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Driver

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[54] **TIGHT OIL OR GAS FORMATION FRACTURING PROCESS**

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[51] **Int. Cl.** **E21b 43/26,** E21b 7/08

[58] **Field of Search** 166/299, 308, 307, 271; 175/62, 61, 107; 102/21, 23

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[57] **ABSTRACT**

According to the invention, a process of fracturing tight oil or gas formations by drilling a band of small holes into the oil or gas formation from a well borehole, so that more explosive or hydraulic fracturing fluids can be placed at a selected depth and positioned to provide more lifting and fracturing force on the oil or gas formation.

3 Claims, 3 Drawing Figures

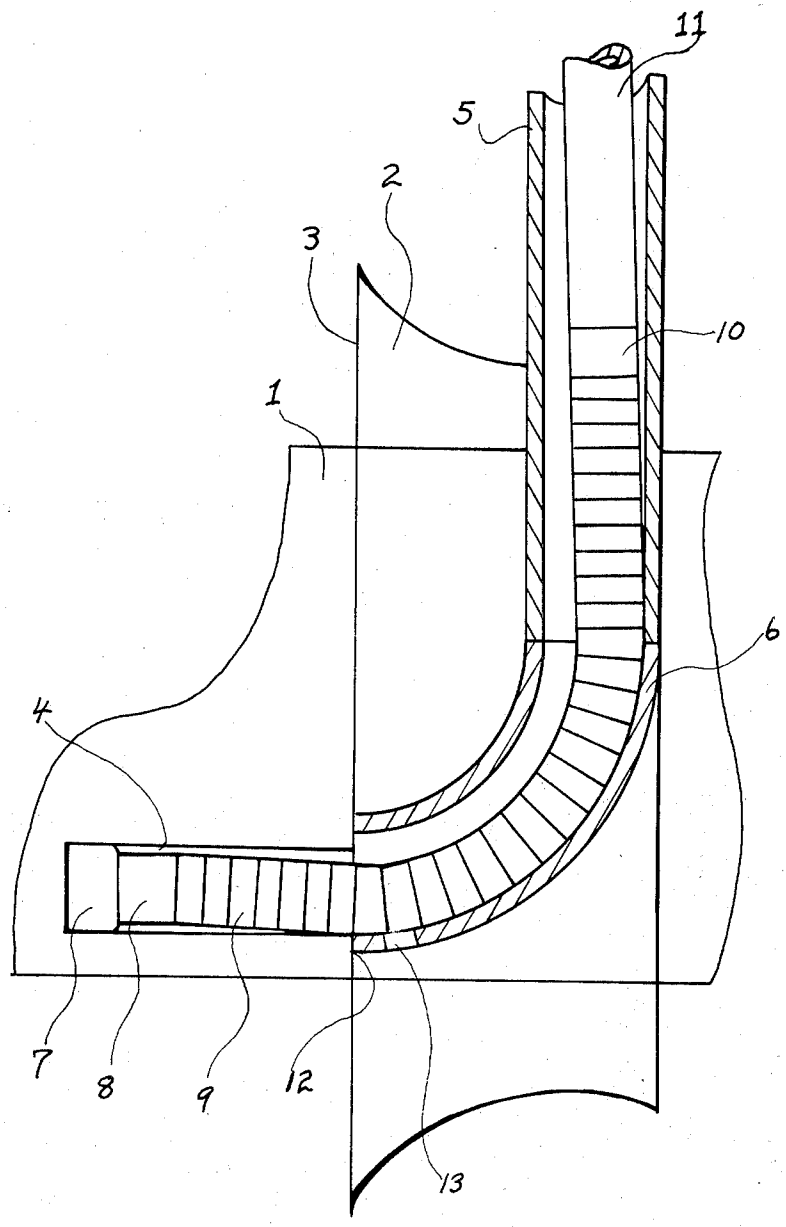


FIG. 1

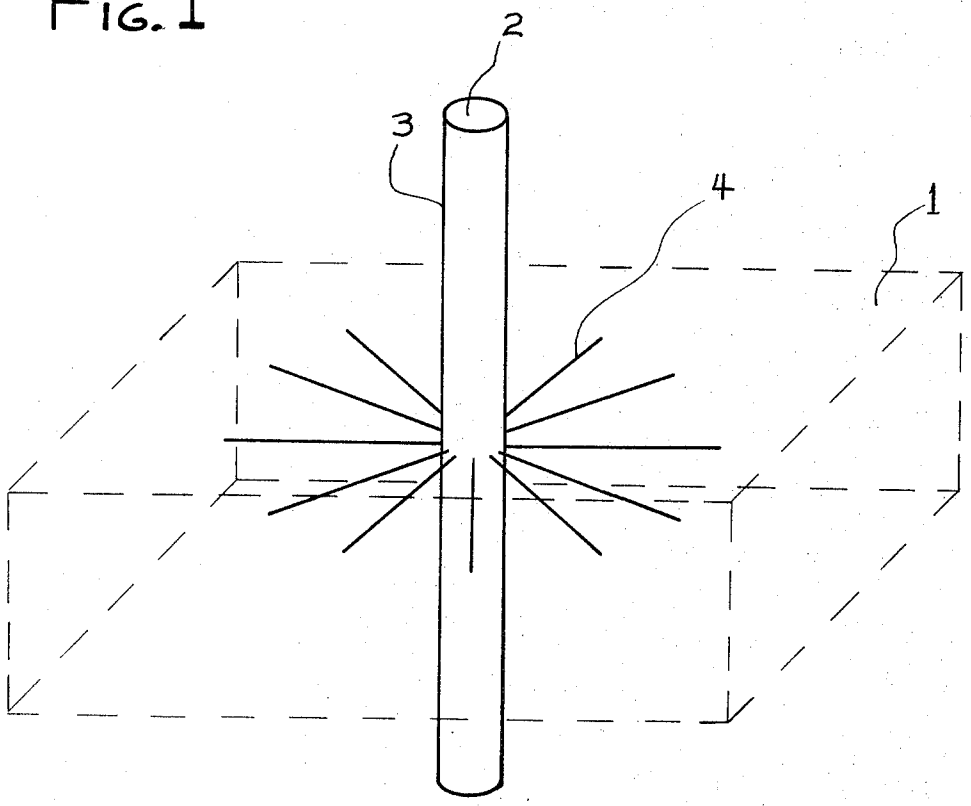


FIG.2

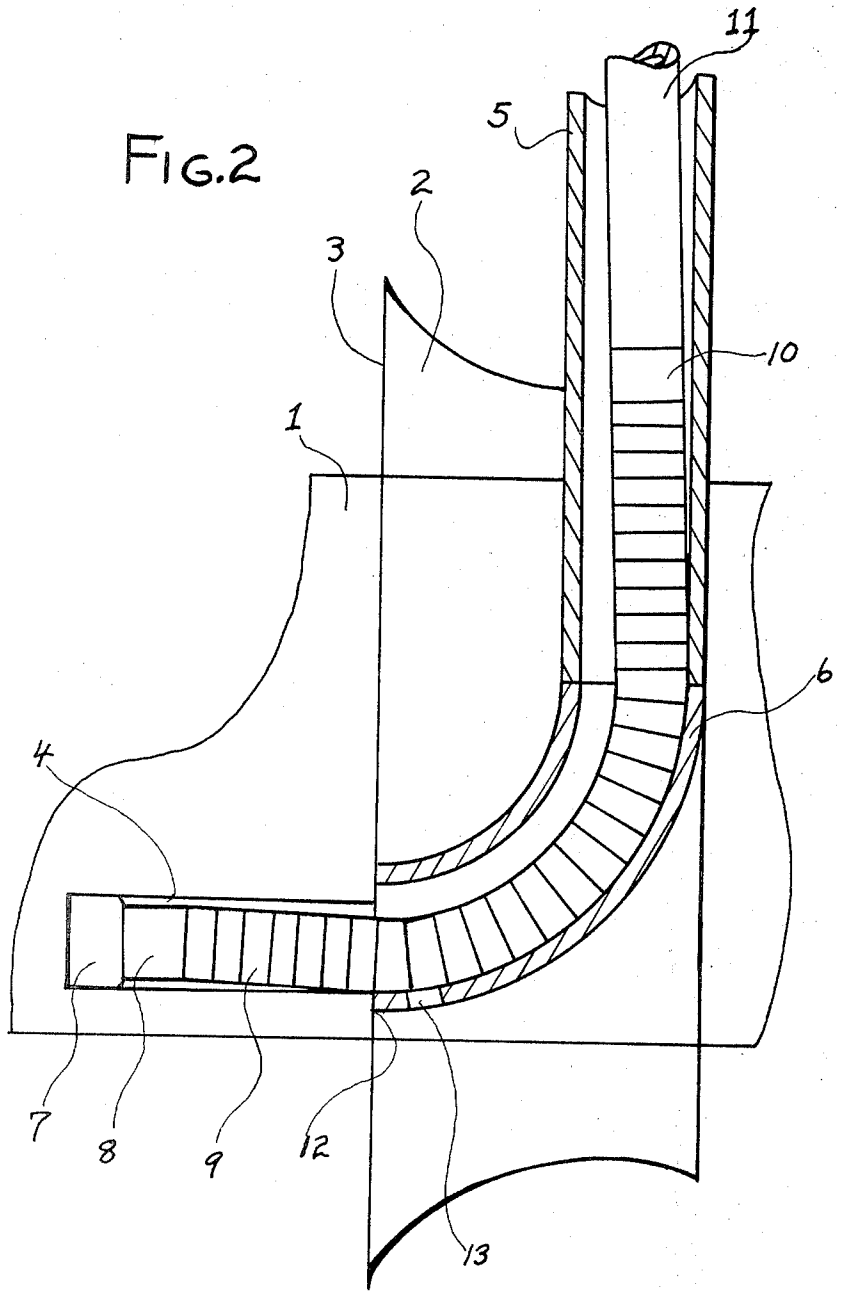
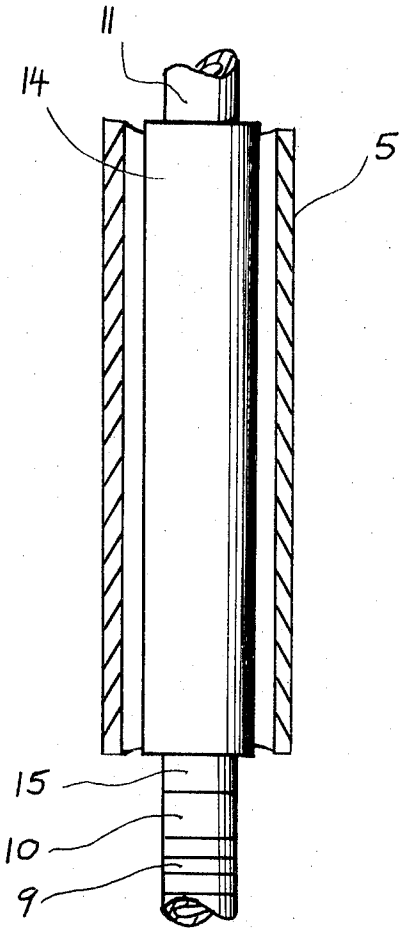


FIG. 3



TIGHT OIL OR GAS FORMATION FRACTURING PROCESS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a process of fracturing tight oil or gas formations so that the oil or gas that they contain can be produced.

2. Prior Art

The permeability of an oil or gas formation is the resistance the formation has on the flow of oil or gas to a well borehole. This resistance to flow is due to small and poorly connected pore space in the formation. It has been an old practice in the petroleum industry to fracture oil or gas formations by pumping fluids under high pressure into a well borehole, also the same thing is accomplished by exploding explosive fluids in the well borehole. In both cases the gas from the explosive fluids or the hydraulic fluids enter the oil or gas formation through the exposed pore space in the well borehole. The fracturing fluids entering the formation lifts the formation. This lifting of the formation causes cracks and enlarges pore space, in which oil or gas can flow with less resistance. In the United States there are millions of barrels of oil and a related amount of gas that cannot be recovered because the formations cannot be fractured as described above. In these formations, fracturing fluids cannot enter because the pore space is too small and poorly connected. To create holes in the formation by shooting them with projectiles from a down hole gun has not been successful, because the projectiles cannot penetrate deep enough due to the density of the formation. These formations are called tight oil or gas formations. A nuclear explosion can fracture these formations, but the oil or gas formation has to have great vertical thickness for nuclear fracturing to be feasible. In most cases the tight formations are too thin in vertical thickness to use nuclear fracturing.

SUMMARY OF THE INVENTION

An object of the invention is to provide a process for fracturing tight oil or gas formations by providing means of accumulating more fracturing fluids, exposing them to more pore space and placing them so they can provide more lifting force at a selected depth in an oil or gas formation than can be obtained from the wall of a well borehole at the same selected depth in an oil or gas formation.

A particular object of the invention is to drill a band consisting of one or more layers, which consist of one or more small holes, into the oil or gas formation from a well borehole in the oil or gas formation. The holes that comprise a layer are drilled in the same plane at selected points around the circumference of the well borehole, and they are drilled perpendicular to the well borehole into the oil or gas formation.

A further object of the invention is to inject the band of holes with liquid explosive, and ignite so the explosion can lift and fracture the oil or gas formation.

Another object of the invention is to inject the band of holes with fluids under high pressure so they can lift and fracture the oil or gas formation.

Another object of the invention is to drill several bands of holes at different depths in one well borehole in an oil or gas formation that has great vertical thickness. The bands of holes in the oil or gas formation would be injected with explosive liquid, and ignited either simultaneously or in sequence. Several bands with 40 foot holes drilled into a formation with great vertical thickness could fracture the formation as well as the nuclear fracturing process presently being used, without the damage to the formation, and without the danger of underground and above ground radiation pollution as would be present in the case of nuclear fracturing.

An object to the invention is to provide the process for drilling the holes into the oil or gas formation from a well borehole. This is accomplished by lowering a string of tubing into the well borehole, that has 90° elbow attached at the downhole end of the tubing string. The string of tubing is set so the open end of the 90° elbow is interfaced with the well borehole wall where a hole is to be drilled. Then a drill bit is lowered to the well borehole wall through the tubing string and 90° elbow. The drill bit is attached by a tool joint to a flexible hollow shaft, that is slightly longer than the hole to be drilled. The flexible hollow shaft is attached by a tool joint to a string of drill pipe that extends up through the tubing string to the top of the well borehole. Machinery at the top of the well borehole turns the drill pipe string, which turns the flexible hollow shaft, which drills the drill bit into the oil or gas formation. The flexible hollow shaft is used to turn and drill the drill bit into the oil or gas formation by being able to rotate and move through the ninety degree elbow. When the hole is drilled to the desired depth, the machinery at the top of the well borehole pulls the drill pipe string up until the flexible hollow shaft and drill bit are pulled from the hole and into the tubing string and 90° elbow. Then the tubing string is rotated until the open end of the ninety degree elbow interfaces the well borehole wall where the next hole is to be drilled. A hole in the wall of the 90° elbow near its open end that interfaces with the well borehole wall, lets the drilling fluids that are pumped down through the drill pipe string, through the flexible hollow shaft, through the drill bit and with cuttings from the hole being drilled, be exhausted into the well borehole. Also, for drilling deep oil or gas formations a downhole motor, with its input attached to the drill pipe string and its output shaft attached to the tool joint attached to the flexible hollow shaft, rotates the flexible hollow shaft and drill bit. This would be a slim motor, which could be inserted through the tubing string. The motor is used at deep depths because slim drill pipe being turned at the speed required to drill the formation at deep depths would probably part. The motor is operated by pumping drilling fluids down through the drill pipe string to the input of the motor. The drilling fluids under pump pressure operate the motor. After the drilling fluids turn the motor they are exhausted through the motor output shaft into the flexible hollow shaft.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings,

FIG. 1 is an overall view showing a band consisting of one layer of small holes drilled in a tight oil or gas formation from a well borehole.

FIG. 2 is a cross section showing how the downhole tools system is configured to drill a small hole.

FIG. 3 is a cross section showing how a downhole motor would be incorporated into the downhole drilling system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the accompanying drawings which form a part of this disclosure a well borehole **2** drilled through tight oil or gas formation **1.** At a selected depth in tight oil or gas formation **1,** a band consisting of one layer consisting of several small holes **4** are drilled into tight oil or gas formation **1** from the wall **3** of well borehole **2.** The small hole **4** is drilled perpendicular to wall **3** of well borehole **2** into tight oil or gas formation **2.** After the band of small holes **4** has been drilled, they are pumped full of liquid explosive and ignited, so the resulting explosion will lift and fracture tight oil or gas formation **1.** The band of small holes **4** can also be pumped with fracturing fluids under high pressure to fracture tight oil or gas formation **1.**

The small hole **4** is drilled into tight oil or gas formation **1** by lowering a tubing string **5** into well borehole **2.** The tubing string **5** has a ninety degree elbow **6** attached to its downhole end. The tubing string **5** is set in the well borehole **2,** so that the open end **12** of ninety degree elbow **6** will interface the wall **3** of the well borehole **2,** where the small hole **4** is to be drilled. Then drill bit **7** is inserted down through tubing string **5** and ninety degree elbow **6** to the wall **3** of well borehole **2** where small hole **4** is to be drilled into tight oil or gas formation **1.** The drill bit **7** is attached by a tool joint **8** to flexible hollow shaft **9,** which is slightly longer than the depth of the small hole **4** that is to be drilled. The flexible hollow shaft **9** is used because it is able to rotate and move through ninety degree elbow **6** and drill drill bit **7** into the tight oil or gas formation **1.** The flexible hollow shaft **9** is attached by tool joint **10** to drill pipe string **11.** The drill pipe string **11** extends up through tubing string **5** to the top of well borehole **2.** Machinery at the top of well borehole **2** rotates and applies downward drilling pressure on drill pipe string **11,** which will drill drill bit **7** and flexible hollow shaft **9** into tight oil or gas formation **1.** To clean the cuttings from hole **4** while it is being drilled, drilling fluids are pumped down through drill pipe string **11,** through flexible hollow shaft **9** and through drill bit **7** into hole **4.** The drilling fluids with cuttings from hole **4** are exhausted into well borehole **2** through drain hole **13** which is in the bottom of ninety degree elbow **6** near its open end **12** which interfaces wall **3** of well borehole **2.** When hole **4** has been drilled, the machinery at the top of well borehole **2** pulls the drill string **11** up until drill bit **7** and the flexible hollow shaft **9** are pulled from hole **4** and into tubing string **5** and 90° elbow **6.** Then the tubing string **5** is rotated until the open end **12** of 90° elbow **6** interfaces the point on wall **3** of well borehole **2** where the next hole **4** is to be drilled.

At deep depths a downhole motor **14** is used to rotate flexible hollow shaft **9** and drill bit **7.** The input of downhole motor **14** is attached to the downhole end of drill pipe string **11,** and the output shaft **15** of downhole motor **14** is attached to flexible hollow shaft **9** up tool joint **10.** Drilling fluids pumped down through drill pipe string **11** operate downhole motor **14** and rotate its output shaft **15,** which rotates flexible hollow shaft **9** and drill bit **7.** The drilling fluids are exhausted from downhole motor **14** through output shaft **15** into flexible hollow shaft **9.** The downhole motor **14** could be used at shallow depths.

I claim:

1. The process of fracturing tight oil or gas formations by drilling into the the tight oil or gas formation from a selected depth in a well borehole in the tight oil or gas formation a band consisting of one or more layers which consist of small holes drilled perpendicular from the well borehole into the tight oil or gas formation, the small holes which comprise a layer are drilled at the same depth and from as many points that can be drilled around the circumference of the well borehole so the small holes will radiate out from the well borehole into the tight oil or gas formation, injecting liquid explosive into the small holes after they have been drilled and igniting said explosive to exert fracturing pressure on the tight oil or gas formation from the small holes, wherein the method used in drilling the small holes consists of lowering a tubing string into the well borehole with a ninety degree elbow attached to the downhole end of the tubing string string and setting the tubing string so the open end of the 90° elbow interfaces with the well borehole wall where a small hole is to be drilled, lowering a drill pipe string down through the tubing string with a flexible hollow shaft attached to the downhole end of the drill pipe string, a tool joint attaching the uphole end of the flexible hollow shaft to the downhole end of the drill pipe string and a drill bit attached to the downhole end of the flexible hollow shaft by means of a tool joint, applying rotation and down pressure to the drill pipe string from the top of the well borehole whereby the drill pipe string rotates and forces the drill bit and flexible hollow shaft through the 90° elbow and drills the drill bit and flexible hollow shaft into the tight oil or gas formation drilling a small hole until the tool joint that attaches the flexible hollow shaft to the drill pipe string is near the point where the tubing string attaches to the 90° elbow, then applying hoisting action to the drill pipe string by the conventional well drilling equipment at the top of the well borehole until the flexible hollow shaft and drill bit have been pulled from the drilled small hole in the tight oil or gas formation into the 90° elbow rotating the tubing string after the drill bit has been pulled into the 90° elbow until the open end of the 90° elbow interfaces with the well borehole wall where the next small hole of a layer is to be drilled, lowering the tubing string when all the small holes of a layer are drilled to the point in the well borehole where the next layer of small holes is to be drilled if the band of small holes requires more than one layer of small holes.

2. In claim **1** comprising drilling one or more drain holes in the 90° elbow near the ninety degree elbows open end which interfaces with the well borehole wall so drilling fluids pumped down through the drill pipe string, through the tool joint that connects the drill pipe string to the flexible hollow shaft, through the flexible hollow shaft, through the tool point that connects the flexible hollow shaft to the drill bit, through the drill bit into the small hole being drilled and with cuttings from the small hole being drilled can be exhausted into the well borehole.

3. In claim **1** when the tight oil or gas formation is at great depths or when very small holes are to be drilled a downhole motor attached to the downhole end of the drill pipe string is used to rotate the flexible hollow shaft and the drill bit, a tool joint attaches the uphole end of the flexible hollow shaft to the output shaft of the downhole motor.

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