An Innovative Method for Drilling Well-Bores:
Apparatus for Drilling Deeper and Wider Wellbores (ADDWW)

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ABSTRACT

Existing drilling technologies have limitations relevant to the depth and diameter of the well bore. In this regard, well bores having a wider diameter cannot be drilled as deep as a well bore with a smaller diameter. Accordingly, there exists a need for a drilling apparatus and a method for drilling a relatively deeper well bore having a relatively wider diameter and reduced drilling cost when compared to conventional drilling technologies. The Apparatus for Drilling, Deeper and Wider Wellbores (ADDWW) can solve those limitations.

A method for drilling deeper and wider well bores consist of an apparatus having a motorized drill head for cutting and shredding ground material; a separate excavation line for transporting cuttings up to the ground surface; a separate line for delivering filtered fluid to the bottom of the well bore; and a separate close loop engine cooling line. The excavation line consists of multiple connected segments of a stationary (not rotating) main pipe with a rotating continuous screw inside configured to move mud and cuttings upward.

The diameter of the excavation line and the rate of flow of the mud and cuttings through it and the diameter of the fluid delivery line and the rate of fluid flow through it are in balance requiring only a limited fluid column at the bottom of the well-bore. The excavation process continues regardless of depth and diameter of the drill head (well-bore) and therefore this method eliminates well known drilling limitations relative to depth and diameter of the well-bore.

Field of Invention

The subject matter described herein generally relates to a drilling apparatus and related method, and more specifically to wellbore drilling for an emerging technology such as “Self Contained In-Ground Geothermal Generators” (SCI-GGG) where drilling relatively deeper wells having a wider diameter and reduced drilling cost are applicable.

Related Art

Nearly all oil, gas, and geothermal wells are drilled using a rotating system. In rotary drilling, a steel tower supports a length of hollow heat treated alloy steel drill pipe having a drill bit positioned at one end. The drill pipe is rotated by a rotary table to cut a hole in the earth called a well bore. The well bore may have a diameter of 20 inches (51 cm) or more, but is typically less.

Four major systems generally comprise an operational rotary drilling (rig) system: a power supply, a hoisting system, a rotating system (mentioned above), and a circulating system. A drill system requires the power supply in order for the other rig systems to operate. Power may be supplied through one or more diesel engines used alone or in combination with an electrical power supply.

The hoisting system raises, lowers, and suspends equipment in the well bore and typically includes a drill or hoist line composed of wound steel cable spooled over a revolving reel. The cable passes through a number of pulleys, including one suspended from the top of the tower. The hoisting system is used to move drill pipe into or out of the well bore. As the depth of the well bore increases additional sections of drill pipe are added to the opposite end of the drill pipe to form a drill string.

During drilling, the circulating system pumps drilling mud or fluid down through the hollow drill pipe into the well bore. A liquid, oil, or synthetic based mud is typically used during the drilling process. The mud and cutting exit the pipe through holes or nozzles in the drill bit and return to the surface through the space between the drill pipe and the well bore wall.

The mud and cuttings separated and the mud is re-circulated into the well bore. Drilling mud cools the drill bit, stabilizes the well bore walls, and controls the formation fluid that may flow into the well bore.

Alternatively, an air drilling system may be employed to remove drill cuttings. The air drilling rig and operations are identical to those for the rotary drilling rig, except there is no circulating...
system. Instead of mud, air is pumped down the drill string and out the drill bit, forcing the cuttings up and out of the well bore.

Several types of drilling techniques are currently employed in oil and gas drilling: straight hole drilling, directional/slant drilling, horizontal drilling, air drilling, and foam drilling. Regardless of the drilling technique, a well bore is typically drilled in a series of progressively smaller-diameter intervals. Thus, a well bore typically exhibits a largest diameter at the surface and relatively smaller diameter at the bottom of the well bore.

Accordingly, existing technologies have limitations relevant to the depth and diameter of the well bore. In this regard, well bores having a wider diameter cannot be drilled as deep as a well bore with a smaller diameter. More specifically, as the well bore depth and diameter increases, tremendous pumping force is required to force rock chips (cuttings) out of the well bore by a fluid (or air) column formed between the drill pipe and the well bore wall.

Exploration and well bore drilling are major cost components of any oil, gas, or geothermal project. Accordingly, there exists a need for a drilling apparatus and a method for drilling a relatively deeper well bore having a relatively wider diameter and reduced drilling cost when compared to conventional drilling technologies to accommodate emerging technology in geothermal energy such as those described in U.S. Patent No. 7,849,690; entitled “Self Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on: Dec.14, 2010.

The “Apparatus for Drilling, Deeper and Wider Wellbores” (ADDWW)

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The Apparatus for Drilling, Deeper and Wider Wellbores (ADDWW) can solve those limitations.

A method for drilling deeper and wider well bores consist of an apparatus having a motorized drill head for cutting and shredding ground material; a separate excavation line for transporting cuttings up to the ground surface; a separate line for delivering fluid to the drill head.
filtered fluid to the bottom of the well bore; and a separate close loop engine cooling line. The excavation line consists of multiple connected segments of a stationary (not rotating) main pipe with a rotating continues screw inside configured to move mud and cuttings upward. Alternatively, the excavation line may consist of multiple connected segments of the stationary main pipe with periodical segments of in-line excavation pumps. The close loop cooling line consists of one heat exchanger in the motorized drill head and one on the ground surface in the binary power unit where fluid is cooled and in the process electricity is produced which can be used as a supplement for powering drill head, pumps, equipment, etc.

The In-ground motorized drill head is connected to lowest section of the main excavation pipe and consist of:

An electric motor having central and peripheral rotors securely engaged with a drill bits;

A motor housing block having inner and outer chambers each connected to the separate close loop lines for cooling the motorized drill head; and

A drill bit which consist of two rotating elements, peripheral and central drill bits, securely engaged with rotors, rotating in opposite directions, cutting and shredding bottom of the well bore to a small bits (cuttings) which are excavated through excavation line;

The diameter of the excavation line and the rate of flow of the mud and cuttings through it and the diameter of the fluid delivery line and the rate of fluid flow through it are in balance requiring only a limited fluid column at the bottom of the well-bore. The excavation process continues regardless of the diameter of the drill head (well-bore) and therefore this method eliminates limitations, well known in conventional drilling technologies, relative to depth and diameter of the well-bore. This new method will drastically reduce drilling cost.

References