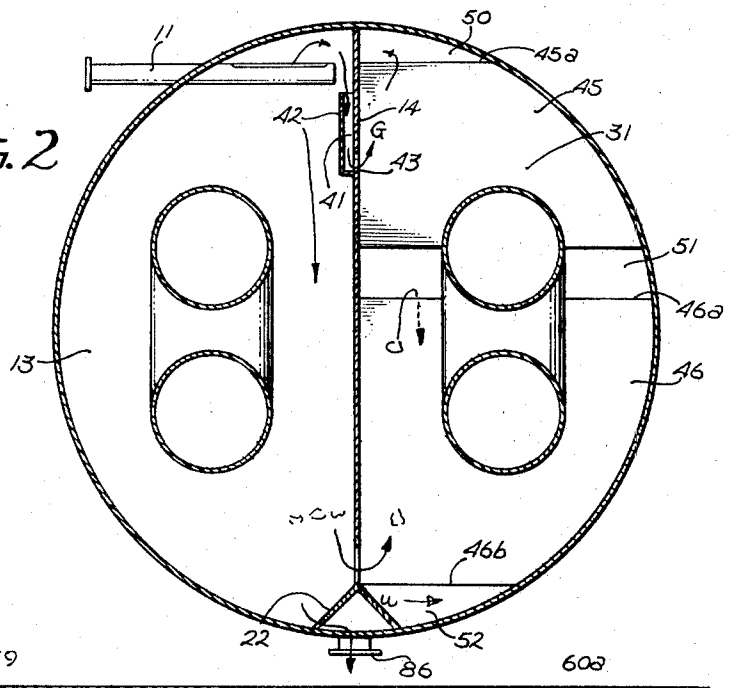
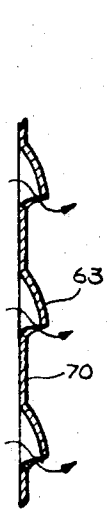


FIG. 4



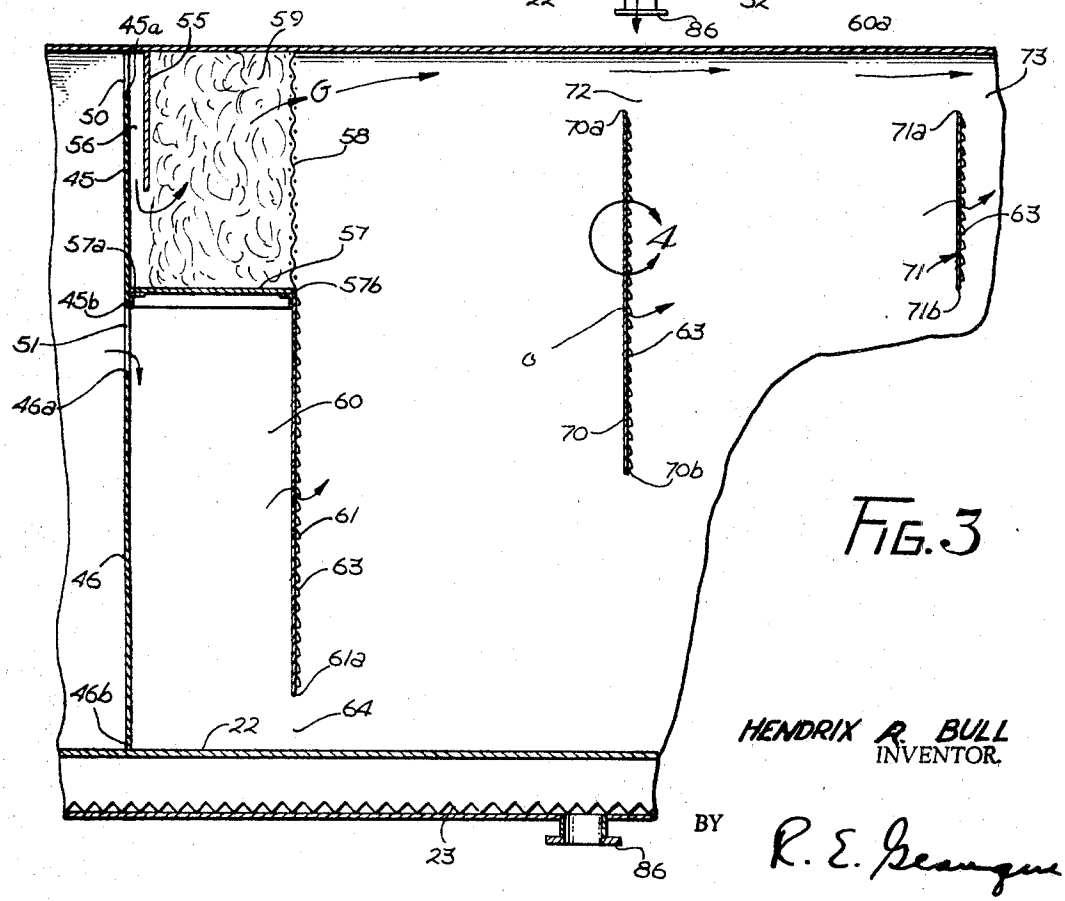


FIG. 3

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EMULSION TREATER TANK

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ABSTRACT OF THE DISCLOSURE

The emulsion treater tank has first and second compartments at one end of the tank separated by a longitudinal, substantially vertical partition. A transverse, substantially vertical partition is located intermediate the ends of the tank and extends from one side of the tank to the end of the longitudinal partition in order to close the end of the first compartment. A pair of transverse distributing plates extend from the other side of the tank to close the end of the second compartment. Crude oil is introduced to the first compartment near the top of the tank adjacent the transverse partition and flows downwardly around the lower edge of the longitudinal partition at the one end of the tank into the second compartment and both compartments containing heaters. The distributing plates provide a top gas passage, an intermediate oil passage and a lower water passage leading from the second compartment toward the other end of the tank. The gas and oil are removed near the top of the other end of the tank and the water is removed at the bottom at the other end of the tank.

This invention relates to an emulsion treater tank, and more particularly to a treater tank which removes impurities from crude oil in order to bring it down to pipeline specifications.

Present treater tanks utilize a heater section to further heat the oil received from a flow-splitter tank and utilize an excelsior section of expanded wire mesh to break up the foam. However, these sections have been so positioned in the flow path of the oil that they become easily clogged and do not effectively operate in the intended manner. No provision has been made for permitting the heating of the incoming oil to remove the gas causing the foam prior to its passage through to the wire mesh section.

By the present invention, the incoming cold oil enters the emulsion treater tank at the top of the tank and at one side of a transverse partition. The oil flows toward one end of the tank along a first side compartment of the tank formed by a longitudinal partition and then under the longitudinal partition and back towards the center of the tank through a second side compartment. The gas and the foam, which rise to the top of the first compartment, are washed through the top of the longitudinal partition and again washed before it passes through an excelsior section located behind the transverse partition. A heater is present in each of the side compartments and as the oil mixture is heated in the first compartment, the warm relatively foam-free oil flows downwardly, since it is heavier than the cold oil containing foam, underneath the longitudinal partition and back into the second compartment. The oil leaves the second compartment through an opening in the transverse partition and on through distributing plates which distribute flow back into a third tank compartment on the other side of the transverse partition, from one quadrant of the tank. The gas in the second compartment washes through an excelsior section at the top of the tank leading to the third compartment. The oil in the third compartment flows

longitudinally and upwardly through the third compartment to the oil outlet. This flow pattern permits further water separation.

It is therefore an object of the present invention to provide an emulsion treater tank in which the incoming oil is heated to remove the foam and the heated oil moved downwardly for separation from the cold oil containing foam.

Another object of the invention is to provide a treater tank in which the gas remains at the top of the tank and is washed through the oil as it passes along the top of the tank to the gas discharge outlet.

Another object of the invention is to provide an emulsion treater in which the foam is treated in the top section of the tank and the warm oil is separated by downflow.

Another object of the invention is to remove remaining water from the oil after foam removal by long horizontal and upward flow of the oil through the tank.

These and other objects of the invention not specifically set forth below will readily become apparent from the accompanying description and drawings in which:

FIGURE 1 is a perspective view in section of the emulsion treater tank showing the directional flow through the tank;

FIGURE 2 is a transverse vertical sectional view along line 2—2 of FIGURE 1 showing the first washing for the gas;

FIGURE 3 is a transverse vertical section along line 3—3 of FIGURE 1 showing the second washing of the gas and the baffles which guide the oil flow; and

FIGURE 4 is an enlarged section of one of the baffles designated by the circle 4 in FIGURE 3.

Referring to the embodiment of the invention chosen for purpose of illustration, the treater tank **7** has dome-shaped ends **8** and **9** and is supported on a pair of stands **10**. the treater tank **7** receives the crude oil from an oil field or a splitter tank or similar unit through the passage **11** which discharges at the top of the tank through the opening **12**. The crude oil received may contain 10% or more impurities and the treater tank of the present invention serves to reduce these impurities to the point where the oil meets pipeline specifications. The opening **12** is adjacent a first transverse partition **13** connecting with a second longitudinal partition **14** which divides one end of the tank into first and second compartments **15** and **16** each of which comprise about one-quarter of the tank. The compartment **15** contains a U-shaped heater **17** having legs **18** and **19** and end **20**. End **18***a* of leg **18** receives a heating medium which is discharged through end **19***a* of leg **19**.

Cold oil entering the compartment **15** at the top is heated by heater **17** and thus causes the production and expansion of gas bubbles which are trapped in the cold oil and which are released upon further heating of the oil. In other words, by heating the cold foamed oil at the top of compartment **15**, the viscosity of the oil drops allowing the gas to escape so that the oil increases in density by removal of the gas even though the oil is warmer. Therefore, the cold foamed oil is lighter than the warmed oil from which foam has been removed by heating and the warm relatively foam-free oil will flow downwardly and longitudinally in compartment **15** to the slit **21** at the lower end of partition **14** leading to compartment **16**. In FIGURE 1, this downward flow of warm oil and water is designated by the arrows labeled O and W. The bottom edge of partition **14** rests on an inverted trough **22** which extends along the bottom of the tank **7** and has serrated edges **23** adjacent the tank for removal of solids as will be later described.

A second heater **35** is located in the compartment **16**

and has legs 36 and 37 connected by end 38. Leg 36 is connected to a source of hot gas and the leg 37 discharges the gas so that further heating takes place in compartment 16 for removal of additional impurities. The light gas and foam which rise to the top of compartment 15 are washed through the liquid in compartment 16 by means of bypass 40. As illustrated in FIGURE 2, the bypass comprises a passage 41 in a rectangular shaped cover 42 extending along partition 14 and passage 41 connects with opening 43 in partition 14. The gas and foam leaving the passage 43 enter the liquid in the top of compartment 16 and liquid particles are removed as the gas and foam rise to the top of compartment 16. This first washing removes at least a portion of the liquid suspended in the gas and the removed liquid joins the liquid in compartment 16.

Two distributing plates 45 and 46 extend from partition 13 and close in end of compartment 16 except for the flow passages 50, 51 and 52. The upper edge 46*a* of partition 46 is located opposite leg 38 of heater 35 and the lower edge 46*b* engages the trough 22. The upper edge 45*a* of plate 45 is spaced from the top of the tank to provide gas and foam passage 50 and the lower edge 45*b* of 45 is spaced from the upper edge 46*a* in order to provide oil passage 51. The space between lower edge 46*b* and the bottom of the tank provides water passage 52. An arc-shaped partition plate 55 is spaced from partition 13 and plate 45 to provide a downward gas flow passage 56. A horizontal expanded wire mesh platform 57 extends at its edge 57*a* from the lower edge 45*b* of the partition 45 and from the partition 13 and a screen 58 extends vertically upward from the other edge 57*b* to the top of the tank to define a space 59 containing excelsior. The wet gas at the top of the compartment 16 passes through the opening 50 and down the passage 56 to be washed by the liquid in the upper part of the tank. As the gas rises to the top of the tank, the excelsior will mechanically rupture any remaining foam bubbles in the gas so that the gas in the top of the tank will be relatively free of liquid.

The warmed oil in the lower portion of the compartment 16 passes through the opening 51 into the space 60 which is formed by a baffle 61 spaced from the plate 46 and extending across the tank and downwardly from edge 57*b* of the platform 57. The lower edge 61*a* of baffle 61 terminates above the bottom of the tank to provide an oil passage 64 along the lower edge of the baffle. The baffle 61 also contains a plurality of small openings which are formed by the punching out of small sections 63 so that fluid can flow through the baffle 61 over its entire area. Thus, the liquid oil further warmed by the heater 35 flows through the passage 51 into the space 60 and then is distributed by passage 64 and by the openings in the baffle 61 into the large compartment 65 at the other end of the tank. All of the oil flowing into the large compartment is distributed from the lower right-hand quadrant of the tank and flows upwardly and longitudinally through the compartment 65 as indicated by the arrows designated O.

Two or more baffles 70 and 71 are spaced along the tank between the baffle 61 and the end 9 of the tank. Each of the baffles contain punched-out sections 63 similar to those in baffle 62 to provide a plurality of passages through to the baffle (see FIGURE 4). The upper edge 70*a* of baffle 70 provides a flow passage 72 for the gas along the top of the tank while the lower edge 70*b* is slightly below the middle of the tank. In a similar manner, the upper edge 71*a* of baffle 71 provides a gas flow passage 73 along the top of the tank while the lower edge 71*b* of the baffle is above the middle line of the tank. The baffles 70 and 71 are about equally spaced in compartment 65 and tend to distribute the oil from passage 64 through the middle and upper portion of compartment 65. Any excess oil flows below the lower edges of the baffles.

An oil outlet trough 80 is located adjacent the end 9 of the tank and collects oil from the top liquid level of the tank for distribution to a pipeline or other location through the outlet pipe 81. The gas in the upper portion of the tank flows in the direction of arrows G and is removed from the tank through the gas outlet line 82. Also, a high level limit passage 83 has its open end located to remove oil from the tank in case its level reaches the maximum safety limit. The water collecting in the bottom of the tank flows along the bottom of the tank in the direction of arrow W and is continually removed from the outlet 85 located adjacent the tank end 9. A number of blow out passages 86 communicate with the interior of trough 22 at spaced locations along its length and the opening of any of these passages causes water to remove the solids which collected along the sides of the trough. The present invention provides a treater tank in which the warm oil flows downwardly after it is heated to remove gas bubbles and the gas is collected at the top of the tank. The removed water collects at the bottom of the tank above the inverted trough so that it can be used for solid removal through the serrated edges of the trough. The heated oil flows upwardly and horizontally from the last heater so that water can continue to separate and flow downwardly without interference from upflowing oil. Thus, the downfalling water will not be limited by the rising oil which will move progressively along the tank to the discharge end. The wet gas is washed several times as it flows along the top of the tank from the inlet opening through the various tank compartments to the gas outlet.

It is understood that various types of heaters can be utilized in the compartments 15 and 16 on opposite sides of partition 14 and that various materials may be used in the space 59 to separate the foam. Various other modifications are contemplated by those skilled in the art without departing from the spirit and scope of the invention as hereinafter defined by the appended claims.

What is claimed is:

1. An emulsion treater tank for crude oil comprising:
   - an elongated tank with its longitudinal dimension extending horizontally;
   - a longitudinal substantially vertical partition extending centrally through said tank from one end thereof over a portion of the length thereof and separating said tank into first and second compartments;
   - a transverse, substantially vertical partition extending from one side of the tank to said longitudinal partition to close the end of said first compartment opposite said one end of said tank; an inlet passage for introducing crude oil near the top of said first compartment and adjacent said transverse partition; an opening in the lower portion of said longitudinal partition adjacent said one end of said tank for passage of liquid from said first compartment and to said second compartment; and
   - heater means located in said first compartment to warm the incoming crude oil.

2. A treater tank as defined in claim 1 having a transverse, substantially vertical distributing plate located across the end of said second compartment opposite said one end of said tank and providing an upper gas passage adjacent the top of the tank.

3. A treater tank as defined in claim 2 having:
   - a transverse screen spaced from said transverse partition and said transverse distributing plate and defining a space located adjacent said transverse partition and said distributing plate;
   - a third tank compartment between said screen and the other end of said tank;
   - gas scrubbing means located in said space; and
   - downwardly extending passage means connecting with said upper gas passage for introducing gas from the top of said second compartment to said scrubbing

means for passage through said scrubbing means to the top of said third compartment.

4. A treater tank as defined in claim 1 having a pair of transverse, substantially vertical distributing plates located at the end of said second compartment opposite said one end of said tank and spaced apart one above the other to form an intermediate oil passage in said tank.

5. A treater tank as defined in claim 4 having:

a platform extending from the top of said oil passage toward the other end of said tank;

a baffle extending downwardly from said platform to form an oil distributing space;

a third tank compartment between said baffle and the other end of said tank; and

oil passage means through said baffle and around the bottom of said baffle leading to said third compartment.

6. An emulsion treater tank as defined in claim 5 having a plurality of spaced baffles in said third compartment, the lower edges of said baffles being progressively higher toward said other end of said tank to direct the oil from said passage means longitudinally and upwardly toward said other end of said tank, the upper edges of said baffles being spaced from the top of said tank for passage of gas to said other tank end.

7. A treater tank as defined in claim 1 having a transverse, substantially vertical distributing plate located at the end of said second compartment and providing a lower water passage between the lower edge of said distributing plate and the bottom of the tank for passage of water collected in said first and second compartments to the other end of the tank.

8. A treater tank as defined in claim 1 having second heater means in said second compartment, outlet means from said second compartment located intermediate between the top and bottom of said tank.

9. A treater tank as defined in claim 1 having a gas washer directing gas from the top of said first compartment downwardly and through said second compartment for flow up through the liquid in said second compartment in contact therewith in order to scrub said gas.

10. A treater tank as defined in claim 1 having transverse, substantially vertical distributing plates located only at the end of said second compartment opposite said one end of said tank providing an upper gas passage adjacent the top of the tank, an intermediate oil passage in said tank and a lower water passage adjacent the bottom of the tank.

11. A treater tank as defined in claim 10 having oil and gas discharge passages in the upper portion of said tank adjacent said other end of said tank, and a water discharge passage in the bottom of said tank adjacent said other end of said tank.

12. An emulsion treater tank as defined in claim 1 having a V-shaped trough extending along the bottom of said tank along the length thereof and having serrated edges engaging the bottom of the tank, a plurality of nozzle passages in the bottom of said tank connecting with the interior of said trough to draw water from the bottom of the tank and remove the solids collected on the outside surface of the trough.

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