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(54) **METHOD FOR CAGD RECOVERY OF HEAVY OIL**

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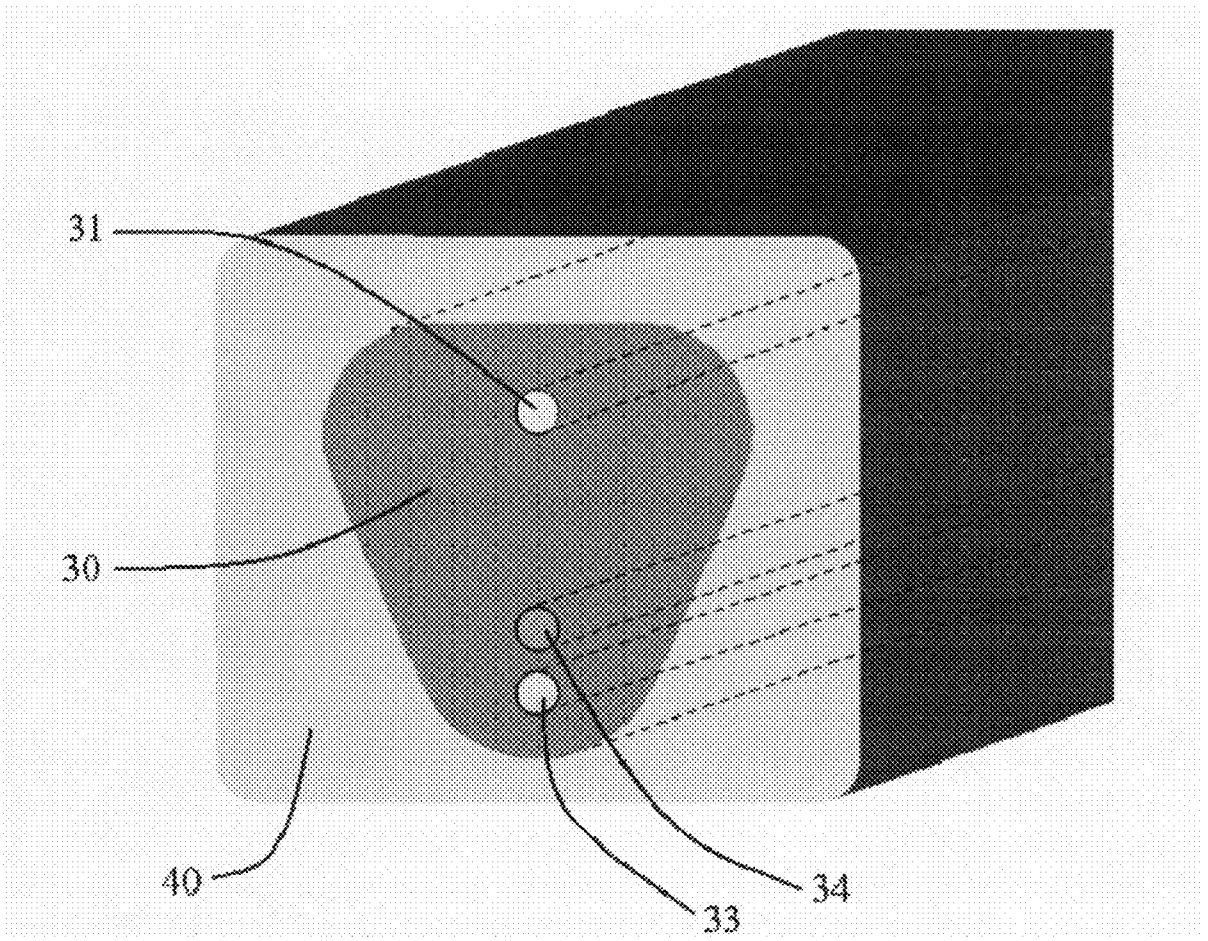
(57) **ABSTRACT**

The invention provides a novel method of recovering oil by injecting oxygen into a chamber within an oil deposit thereby combusting oil at the chamber walls. The heated oil to drains towards the reservoir floor and is recovered oil via a production well.



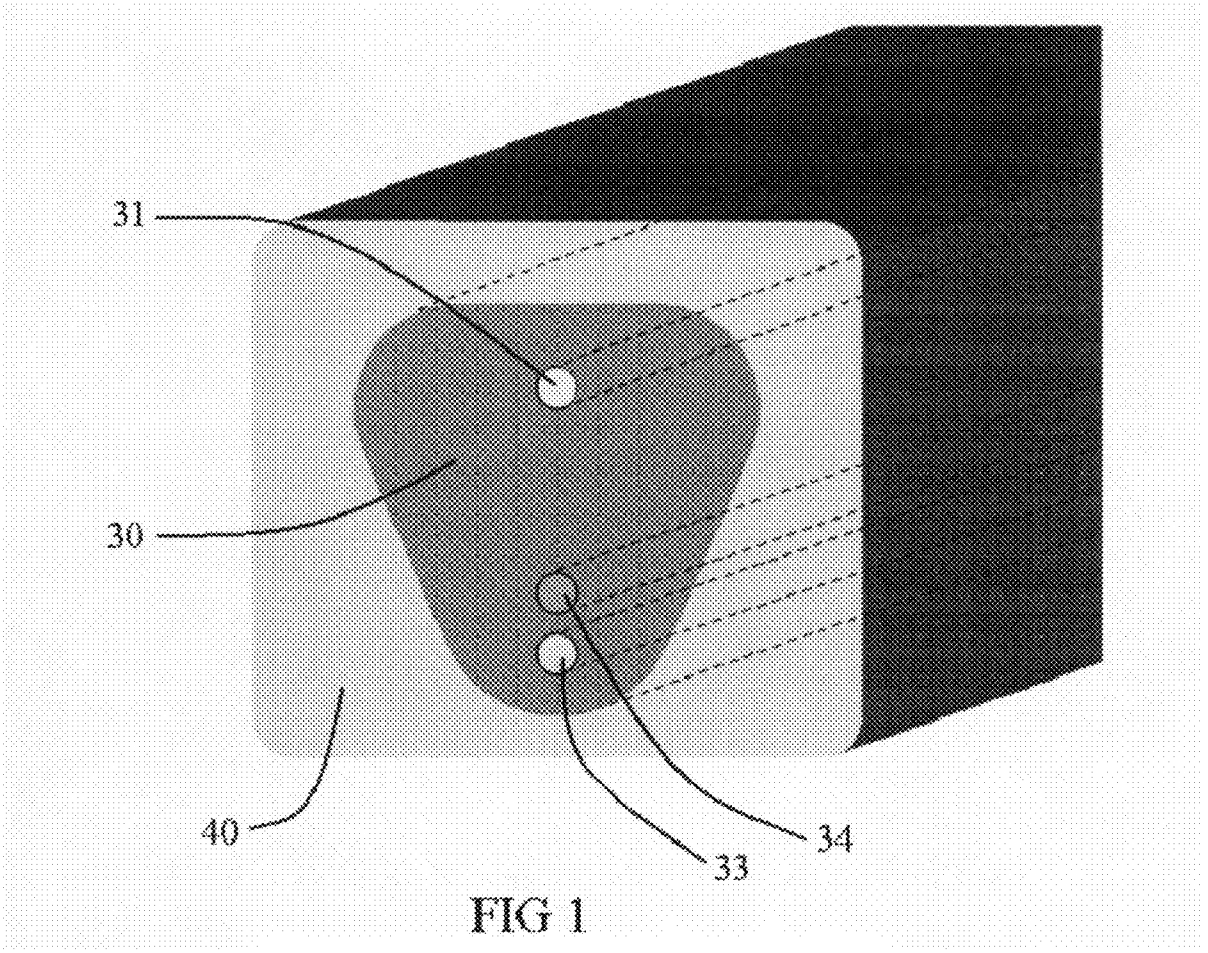


FIG 1

METHOD FOR CAGD RECOVERY OF HEAVY OIL

CROSS-REFERENCE

[0001] This application claims the benefit of U.S. Provisional Application No. 60/773,410 filed Feb. 15, 2006.

FIELD OF THE INVENTION

[0002] This invention relates to a method for the recovery of heavy oil. More specifically, this invention relates to reducing the energy inputs required in Steam Assisted Gravity Drainage (SAGD) methods now employed commercially. This invention also relates to improved methods for in-situ combustion.

BACKGROUND OF THE INVENTION

[0003] In-situ combustion of heavy oil is a potentially attractive method of mobilizing heavy oil for production. No external source of fuel is required and temperatures can be high enough for oil upgrading. However, few commercial trials have been successful because of the difficulty in controlling combustion. An improvement known as Toe to Heel Air Injection (THAI) is one attempt to solve this issue. Another approach to heavy oil production is heating by steam injection. A recent break-through is Steam Assisted Gravity Drainage (SAGD). SAGD is now widely used to produce heavy oil from oil sands such as are found throughout Alberta.

[0004] Although heavy oil can be economically produced, little or no upgrading of the oil is achieved. In SAGD, steam is injected into a heavy oil deposit forming an expanding steam chamber avoiding loss of steam through cracks. Heated oil drains to a production well located under the injection well. Both wells are typically horizontal wells. Typically, the amount of steam required to produce a barrel of oil decreases with time for a period following initial operation. The minimum steam requirement is usually reached after three or four years of operation. Inasmuch as a major cost of such an operation is the cost of providing the steam, there is a need to reduce the amount of steam required to an amount below the minimum now achievable.

[0005] It is therefore an object of the present invention to provide a significant reduction in the amount of steam required to produce oil. It is a prime object of the invention to make possible utilization of in-situ combustion to replace at least a portion of the steam required in SAGD production of heavy oil from oil sands. Further it is an object of the invention to provide a method to produce upgraded oil.

SUMMARY OF THE INVENTION

[0006] It has now been found that injection of oxygen along with steam into a SAGD steam chamber reduces the amount of steam required to produce a barrel of oil. The resulting in-situ combustion, referred to herein as Combustion Assisted Gravity Drainage ("CAGD") provides heat to reduce the amount of steam required to produce a barrel of oil and provides for temperatures high enough for oil upgrading.

[0007] In-situ combustion in the presence of steam allows control of reaction temperature by control of the oxygen concentration in the gases within the steam chamber. Temperatures at the chamber wall may be well above the saturated steam temperature at the pressure within the chamber. Oil may be upgraded by cracking and high enough temperatures for steam reaction with carbon or hydrocarbons to produce hydrogen are achievable. For existing SAGD operations, oxygen may be mixed with the steam being injected via an injection well. A separate oxygen injection well may be used to inject the oxygen at a higher elevation than the existing steam injection well.

[0008] Injecting oxygen into a SADG steam chamber for in-situ combustion without a continuing supply of steam eliminates the need for a surface fuel supply to produce steam. In this case, air or oxygen-enriched air may be utilized rather than high purity oxygen. For the purpose of this invention, a chamber is a region within a heavy oil deposit bounded by low permeability walls. A steam chamber is a chamber in an oil reservoir formed by injecting steam into the reservoir replacing all or a portion of the chamber oil with steam.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** depicts a SAGD steam chamber in a heavy oil deposit operated in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] FIG. **1** depicts a SAGD steam chamber **30** in heavy oil deposit **40** operated in accordance with the present invention. As in SAGD, drained oil is withdrawn through production well **33**. Oxygen in admixture with steam is injected via well **34** to maximize upgrading of produced oil. Alternatively, oxygen in admixture with steam is injected via optional well **31** into an upper region of chamber **30**. In this mode of operation, oxidation and upgrading of oil draining toward production well **33** may be limited by injection of oxygen-free or reduced-oxygen content fluid, as for example steam, via well **34** in sufficient quantity to limit access of oxygen to drained oil being withdrawn through well **33**.

[0011] Although the present invention has been described in detail with reference to certain preferred versions thereof, other versions are possible. Therefore, the spirit and scope of the invention should not be limited to the description of the preferred versions contained herein.

1. A method of recovering oil comprising:

a) injecting oxygen into a chamber within an oil deposit thereby combusting oil at the chamber walls;

b) allowing heated oil to drain towards the reservoir floor; and

c) recovering oil via a production well.

2. The method of claim **1** wherein the chamber is a steam chamber.

3. The method of claim **2** wherein the combustion temperature at the chamber walls is above the saturated steam temperature at the steam chamber pressure.

4. The method of claim **2** wherein the combustion temperature is controlled by adjusting the oxygen concentration within the steam chamber.

5. The method of claim **1** wherein the oxygen is injected in admixture with steam.

6. The method of claim **5** wherein high purity oxygen is injected in admixture with steam.

7. The method of claim **1** wherein the chamber walls are maintained at a temperature above that at which the in place oil cracks.

8. The method of claim **5** wherein the combustion temperature is high enough to promote reaction of steam with carbonaceous materials.

9. A method of producing upgraded oil from a heavy oil deposit comprising:

a) injecting oxygen into a chamber within the deposit;

b) combusting fuel at the chamber walls;

c) maintaining the walls at a temperature above that at which the deposit oil cracks; and

d) withdrawing upgraded oil via a production well.

10. The method of claim **9** wherein the oxygen is injected in admixture with steam.

11. The method of claim **9** wherein the oxygen is injected in admixture with nitrogen.

12. The method of claim **1** wherein oxygen is supplied as air.

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