APPARATUS FOR TREATING PETROLEUM EMULSIONS

Filed Oct. 30, 1935

Inventor:
George S. Bays

By:
S. L. Parkhurst
Attorney
UNITED STATES PATENT OFFICE

2,056,763

APPARATUS FOR TREATING PETROLEUM EMULSIONS

George S. Bays, Tulsa, Okla., assignor to Stanolind Oil and Gas Company, Tulsa, Okla., a corporation of Delaware

Application October 30, 1935, Serial No. 47,563

10 Claims. (Cl. 210—47)

This invention relates to an apparatus for treating or breaking petroleum emulsions, particularly emulsions of crude oil and brine such as are encountered in the oil fields.

5 Petroleum emulsions, and particularly oil field emulsions, are in many cases very stable and considerable difficulty is often encountered in treating or breaking them to remove the water or brine. Many methods have been proposed and used in the past for treating such emulsions with varying degrees of success. It is an object of my invention to develop a peculiarly efficient and inexpensive apparatus for accomplishing this purpose. Other and more detailed objects of my invention will become apparent as the description thereof proceeds.

15 I have experimented with a great variety of different processes and apparatus for breaking emulsions and have found that the best results can be obtained by rolling the emulsion in thin films or discrete globules through a body of water in contact with a wooden surface. I am not entirely sure what the reason is for the great success of this method but certain theories in this connection will be set forth hereinafter.

20 The apparatus of my invention and the process in which it is used will now be more fully described in connection with the accompanying drawings which form a part of this specification and in which

Figure 1 is an elevation of one preferred embodiment of my invention, partly in section;

25 Figure 2 is a sectional plan taken along the line 2—2 of Figure 1;

Figure 3 is an elevation, partly in section, at right angles to the elevation of Figure 1, taken along the line 3—3 of Figure 2;

Figure 4 is a detailed sectional elevation corresponding to the lower right hand portion of Figure 1; and

30 Figure 5 is a detailed elevation taken along the line 5—5 of Figure 4.

Referring now more particularly to the drawings it will be seen that my apparatus comprises a treating tank 11 containing a plurality of pairs of troughs, inclined planes or baffles 12, 13, 14, 15, 16, 17, 18, and 19 arranged at slight angles to the horizontal in zig-zag fashion as shown.

35 Tank 11 is normally filled with water to a level above the top troughs 19.

Water is introduced into treating tank 11 through valve 20 and pipe 21. The level of the water in the treating tank is controlled by means of water leg 22. Thus when valve 23 is open and valve 24 is closed the water level in pipe 25 rises as water enters treating tank 11 and eventually overflows through pipe 26, thereby assuring a constant level of water which should in all cases extend above the top troughs 19. Water accumulating from the treating operation overflows in this same manner. Pipe 27 extends upward and is preferably open to the atmosphere to avoid any possible syphoning effect. The water in treating tank 11 can be changed as required through valve 26 and/or valves 23 and 24.

When treating tank 11 has been filled with water a petroleum emulsion, which will normally be of the water-in-oil type and which will normally contain crude oil, water (or brine) and gas is introduced from storage or directly from an oil well through line 28 into gas separator 29 which may be of any conventional type and which may be mounted on treating tank 11, alongside it or in any convenient location. The emulsion from which the gas has been separated is then passed through line 30 into my treating tank 11. The gas passes off from the top of gas separator 29 through line 31 which communicates with the top of treating tank 11 through fitting 32. The gas then passes out of the system through line 33 from which it may be fed to the boilers normally used in connection with oil field practice or may pass to any other desired equipment.

The reason for separating the gas is to prevent its liberation in treating tank 11 wherein it would rile up the material being treated and interfere with the efficiency of the treating operation. In order to avoid the development of pressure in treating tank 11, and to avoid the gas loss and hazard which would occur if the tank were vented to the atmosphere, the gas line is connected with the top of the tank.

45 It will be understood of course that it is not always absolutely necessary to separate the gas even when it is present. Moreover in some cases the emulsion may not contain any substantial amount of gas. Thus it is possible to eliminate the gas separation equipment and pass the emulsion directly into treating tank 11. In any event the emulsion in treating tank 11 is directed upward by riser 34 and by its natural buoyancy. The emulsion accumulates below distributor 35, the detailed construction of which is shown in Figures 4 and 5. The purpose of this device is to distribute incoming emulsion evenly across the troughs 12. This is accomplished by means of saw teeth 36 through which

50
the emulsion bubbles. Distributor 38 is, of course, closed at its ends. The rising bubbles of emulsion contact the lower portion of the bottom troughs 12 and flow upward past saddle 37. This saddle is likewise of saw tooth construction, the saw teeth being somewhat finer and less deep than those of distributor 38, so that coarse distribution is obtained by means of distributor 38 and fine distribution by means of distributor 37. It will be understood that in many cases one or both of these saw toothed elements may be omitted but their presence serves to secure better distribution of the emulsion.

Block 39 serves to prevent any of the emulsion from passing upward through the spaces between the various pairs of troughs.

After passing saw toothed saddle 37, the emulsion passes upward through the water along the under sides of troughs 12 and it is at this point that the real treating or emulsion breaking action begins to occur. The emulsion passing upward along the under side of troughs 12 in a thin film or preferably in discrete globules is subjected to a rolling action and this rolling action tends to break the film separating the oil from the emulsion from the water or brine therein. The rupture of this film promotes the breaking of the emulsion and the water gradually separates out and augments the body of water in treating tank 11.

On reaching the upper end of troughs 12 the emulsion passes upward to the under sides of troughs 13 and is prevented from escaping from the trough system by means of drop ends 40.

The emulsion which has now commenced to break passes upward along the lower surface of troughs 13 and then downward along the lower surfaces of troughs 14, 15, 16, 17, 18 and 19 in succession. By the time it reaches the top of the system the water has been practically completely separated and the demulsified oil forms a layer at the top of the treating tank. This layer overflows through enlarged pipe 41 and then out of the system through pipes 32 and 43 to storage or other facilities.

As shown, the troughs may suitably be supported by means of columns 44. Treating tank 11 and all its internal equipment except the plows and the various elements may suitably be put together with copper nails, brass screws, etc. This gives an inexpensive, corrosion proof construction. It is however, particularly important that the troughs or baffles, and still more particularly their under surfaces, should be of wood.

Also as shown in the drawings, tank 11 may be provided with clean out boxes 45.

In order to prevent the films or globules of the emulsion from spreading laterally beyond the edges of the troughs and in order to keep the emulsion distributed across the troughs, the latter are provided with drop sides 46 and rails 47.

Devices similar to saddles 31 can also be used on the lower parts of the other troughs if better reduction is desired.

I have found that in my new process and apparatus the use of wood baffles has a very real, important and outstanding advantage over the use of baffles made of other materials, for instance metals. I do not know of any completely satisfactory explanation for this but the fact of the superiority of the wood baffles is very well established and these wood baffled treating tanks have come into wide spread use in the industry. It appears that the normally rough surface of the unfinished or semi-finished wood usually used tends to enhance the film rupturing effect of the rolling particles by subjecting them to an uneven surface and by puncturing them at intervals due to surface irregularities.

I have described my invention particularly in connection with certain embodiments and in connection with certain theories which make up its success, it is to be understood that these embodiments and these theories are by way of illustration rather than by way of limitation and that I do not mean to be bound thereby but only to the broadest, valid interpretation of the appended claims in which I will define my invention.

I claim:

1. An apparatus for treating a petroleum emulsion comprising a tank and a plurality of said tanks and wooden baffles being disposed at small angles to the horizontal in zig-zag relationship to each other, means for introducing a body of water into said tank to cover said baffles, and means for introducing said petroleum emulsion into said tank below the lowest of said baffles, whereby said emulsion can be broken by passing it upward through said body of water along the lower surfaces of said baffles in succession.

2. An apparatus according to claim 1 which includes means for withdrawing the de-emulsified petroleum from said tank at a level above the uppermost of said wooden baffles, and means for maintaining a substantially constant water level in said tank, said water level being located slightly below the level at which said de-emulsified petroleum is withdrawn.

3. An apparatus for treating a petroleum emulsion which contains an oil phase, an aqueous phase and gas, which apparatus comprises a gas separator, means for introducing an emulsion into said separator, a treating tank, a gas line leading from said separator to the top of said treating tank, a plurality of wooden baffles in said tank, said wooden baffles being disposed as small angles to the horizontal in zig-zag relationship to each other, means for introducing a body of water into said tank to cover said baffles, and means for introducing said petroleum emulsion into said tank below the lowest of said baffles, whereby said emulsion can be broken by passing it upward through said body of water along the lower surface of said baffles in succession.

4. An apparatus according to claim 3 which includes a distributor for distributing said emulsion laterally across said baffles.

5. An apparatus according to claim 3 in which said baffles are equipped with drop sides to prevent the lateral spreading of the emulsion.

6. An apparatus for treating petroleum emulsions comprising a tank and a plurality of inverted wooden troughs in said tank, said inverted wooden troughs being disposed at small angles to the horizontal in overlapping zig-zag relationship to each other, means for introducing a body of water into said tank to cover said baffles.
troughs and means for introducing said petroleum emulsion into said tank below the lowest of said troughs, whereby said emulsion can be broken by passing it upward through said body of water along the under sides of said troughs in succession.

7. An apparatus according to claim 6 in which said troughs are arranged in pairs on the two sides of a central column within said tank.

8. An apparatus according to claim 6 wherein said troughs are equipped with drop ends to prevent short circuiting of the emulsion.

9. An apparatus according to claim 6 in which said troughs carry a plurality of longitudinal rails on their under surfaces in order to maintain the distribution of the emulsion.

10. An apparatus according to claim 6 which includes a saw-toothed distributor located between said means for introducing said petroleum emulsion and the lowest of said troughs.

GEORGE S. BAYS.