

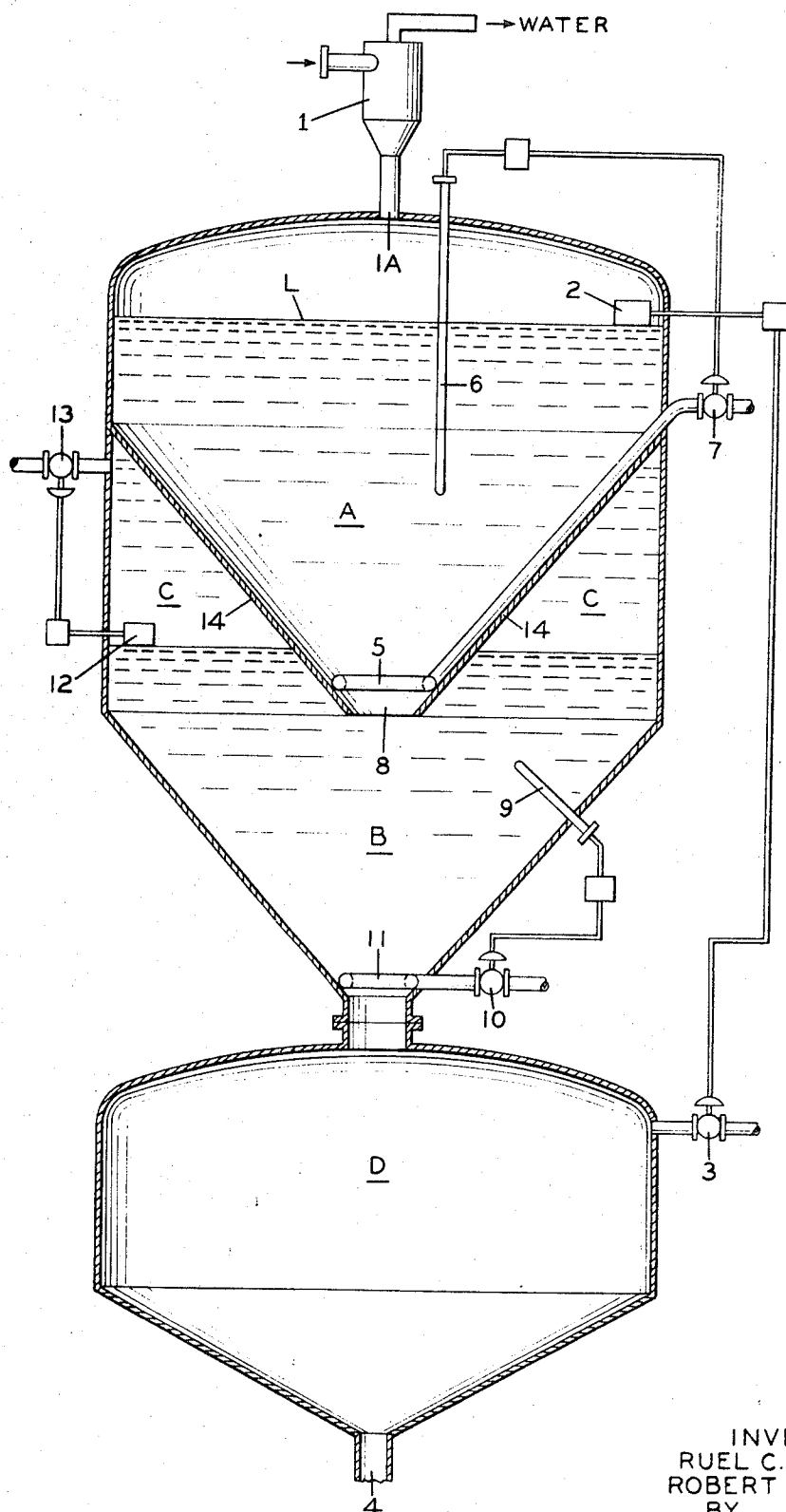
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R. C. TERRY ET AL

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HYDROCARBON EXTRACTION

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INVENTORS
RUEL C. TERRY
ROBERT E. LANE
BY

Donethan Hunt
ATTORNEY

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HYDROCARBON EXTRACTION

Ruel C. Terry and Robert E. Lane, Houston, Tex., assignors to Allied Chemical Corporation, New York, N.Y.

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6 Claims

ABSTRACT OF THE DISCLOSURE

Continuous extraction of hydrocarbons from asphaltic or bituminous materials, such as "tar sands," within a pressurised vessel at elevated temperatures.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to unique apparatus and method for recovering hydrocarbons from naturally occurring oil bearing materials; tar sands, for example. More particularly this invention relates to an inexpensive method, utilizing a simple and compact equipment, for preferably continuously recovering hydrocarbon from tar sands, for example, which may be mined in a conventional manner and introduced into the process in slurry form.

In the prior art, for example, pulverized tar sands are mixed with hot water in a rotating conditioning drum which discharges on screens flooded with more hot water. Because this operation is carried out at atmospheric conditions maximum temperatures of only about 185° F. can be reached. The screen undersize, a mix of oil, sand and hot water, enters flotation cells where the mix is agitated and where air is added to form an oily froth which can be skimmed off the top. This material is diluted with naphtha and centrifuged prior to entering final clarification and storage tanks.

This invention as described hereinbelow eliminates some of the steps of the prior art effecting savings in both equipment and simplicity of method.

SUMMARY OF INVENTION

In accordance with the invention, hydrocarbon bearing materials are introduced as a slurry into a centrifugal separator where the material is substantially concentrated.

The concentrated material (separator underflow) discharges into a vessel containing hot water at a temperature in a controllable range of about 200° F. to about 300° F. The difficulty of obtaining the 200° F. temperature at atmospheric conditions, because of the blending with cold materials, results in the temperature range of above 212° F. to about 300° F. under pressure conditions for the hot water being preferable. This temperature is controlled by direct steam injection into the vessel in such a fashion that it also aids in agitating the influent materials. As the material passes through the hot water zone the hydrocarbons are freed from the gangue material and float to the surface of the water. Brine may be used in the slurry to aid in floating the hydrocarbons. The hydrocarbons are removed in one embodiment through a float controlled automatic valve at some upper level.

The application of heat reduces viscosity of the hydrocarbons and their specific gravities. Because the water preferentially wets the sand particles and excludes oil particles, the oil particles are, therefore, freed from the sand. The lowered viscosity and hence lower surface tension allows for the action of the water as described. Because the oil is lighter than the water a gravity separation takes place.

The cleansed material settles to the bottom of the vessel where it is automatically flushed as tailings.

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DETAILED DESCRIPTION OF THE EXTRACTION UNIT

The drawing shows an elevational sectional view of one embodiment of an extraction unit.

In the embodiment shown in drawing, hydrocarbon bearing material such as tar sands are introduced as a water-tar sand slurry into centrifugal separator 1. The slurry is concentrated from approximately 30% tar sands to approximately 75% tar sands. This concentration is necessary in order to minimize heat requirements. The underflow or concentrated slurry discharges into the extraction unit, as at 1A. A fluid level is maintained in the extraction unit as indicated in section A by flooding section D with cold water, the volume of which is regulated by control valve 3 which is actuated by level control mechanism 2.

As the bituminous materials move downward by gravity through section A they must pass through steam sparge ring 5 as a result of direction by cone 14. Steam entering at this point provides heat to section A and also provides positive agitation of the materials, a necessary function in cleansing the sand particles. The amount of steam is regulated by control valve 7 which is actuated by the temperature sensing-transmitter device 6. Section A, as shown in the drawing, is defined in this embodiment by (1) the upper level L of the fluid surface, (2) the cone 14 and (3) the sides of the unit.

As the material moves from section A to section B through opening 8 in the cone 14 the cleansed sands will continue their downward path while the lighter oils will tend to float into zone C. The hydrocarbon-water interface between zones B and C is controlled by removing hydrocarbons through valve 13 which is actuated by level indicator-transmitter 12. As shown in the embodiment described, zone B lies below the cone 14 and zone C is on top of zone B but also limited in its upward extent by the cone 14.

Heat is applied to section B by the introduction of steam through sparge ring 11, the volume of which is regulated by valve 10 which in turn is actuated by temperature sensing-transmitting device 9. The introduction of steam at this point further aids in cleansing the material and maintains temperatures at described levels.

After passing through sparge ring 11 the cleansed sand enters section D where it is preferably continuously flushed out fixed exit orifice 4, although a valving arrangement could be provided.

The fixed orifice is sized such to provide enough restriction to allow maintenance of pressures above the orifice at desired levels by the addition, for example, of cold water into section D through for example valve 3.

Preferably the pressure drop through the orifice remains substantially constant no matter what the varying characteristics of the slurry: for example, fluctuation in the viscosity of the material going through the orifice. This is accomplished as stated by introducing water into the slurry at a point before it goes through the orifice and maintaining the flow of the liquid introduced such that the conditions set forth above occur.

In one specific example of the embodiment described above, slurry made up of tar sands and water is introduced into the separator to obtain a rate of about 40 tons per hour of tar sand, with a resultant hydrocarbons output exiting from valve 13 at a rate of 5 to 15 bbls. per hour, depending upon the hydrocarbon content in the ore. In the range of about 150 to 300 gallons per minute, for example, of cold water is introduced into the cold water section in this specific example. Steam is introduced at a rate to maintain temperatures within the unit in a range from about 212° F. to 300° F.

Although the invention has been described with relation to water and tar sands in the slurry and in the unit, it is recognized that other fluids, such as oil, and other hydrocarbon bearing materials could be utilized. Having now illustrated the invention with relation to one illustrative embodiment thereof.

I claim:

1. A method of removing asphaltic or bituminous liquids from hydrocarbon bearing materials by washing said materials with a fluid comprising substantially water at temperatures above about 200° F.

2. A continuous method for extracting hydrocarbons from ore using a column of water comprising the steps of:

- (a) providing a first upper zone wherein heated water is maintained above about 200° F. to about 300° F.;
- (b) introducing said ore into the top of said first upper zone to free the hydrocarbon from said ore,
- (c) introducing steam into said first zone to provide heat thereto and agitate said water;
- (d) moving said ore under the action of gravity alone through said first zone and from said first zone through an exit opening and into a second lower zone of relatively cold water;
- (e) introducing cold water into the second zone;
- (f) maintaining the level of said first zone of water as a result of introducing water into said second zone;
- (g) moving said ore under the influence of gravity through said second zone and out of said column;

and

(h) collecting said hydrocarbons at the upper part of said first zone of water, and drawing said hydrocarbons from said column.

3. A continuous method as set forth in claim 2, wherein the first upper zone is maintained above 212° F. under pressure conditions.

4. The continuous method as set forth in claim 3 further comprising the steps of dividing said first upper zone into an upper and lower area, both areas containing heated water with steam introduced thereinto, and collecting said hydrocarbons in the upper part of said lower area.

5. A continuous method as set forth in claim 4, further comprising maintaining said second zone open to the atmosphere at the bottom thereof and flowing tailings and water through said bottom opening.

6. The method of claim 5, further comprising flooding the second zone with water so as to eliminate the need for a variable orifice at the bottom opening by maintaining pressure levels above said orifice above a predetermined level.

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