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Merrill, Jr. et al.

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[54] **METHOD OF MAKING A PUMPABLE SLURRY FROM WAXY CRUDE OIL**

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[*] Notice: The portion of the term of this patent subsequent to Apr. 16, 1991, has been disclaimed.

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[21] Appl. No.: **354,604**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 290,205, Sept. 18, 1972, Pat. No. 3,804,752.

[52] **U.S. Cl.** **208/370;** 137/13; 208/24; 208/93

[51] **Int. Cl.** **C10g 43/04**

[58] **Field of Search** 208/24, 33, 37, 93, 370; 137/13; 252/8.3; 302/13, 14, 66; 264/13

[56] **References Cited**

UNITED STATES PATENTS

2,726,990	12/1955	Baker	208/33
3,234,122	2/1966	Allibone et al.	208/370
3,294,672	12/1966	Torobin	208/33
3,468,986	9/1969	Watanabe	264/9

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[57] **ABSTRACT**

Hydrocarbon mixtures (e.g., "waxy" crude oil) having an average pour point above the average minimum temperature of a transporting system are effectively transported by first fractionating the mixture into at least a relatively high pour point fraction and a relatively low pour point fraction, congealing the high pour point fraction, preferably by prilling, and thereafter slurrying at least a portion of the congealed fraction with a low pour point hydrocarbon fraction and transporting the slurry, preferably in a conduit, at temperatures which maintain the congealed fraction in the solid or semi-solid state. Fractionation is preferably effected by distillation. Diluents, e.g., crude oil, low pour point hydrocarbons such as reservoir condensates, fractions of crude oil, can be mixed with the slurry to improve the pumpability thereof. Also, a portion, e.g. equivalent up to 50% by volume of the otherwise high pour point fraction, can be cracked during fractionation to improve the fluidity of the slurry.

41 Claims, No Drawings

METHOD OF MAKING A PUMPABLE SLURRY FROM WAXY CRUDE OIL

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part of U.S. Pat. application Ser. No. 290,205, Filed 9/18/72, now issued as U.S. Pat. No. 3,804,752, Apr. 16, 1974.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to making a slurry from a viscous hydrocarbon mixture that can be effectively transported, e.g., in a pipeline. The hydrocarbon, e.g., crude oil, is first fractionated into at least two fractions, one fraction is congealed into particles and then suspended in a low pour point hydrocarbon fraction and the resulting slurry transported.

2. Description of the Prior Art

It is difficult to pump viscous crudes below their pour point. The use of heat transfer and chemical agents to improve fluid flow properties has been studied. Pour point depressers and diluents have been used to improve the pumpability. Visbreaking has also been tried but with little success. In addition, the oil has been congealed, suspended in water and the resulting slurry pumped at temperatures below the pour point of the crude oil.

Examples of patents representative of the art include:

Kells in U.S. Pat. No. 271,080 separates wax from crude oils by pumping the crude oil, e.g. in small streams or jets, into the bottom of a tank containing a brine at a temperature sufficiently low to congeal the wax. The congealed wax is recovered in the brine.

Persch in U.S. Pat. No. 1,454,485 blasts air under pressure into crude oil to form an emulsion of air and oil to increase the fluidity of the oil.

Oberfell et al in U.S. Pat. No. 2,526,966 teach transporting viscous crude oils by removing the light hydrocarbons (including straight-run gasoline), hydrogenating the residue to increase the fluidity thereof and then combining the hydrogenated product and the light hydrocarbons and pumping the mixture.

Chilton et al. in U.S. Pat No. 2,821,205 form a film of water on the interior wall of the pipe to improve the pumpability of viscous oil. In addition, a light petroleum or condensed casing-head gas can be mixed with the crude oil to reduce the viscosity. Agents such as phosphates and polyphosphates can be added to increase the water's ability to selectively adhere to the steel pipe and to displace any oil from the surface of the pipe without forming an emulsion.

Scott et al in U.S. Pat. No. 3,269,401 teach facilitating flow of wax-bearing oil in a pipeline by dissolving in the oil, at superatmospheric pressure and while above its pour point, a gas, e.g. N_2, CO_2, flue gas, and hydrocarbons containing less than 3 carbon atoms. The "gas becomes associated in some way with the wax crystals and prevents the precipitated wax from agglomerating to form strong wax structures". Also, the gas collects on the surfaces of the wax particles—especially the larger ones—to form films of gas envelopes which isolate the particles from one another and prevents the wax particles from combining.

Kane in U.S. Pat. No. 3,425,429 transports viscous crude oils by forming an oil-in-water emulsion, the water containing a non-ionic surfactant.

Watanabe in U.S. Pat. No. 3,468,986 forms spherical particles of wax by melting the wax, then dispersing wax droplets in a non-solvent liquid (e.g., water) maintained at a temperature above the solidification temperature of the wax and thereafter cooling the dispersion to solidify the dispersed droplets into discrete solid particles. The particles can be coated with finely divided coating solids such as calcium carbonate, etc. Watanabe teaches that it is known in the art to disperse waxy particles by molding, prilling, spray drying, extruding, etc.

Titus in U.S. Pat. No. 3,527,692 transports crushed oil shale in a solvent slurry. The oil shale is first comminuted to a size of 140–325 mesh and then suspended in a solvent such as crude oil, retorted shale oil, or a fraction thereof.

Allen in U.S. Pat. No. 3,548,846 teaches transporting waxy crude oils by incorporating propane or butane within the crude oil.

Vairogs in U.S. Pat. No. 3,618,624 transports viscous crude oils by incorporating a miscible gas, e.g. CO_2, methane, ethane, etc. into the crude to reduce the viscosity of the viscous crude.

The art has also used tracer lines and large heat exchangers placed intermittently along the pipeline to maintain the crude oil above its pour point and thus facilitate pumping of same. The main disadvantage of these methods is the crude oil tends to "set up" during shut downs.

This technology, except for heat transfer systems and crude oil-water suspension systems, has generally proven to be economically unattractive from a commercial standpoint.

SUMMARY OF THE INVENTION

Applicants have discovered a process of transporting viscous hydrocarbon mixtures by first fractionating the hydrocarbon mixture into at least two fractions, one fraction having a relatively high pour point and the other fraction having a relatively low pour point, then subjecting at least a portion of the relatively high pour point fraction to a congealing process, e.g., prilling, to form solid particles (preferably spherical) having an average diameter of 0.05–20 mm, and thereafter slurrying at least a portion of the particles in the low pour point fraction and transporting the slurry (preferably in a pipeline). Before transporting the slurry, it can be sheared, e.g., by passing it through a centrifugal pump. This step may be desirable where the slurry is transported in a pipeline. The pipeline is preferably maintained at temperatures which will not redissolve substantial amounts of the congealed fraction while being transported.

PREFERRED EMBODIMENTS OF THE INVENTION

Hydrocarbon mixtures having average pour points above the seasonably ambient temperature of the transportation system, are particularly useful in this invention. Examples of hydrocarbon mixtures include crude oil, shale oil, tar sand oil, fuel oil, gas oil, like hydrocarbon mixtures and mixtures of two or more of the same type or different hydrocarbon mixtures. Crude oils are particularly useful with this invention and especially those classified as "waxy" crude oils. Examples of the latter include crude oils which exhibit a "waxy gel" appearance at seasonably ambient temperature and

which contain about 1% to about 80% wax (wax is defined as the precipitate which forms after one part of crude oil is dissolved in 10 parts of methyl ethyl ketone at about 80°C. and the mixture chilled to −25°C.) and which have an average pour point above the ambient average minimum temperature of the transporting system at the time of transport. Examples of average pour points of crude oils particularly useful with this invention include about −10 to about 200°F. and preferably about 0° to about 150°F. and more preferably those having pour points greater than about 50°F.

The hydrocarbon mixture is first fractionated into at least two fractions, an overheads fraction which has a relatively low pour point (also identified as having a density and viscosity at a given temperature lower than the original hydrocarbon mixture) and a bottoms fraction which has a relatively high pour point (also identified as having a density and viscosity at a given temperature above that of the original hydrocarbon mixture). The bottoms fraction can be any portion of the original hydrocarbon mixture but can be about 1 to about 80% and preferably about 20 to about 70% and more preferably about 30 to about 60% by weight of the original hydrocarbon mixture. It is to be understood that fractions other than the overheads and bottom fractions can be obtained and these fractions used in other processing streams. Also other fractions or portions thereof can be combined with the relatively high pour point fraction before congelation of the latter.

Fractionation can be accomplished at atmospheric pressure, sub or superatmospheric pressure and at low and high temperatures by processes such as distillation, solvent extraction, membrane fractionation, crystallization, or any process which separates the hydrocarbon mixture into at least two fractions. Optionally, an equivalent amount of up to 50%, preferably up to 42% and more preferably up to 33% by volume of the high pour point fraction can be cracked (by thermal, hydrogenation, catalytical or combinations thereof) during fractionation or before congelation.

The low pour point fraction should have a pour point at least 1° and preferably at least about 5°F. and most preferably at least about 10°F. below the average of the minimum temperature range of the transporting system, at the time the slurry is transported. The transporting system can include a pipeline or a combination of pipeline and tank battery.

After the hydrocarbon mixture is fractionated, all or at least a portion (preferably at least 50%) of the high pour point fraction or the bottoms fraction is collected, congealed and comminuted to form substantially solid particles having an average diameter of less than about 0.05 to about 20 or more mm (millimeters) and preferably about 0.1 to about 5 mm and more preferably about 0.5 to about 3 mm. The particles can be of any shape such as tubular, spherical, or irregular, but are preferably spherical and can be of substantially uniform or random diameter sizes. Comminution is accomplished by prilling, extruding, molding, shredding, grinding, shearing, and like methods for dispersing or disintegrating the uncongealed or congealed material. Where shredding or grinding is used, comminution preferably takes place after congelation. Congealing as used herein includes solidification, crystallization, making into a consistency like a firm jelly, etc. The high pour point fraction is preferably about 1 to about 150° and more preferably about 10 to about 100°F. above its average congelation temperature as it enters the congelation and/or comminution steps. Prilling can be accomplished by spraying the bottoms fraction into a prilling tower where the prill comes in contact with gas (e.g., air, N_2, CO_2, natural gas, or like gases) and/or water (liquid and/or vapor). Optionally, the prill is collected in a water bath at the bottom of the tower. Air is the preferred gas and is preferably moved through the prilling tower, by natural or forced convection, at velocities sufficient to not exceed the drop or settling rate of the prill falling through the prilling tower; air velocities below about 20 ft/sec (feet per second) and preferably below 10 ft/sec and more preferably below about 5 ft/sec are useful. Temperature of the air entering the prilling tower is preferably about 1° to about 230° and more preferably about 10° to about 150°F. below the congealing temperature of the prill. Temperature of the air leaving the prilling tower is preferably about 230° below to about 150° above and more preferably about 100° below to about 10°F. above the average congealing temperature of the fraction entering the tower. Water is preferably sprayed into the tower along with the air, the water being at a temperature at least about 5°F. and preferably at least about 20°F. below the congealing temperature of the high pour point fraction. Also, it is preferred that the water be sprayed into the tower as a mist.

Another method for congealing the high pour point fraction is by extruding or spraying into water, the fraction preferably at about 5° to about 100°F. and more preferably is about 130° to about 220°F. above its average congelation temperature and more preferably the water is in turbulent flow at the injection point of the high pour point fraction. The dispersed high pour point fraction is thereafter congealed by admixing cooler water, e.g., at about ambient temperature, with the aqueous mixture. The congealed fraction is thereafter separated from the water, slurried in the low pour point fraction and then transported.

Surfactants or other additives such as bactericides, insecticides, etc. can be incorporated into the high pour point fraction before it is congealed, e.g., it can be admixed with the fraction before or as it enters the prilling tower. Volume amounts of about 0.0001 to about 20% and preferably about 0.001 to about 10%, and more preferably about 0.01 to about 1% by volume, based on the fraction, are useful. The surfactant should be at least partially hydrocarbon soluble. It is postulated that the surfactant molecules tend to orient their hydrophilic portion radially at the droplet surface and thus impart a hydrophilic property to the prill which in turn inhibits solubilization of the prill in the low pour point fraction. Theoretically, this happens as the droplets of wax are formed. Examples of useful surfactants include fatty acids (e.g., those containing about 10 to about 20 carbon atoms) and preferably monovalent cation containing salts thereof. Sorbitan monolaurate is an example of a useful surfactant. Preferably the surfactant is a petroleum sulfonate preferably having a monovalent cation, e.g., Na^+, and preferably having an average equivalent weight of about 200 to about 600 and more preferably about 250 to about 500 and most preferably about 350 to about 420.

Chemical agents to facilitate suspension of the congealed fraction can be added to the slurry. Examples of such agents include high molecular weight polymers, including biopolymers and chemically synthesized

polymers. Also, viscosity reducing agents, pour point reducers, drag reduction agents can be admixed with the slurry to impart desired properties.

After the high pour point fraction is congealed or during the congelation and/or comminution thereof, the particles can be coated with a solid material. This inhibits agglomeration of the particles and may permit higher slurry temperatures during transportation. Examples of coatings include those disclosed in U.S. Pat. No. 3,468,986 to Watanabe. Where the high pour point fraction is prilled, the coating can be applied as a spray, either hydrous or anhydrous, or as an aqueous bath containing the solid material. Examples of useful coating materials include inorganic and organic salts of the metals of Group II, III, IV–A, V, VI, VII, and VIII of the Periodic Table; synthetic resins such as cellulose acetate, polystyrene, polyethylene, polyvinyl acetate, and like resins; and other materials such as clay (e.g., bentonite), kaolin, Fuller's earth and other aluminum silicates, limestone, etc. Calcium carbonate is a preferred coating material.

After the high pour point fraction is congealed into the desired particle size, at least a portion and preferably all of the particles are slurried (e.g., combined or mixed) with the low pour point fraction. The concentration of congealed fraction in the slurry is preferably about 1% to about 80% and more preferably about 5% to about 55% and most preferably about 10% to about 50% by weight. Water may be entrapped within the congealed fraction or sorbed, e.g., adsorbed, onto the prill and this water in addition to "slop over" water from the congealing process, etc. may account for up to about 20% and preferably less than about 10% and more preferably less than about 5% by weight of water within the slurry. During the slurrying operation, the temperature of the low pour point fraction is preferably about 30° below to about 30° above and more preferably about 20° below to about 20° above the minimum, seasonably ambient temperature of the transportation system. Also, the temperature of the low pour point fraction during slurrying should be below and preferably at least about 5°F. and more preferably at least about 15°F and most preferably at least about 30°F. below the solution temperature of the congealed high pour point fraction in the low pour point fraction. A liquid diluent, such as crude oil (preferably a non "waxy" crude), straight run gasoline, reservoir condensate, crude oil fraction(s), or like hydrocarbon, can be admixed with the low pour point fraction either before or after the slurrying operation— any diluent which is miscible or substantially miscible with the low pour point fraction and which preferably has a pour point below the minimum ambient average temperature of the transportation system at the time of transport is useful with this invention.

A gas miscible with the low pour point fraction but preferably immiscible with the congealed fraction can be admixed with the slurry to reduce the viscosity thereof. The gas may be liquid at the temperature and pressure of the transportation system. Examples of such miscible gases include CO_2, lower hydrocarbons containing less than 4 carbon atoms, etc. Also, the miscible gas can be injected into the slurry under conditions such that the gas is present in concentrations greater than that at atmospheric conditions. Preferably, the mixture is saturated with CO_2 at superatmospheric pressures.

The slurry can be subjected to a shearing action before it is transported. For example, the slurry can be passed through a centrigual pump or like shearing action before it is transported in a pipeline; of course, the pump can be part of the pipeline system.

The slurry can be transported in bulk, e.g., tank car, tank truck, tank trailer, tank barge, tanker or like means, but is preferably transported in a conduit, such as a pipeline. Of course, the conduit pipeline system may have tank batteries, i.e., collection or holding tanks, associated with it. The collection or holding tanks may have agitators or mixers to facilitate suspension of the congealed particles in the slurry. Also, the tanks can be insulated or have some means of controlling the temperature of the slurry.

The slurry can be transported under laminar, transitional (e.g., Reynolds Number range of about 2000 to about 4000) or turbulent flow conditions in the conduit. Turbulent flow conditions may be preferred where it is desired to maintain the congealed particles in a "homogeneous" dispersed state.

The slurry is preferably transported in a conduit wherein the average temperature of the conduit in at least its major initial length is below the solution temperature of the congealed fraction. The average maximum temperature of the conduit is preferably about 1°F. below and more preferably about 5°F. below the average solution temperature of the congealed fraction within the slurry— solution temperature as used herein means the temperature at which substantially all of the congealed particles are in solution within the continuous phase of the slurry. In addition, the average temperature of the conduit should not be below the average pour point of the low pour point fraction and preferably is at least about 1°F and more preferably at least about 5°F. and most preferably at least about 10°F. above this pour point.

WORKING EXAMPLES.

EXAMPLE I

A waxy crude oil from the Altamont Field in Utah's Uinta Basin has an average API gravity of about 40° and has an average pour point of about 110°F. This crude oil is distilled such that 32% by weight of the crude is taken as an overheads fraction (i.e., low pour point fraction). The final overheads temperature on the distillation column is 266°F and the final temperature of the bottoms fraction (i.e. high pour point fraction) is 581°F. Pour point of the bottoms fraction is 118°F. The bottom fraction is prilled by spraying it at a temperature of 160°F. into the atmosphere (air at 80°F) through a 0.014 inch circular nozzle at a rate of about 0.3 gallons/hour. Nozzle temperature is maintained at 118°F–127°F. As the liquid leaves the nozzle, it solidifies into beads upon contact with the air. Average diameter size of the beads is about 0.1–1 mm. The beads fall about 7.5 feet into the overheads fraction, the resulting slurry is maintained at about 32°F.

The slurry is pumped through 20 feet of ½ inch pipe in series with 8′ of ½ inch tubing at a rate of about 3.7–8.0 gpm (gallons per minute). During pumping, the temperature never exceeds 74°F.

After pumping, the slurry is examined and it appears the beads are not substantially sheared and are not in solution with the overheads fraction.

EXAMPLE II

A viscous crude oil having a pour point of about 117°F and an API gravity of about 40° is distilled to obtain 44% by weight overheads fraction and 56% by weight bottoms fraction. The distillation column has an average overheads temperature of 500°F at the end point and a bottoms temperature of about 700°F at the end point. Pressure of the distillation column is about 632 mm Hg ab. The bottoms fraction is separated and sent to a prilling tower. The bottoms fraction (average pour point = 128°F.) is sprayed at 180°F into a prilling tower. Average temperature of air entering the tower is about 70°F and the average temperature of air leaving is about 75°F—average velocity of the air is about 2 ft/sec. About 200 gal/hr of water is sprayed (atomized) into the lower section of the tower to facilitate congelation of the prill. The prill falls about 27 feet to the bottom of the prilling tower where it is collected in water maintained at 60°–65°F. The average diameter size of the prill is about 0.8–1.25 mm.

The aqueous suspension of the prill is separated into water and the prill. Thereafter, the prill is slurried with the overheads fraction at about 40°F. Thereafter, the slurry is transported in a pipeline at temperatures not exceeding 75°F under laminar and transitional flow conditions. The slurry apparently acts as a Bingham plastic.

EXAMPLE III

The procedure of Example II is repeated except the bottoms fraction is prilled into an aqueous bath containing about 1% by weight of calcium carbonate. The calcium carbonate coats the prill with at least a monomolecular layer of the carbonate.

What is claimed is:

1. A process for preparing a hydrocarbon slurry from a hydrocarbon mixture that can be effectively transported, the process comprising fractionating the hydrocarbon mixture into at least a relatively low pour point fraction and a relatively high pour point fraction, taking at least a portion of the high pour point fraction and congealing all of said portion to obtain substantially congealed particles and thereafter slurrying at a temperature below about the solution temperature of the congealed particles in the slurry, at least a portion of the substantially congealed particles in a liquid hydrocarbon comprised of at least pour point portion of the relatively low pour fraction, to obtain the hydrocarbon slurry suitable for transport at predetermined temperatures.

2. The process of claim **1** wherein the hydrocarbon mixture is a "waxy" crude oil.

3. The process of claim **2** wherein the waxy crude oil has an average wax concentration of about 1 to about 80% by weight.

4. The process of claim **2** wherein the waxy crude oil has an average pour point above the average seasonably minimum temperature of the transportation system.

5. The process of claim **1** wherein the hydrocarbon mixture is a crude oil having an average pour point of about −10° to about 200°F.

6. The process of claim **1** wherein the slurry is transported in a conduit.

7. The process of claim **6** wherein the slurry is subjected to a shearing action before being transported in the conduit.

8. The process of claim **1** wherein the concentration of the congealed particles in the slurry is about 1 to about 80% by weight.

9. The process of claim **1** wherein the concentration of the congealed particles in the slurry is about 5 to about 55% by weight.

10. The process of claim **1** wherein the concentration of the congealed particles in the slurry is about 10 to about 50% by weight.

11. The process of claim **1** wherein slurrying is effected at a temperature at least about 5°F. below the average solution temperature of the congealed particles in the slurry.

12. The process of claim **1** wherein the relatively high pour point fraction is congealed at a temperature at least about 5°F. below its pour point.

13. The process of claim **1** wherein congelation is effected by prilling.

14. The process of claim **1** wherein an equivalent amount of up to about 50% by weight of the high pour point fraction is cracked before it is congealed.

15. The process of claim **1** wherein the average diameter of the congealed particles is about 0.05 to about 20 mm.

16. The process of claim **1** wherein the slurry contains up to about 20% by weight water.

17. A process of preparing a hydrocarbon slurry from a waxy crude oil that can be transported in a conduit, the process comprising:

1. fractionating the curde oil into at least a relatively low pour point fraction and a relatively high pour point fraction, the relatively high pour point fraction equivalent to about 1 to about 80% by weight of the original weight of the crude oil,
2. substantially congealing at least a portion of the relatively high pour point fraction taking at least a portion of the relatively high pour point fraction and congealing said portion to obtain congealed particles, and
3. thereafter slurrying at least a portion of the congealed particles in a liquid hydrocarbon, comprised of at least a portion of the relatively low pour point fraction, at a temperature below about the solution temperature of the congealed particles in the slurry to obtain the hydrocarbon slurry suitable for transport in a conduit at predetermined temperatures.

18. The process of claim **17** wherein the concentration of the congealed particles in the slurry is about 5 to about 55% by weight.

19. The process of claim **17** wherein the average pour point of the crude oil is between about −10 to about 200°F.

20. The process of claim **17** wherein an equivalent amount of up to about 50% by weight of the relatively high pour point fraction is cracked before it is congealed.

21. The process of claim **17** wherein an equivalent amount of up to about 33% by weight of the relatively high pour point fraction is cracked before it is congealed.

22. The process of claim **17** wherein congelation is effected in a prilling tower.

23. The process of claim **17** wherein fractionation is effected by distillation.

24. The process of claim 17 wherein fractionation is effected by distillation and wherein at least a portion of the crude oil is cracked during the distillation.

25. The process of claim 17 wherein an oleophilic surfactant is admixed with the high pour point fraction before it is congealed.

26. The process of claim 25 wherein about 0.0001 to about 20% by volume, based on the high pour point fraction, of the surfactant is admixed.

27. The process of claim 17 wherein a gas miscible with the low pour point fraction is admixed with the slurry.

28. The process of claim 27 wherein the gas is CO_2.

29. The process of claim 17 wherein the slurry contains up to about 10% by weight of water.

30. The process of claim 17 wherein a drag reducing agent is admixed with the slurry.

31. The process of claim 17 wherein a liquid diluent is admixed with liquid hydrocarbon containing the low pour point fraction either before, during or after slurrying.

32. The process of claim 31 wherein the liquid diluent is crude oil.

33. The process of claim 17 wherein the average diameter of the congealed particles is about 0.05 to about 20 mm.

34. The process of claim 17 wherein the congealed particles are substantially coated with a solid material.

35. The process of claim 34 wherein the solid material is an inorganic salt or an organic salt of the metals of Group II, III, IV–A, V, VI, VII, and VIII of the Periodic Table.

36. The process of claim 17 wherein the average diameter of the congealed particles is about 0.1 to about 5 mm.

37. The process of claim 36 wherein the congealed particles are substantially coated with calcium carbonate.

38. The process of claim 17 wherein the concentration of the congealed particles in the slurry is about 10 to about 50% by weight.

39. The process of claim 17 wherein the average diameter of the congealed particles are about 0.1 to about 5 mm. and wherein the congealed particles are substantially spherical in shape.

40. The process of claim 17 wherein the slurry is subjected to a shearing action.

41. The process of claim 17 wherein all of the relatively low pour point fraction is slurried to obtain the hydrocarbon slurry.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,900,391 Dated 8/19/75

Inventor(s) LaVaun S. Merrill, Jr. et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 6, line 3:	Delete "centrigual" and insert --centrifugal--.
Col. 6, line 24:	Insert --maximum-- after "average"
Col. 7, line 50 (Claim 1)	Delete "pour point".
Claim 17, Col. 8, line 33:	Delete "curde" and insert --crude--.

Signed and Sealed this

thirtieth Day of December 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks