ALTERNATE ATOMIZING MEDIUM FOR BURNING EFFICIENCY OF EMULSION FUELS, HEAVY OILS AND BITUMEN

Inventor: John K. Wearing, Calgary (CA)

Correspondence Address:
OGILVY RENAUT LLP
1981 MCGILL COLLEGE AVENUE, SUITE 1600
MONTREAL, QC H3A2Y3

Assignee: Diamond QC Technologies Inc., Calgary (CA)

Appl. No.: 11/436,555

Filed: May 19, 2006

Publication Date: Dec. 6, 2007

Publication Classification
Int. Cl.
F23J 7/00

U.S. Cl. 431/4

ABSTRACT

A method for augmenting the heat enthalpy of an emulsified alternate fuel. An atomizing medium containing produced solution gas is used to atomize the emulsified fuel and add to the heat content of the emulsified fuel enhancing combustion. Alternate embodiments include the use of other gaseous hydrocarbon material as the atomizing medium either utilized alone or mixed with air or steam.
ALTERNATE ATOMIZING MEDIUM FOR BURNING EFFICIENCY OF EMULSION FUELS, HEAVY OILS AND BITUMENS

FIELD OF THE INVENTION

[0001] The present invention relates to augmenting the heat enthalpy of an emulsified alternate fuel and more particularly, the present invention relates to employing produced solution gas or other gaseous hydrocarbon products as an atomizing medium and a method of using such a fuel in the recovery of hydrocarbon.

BACKGROUND OF THE INVENTION

[0002] Typically, liquid fuels require some kind of atomization at the burner tip to facilitate mixing of the hydrocarbon liquid with combustion air, allowing combustion to occur. Atomization is normally achieved by combining the hydrocarbon stream with a separate stream of atomizing medium, this medium typically being low pressure steam or low pressure air. The atomizing medium assists in forcing the hydrocarbon stream through the atomizing nozzle, resulting in formation of small droplets. These droplets are brought into contact with combustion air within the combustion chamber, and provide mixing of the hydrocarbon with the combustion air facilitating combustion.

[0003] The production of heavy oil/bitumen via Thermal Insitu Heavy Oil recovery techniques also generates quantities of natural gas held in solution (solution gas) by the heavy oil/bitumen in situ. As the heavy oil/bitumen is produced to surface, this solution gas is released and is typically captured for use in supplemental combustion, or is considered a waste product and is incinerated in a local flare stack. Solution gas from production of Thermal Insitu recovery techniques, including Steam Assisted Gravity Drainage (SAGD) and Cyclic Steam Stimulation (CSS) techniques, typically contains hydrogen sulphide or other sulphur compounds, which on combustion releases Sulphur Dioxide to the atmosphere.

[0004] Recently an emulsified hydrocarbon fuel known as Multiphase Superfine Atomized Residue (MSAR™) has been developed as a low cost fuel replacement for natural gas. Combustion of MSAR™ requires an atomizing medium such as low pressure steam or low pressure air. Other oil field producers are experimenting with combustion of bitumen, and typically this action requires the use of steam as the atomizing medium. Both MSAR™ and bitumen contain sulphur and combustion of these hydrocarbon products will generate sulphur dioxide and therefore will require the implementation of some kind of flue gas desulphurization technology, for which numerous commercial applications are in use.

SUMMARY OF THE INVENTION

[0005] One object of the present invention is to provide an improved technique for supplementing the total heat enthalpy of fuel burned in an atomizing assembly for use in steam generators.

[0006] Generally, produced gas is inherent in a hydrocarbon formation and is typically flared or used to supplement other natural gas sources to fire the steam generators. By making use of the produced gas in combination with an emulsified fuel such as MSAR™, the overall energy content of the mixture of the emulsified fuel and the gas is greater. Accordingly, a further object of one embodiment of the present invention is to provide a method for augmenting heat enthalpy for the burning of emulsified alternate fuel, by utilizing the produced gas (or other gaseous hydrocarbon material) as the atomizing medium. The atomized fuel will contain heat enthalpy from both the said emulsified fuel and the gas.

[0007] A further object of one embodiment is to provide a method for the recovery of hydrocarbons from a formation containing said hydrocarbons, comprising providing a steam generator circuit for introducing steam into said formation, said circuit having an atomizing assembly for burning fuel, providing a source of emulsified fuel for burning, providing an atomizing medium containing waste natural gas, atomizing said emulsified fuel with said solution gas, burning the atomized mixture of emulsified fuel and gas to generate steam, said atomized mixture containing heat enthalpy from both said emulsified fuel and said gas in said assembly, and recovering hydrocarbons from said formation.

[0008] A still further object of one embodiment of the invention is to provide a fuel composition for use in an atomizing burner, comprising an emulsified hydrocarbon based fuel, and an atomizing medium for entraining said emulsified hydrocarbon based fuel, said atomizing medium comprising solution gas produced from a hydrocarbon formation.

[0009] Having thus generally described the invention, reference will now be made to the accompanying drawings illustrating preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a schematic illustration of a prior art conventional thermal heavy oil in situ operation;

[0011] FIG. 2 is a schematic illustration of a prior art atomization/steam generation system; and

[0012] FIG. 3 is a schematic illustration of one embodiment of the present invention.

[0013] Similar numerals are indicative of similar elements.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Referring now to FIG. 1, shown is a schematic representation of a conventional thermal oil operation, globally denoted by numeral 10. A source of natural gas 12 fuels the steam generator(s) 14 to generate steam 16 introduced into the hydrocarbon formation 18. Production fluids 20 (natural gas, water, viscous hydrocarbon material) are recovered and exposed to several treatment unit operations, generically referenced by numeral 22. Saleable heavy oil and bitumen is removed at 24 while produced water 26 is treated at 28 with at least a portion recycled as feed water 30 for use in generator(s) 14. Blowdown 32 is removed and make up water 34 added as required.

[0015] It is now trite that the cost of using natural gas to generate steam for hydrocarbon value recovery is unattractive from an economic point of view and inherently wasteful in view of the burgeoning activity and developments in alternate fuel synthesis. To this end, FIG. 2 is illustrative of a more pragmatic solution to that which has been historically practiced.

[0016] In the example, numeral 40 globally references the circuit for steam generation using MSAR™, an alternate
fuel and trademark of Quadrise Fuel Systems Canada. The alternate fuel 42, an aqueous emulsion of heavy oil, bitumen etc. is introduced into generator(s) 14 by an atomizing assembly 44 for generating atomized fuel. The fuel 42 requires an atomizing medium for transport and fluidization. This is shown as steam 46, a portion of which is recovered from generator(s) 14. In this method, atomization may be supplemented with air from compressor or blower 48.

[0017] Steam generated from the generator(s) 14, in the usual manner, is introduced into the formation 18. In view of the fact that natural gas is not the principal fuel in this scenario, the circuit requires a flue gas desulfurization circuit 50 to capture flue gas 52 and ensure environmental compliance. The thermal energy in the treated flue gas 54 may be utilized by injection into the formation.

[0018] Having regard to the utility of alternate fuels, FIG. 3 exemplifies one embodiment of the present invention.

[0019] In the example, solution gas (waste gas) 56 comprising essentially natural gas is introduced in to the assembly 44 to function as the atomizing medium. Contemporary methods simply disposed of the gas by flaring and thus the valuable commodity wasted. It has been found that the use of the gas augments the effectiveness of MSAR™ fuel by the addition of the heat enthalpy to the emulsified fuel. In this manner, the “composite fuel” takes on the desirable characteristics of natural gas in terms of heat content of the flame, flame temperature, cleanliness of burn and reduced incomplete or partial combustion of the solids in the emulsion. In respect of the latter, more complete burning results in the maximum possible utilization of the available Btu content of the emulsion.

[0020] Depending upon the necessities of each situation, the solution gas stream 46 may be complimented with at least one of steam 46 from generator(s) 14 and air 48.

[0021] A further aspect of the illustrated embodiment is self containment. This is achieved by incorporating an MSAR™ fuel manufacturing circuit into the overall protocol. The circuit is denoted by numeral 56. The manufacturing may follow the methods established by either of the methods established by Warchol in U.S. Pat. No. 6,530,965 or in patent application Ser. No. 10/369,511, Warchol and Knesyak, both of which are incorporated herein by reference.

[0022] From the references, it is known to provide the produced heavy oil and bitumen 24 as the feedstock for the synthesis of MSAR™ and the produced water 26. The fuel 42 so formed may then be immediately introduced into the assembly 44 to provide a self contained and closed loop method.

[0023] The embodiment(s) of the invention described above is (are) intended to be exemplary only. The scope of the invention is therefore intended to be limited solely by the scope of the appended claims.

We claim:

1. A method for augmenting heat enthalpy for the burning of emulsified alternate fuel, comprising:
   providing a source of emulsified fuel for burning;
   providing an atomizing medium containing waste natural gas or other gaseous hydrocarbon materials;
   atomizing said emulsified fuel with said gas; and
   burning the atomized emulsified fuel and atomizing gas as a mixture, said mixture containing heat enthalpy from both said emulsified fuel and said gas.

2. The method as set forth in claim 1, wherein said fuel comprises heavy oil, vacuum residues, asphaltenes, bitumen, biomass and coal pitch tar.

3. The method as set forth in claim 1, wherein said emulsified fuel comprises MSAR™.

4. The method as set forth in claim 1, wherein said atomizing medium contains steam.

5. The method as set forth in claim 1, wherein said atomizing medium contains air.

6. The method as set forth in claim 1, wherein said atomizing medium contains steam and air.

7. A method for the recovery of hydrocarbons from a formation containing said hydrocarbons, comprising:
   providing a steam generator circuit for introducing steam into said formation, said circuit having an atomizing assembly for burning fuel;
   providing a source of emulsified fuel for burning;
   providing an atomizing medium containing waste natural gas or other gaseous hydrocarbon material;
   atomizing said emulsified fuel with said solution gas or other gaseous hydrocarbon material;
   burning the atomized emulsified fuel and atomizing gas as a mixture to generate steam, said mixture containing heat enthalpy from both said emulsified fuel and said gas in said assembly; and
   recovering hydrocarbons from said formation.

8. The method as set forth in claim 7, wherein said formation comprises a SAGD formation.

9. The method as set forth in claim 7, wherein said formation comprises an oil sands formation.

10. The method as set forth in claim 7, wherein said emulsified fuel comprises heavy oil, vacuum residues, asphaltenes, bitumen, biomass and coal pitch tar.

11. The method as set forth in claim 7, wherein said emulsified fuel comprises MSAR™.

12. The method as set forth in claim 7, wherein said atomizing medium contains steam.

13. The method as set forth in claim 7, wherein said atomizing medium contains air.

14. The method as set forth in claim 7, wherein said atomizing medium contains steam and air.

15. The method as set forth in claim 7, further including recycling produced solution gas from said formation for atomizing said emulsified fuel.

16. The method as set forth in claim 7, further including the step of synthesizing said emulsified fuel from hydrocarbons from said formation.

17. The method as set forth in claim 7, wherein said method is self contained.

18. A fuel composition for use in an atomizing burner, comprising:
   an emulsified hydrocarbon based fuel; and
   an atomizing medium for atomizing said emulsified hydrocarbon based fuel, said atomizing medium comprising solution gas produced from a hydrocarbon formation or other gaseous hydrocarbon material.

19. The fuel as set forth in claim 16, wherein said atomizing medium includes steam.

20. The fuel as set forth in claim 16, wherein said atomizing medium includes air.

21. The fuel as set forth in claim 16, wherein said atomizing medium includes air and steam.

* * * * *