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System for Drilling Deeper and Wider Wellbores

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ABSTRACT

Contemporary drilling systems for wellbores have serious limitations on how wide and deep wellbore can be drilled. In conventional systems, mud is injected through the pipe and exit through several orifices at drill-bit and circulates up between the pipe and wall of the wellbore providing a necessary stream for cutting to be excavated. By increasing the size of the drill-bit (wellbore) and/or by increasing the depth of the wellbore it requires a tremendous increase of pressure inside the pipe to form a sufficient stream of fluid up for cuttings to be excavated. Also, the wellbore has a gradually smaller diameter with each subsequent section because of the casing.

The presented system provides a solution for drilling deeper and wider wellbores with a constant diameter. The presented system consists of a motorized drill head; separate excavation line; separate fluid delivery line, and a separate closed-loop cooling line engaged with Binary Power Unit on the ground surface. The presented drilling apparatus has retractable bits on the motorized drill head. The casing of the wellbore can be built during the drilling process. The drilling apparatus consists of the elevator sliding over the drilling/excavation/heat exchange apparatus delivering and installing casing sheets and concrete. The elevator also has an expendable chamber, and containers for delivering air, and concrete. The containers with air also can be used for providing buoyancy thus minimizing the weight issue during the disassembling process. The diameter of the excavation line and rate of flow of mud and cuttings through it and the diameter of the fluid delivery line and rate of fluid flow through it are in balance requiring only a limited fluid column at the bottom of the wellbore. The fluid column may exist through the whole wellbore to sustain the wellbore during the drilling process, and later for better conduction of the heat, but not for the excavation purpose. The excavation process continues regardless of the diameter of the drill head (wellbore); therefore, this method eliminates well-known drilling limitations relative to the depth and diameter of the wellbore.

1. INTRODUCTION

1.1 Note

Presented paper with the title “System for Drilling Deeper and Wider Wellbores” is a segment of the comprehensive design for the long-term solution for the restoration of the Salton Sea (Lake in California). The solution for the restoration of the Salton Sea includes an architectural element that harmoniously implements several breakthrough technologies into a self-sustaining organism. There are five phases (segments) of the project including harnessing solar and hydro energy which are excluded for this occasion as not relevant to the geothermal issue. Each of the phases (segments) is essential for the final result of the project. The presented “System for Drilling Deeper and Wider Wellbores” is a fundamental segment of the comprehensive design on which the function of other segments depends.

For this occasion, the paper “System for Drilling Deeper and Wider Wellbores” is marked as a (Segment III). For a complete understanding of this segment it is necessary to review the other two integral parts of the comprehensive design with titles “Harnessing Energy and Water in the Salton Sea” as a (Segment I), and “Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator and Self Contained In-Ground Geothermal Heat Exchanger” as a (Segment II).

1.2 Overview of the contemporary drilling system

Contemporary drilling systems for wellbores have serious limitations on how wide and deep wellbore can be drilled. Mud is injected through the pipe and exit through several orifices at drill-bit and circulates up between the pipe and wall of the wellbore providing a necessary stream for cutting to be excavated. By increasing the size of the drill bit (diameter of the wellbore) and/or by increasing the depth of the wellbore it requires a tremendous increase of pressure inside the pipe to form a corresponding stream up for cuttings to be excavated. Also, wellbores have a gradually smaller diameter with each subsequent section because of the casing.

Relevant to the presented proposal for the restoration of the Salton Sea which includes many power plants using a completely closed-loop system for harnessing geothermal energy and each of those power plants having 24 wellbores there is a need for a system for drilling faster, deeper and wider wellbores.

1.3 Summary of the new system for drilling faster, deeper, and wider wellbores

Presented system for drilling faster, deeper and wider wellbore consist of motorized drill head; separate excavation line; separate fluid delivery line; and separate closed-loop cooling line engaged with the Binary Power Unit on the ground surface which generates electric energy. The presented drilling apparatus has retractable bits on the motorized drill head (See FIG. 8). The apparatus also consists of the elevator sliding over the drilling/excavation/heat exchange apparatus (line) delivering and installing casing sheets and concrete during the drilling process (See FIG. 2-3).

The motorized drill head cuts and shred ground material and suck into the excavation line for transporting it to the ground surface. The whole excavation line consists of multiple segments of the electric motor, the "In-Line Pump, with a continuous spiral blade inside the rotor.

The separate fluid delivery line delivers filtered fluid into the bottom of the wellbore for easier cutting and partially cooling the drill head (See Fig. 1 and 8). Separate closed-loop cooling line function as a closed-loop heat exchange system taking heat from the motorized drill head and transporting it into a binary power unit on the surface which can produce electricity which can be used to supplements energy needed for powering the motorized drill head. The drill head can be powered by an electric motor or hydraulic motor.

The circular cage slides up and down over the excavation line delivering and installing casings (See Figs. 2, 3, and 7). The circular cage has an expandable compartment with a bladder on which is attached rolled adjustable metal sheets although does not need to be metal. The bladder is made of heat resistant material and expands when air from the air containers is injected into the bladder and the metal sheet is inserted in needed location. Concrete from the concrete containers is injected between the metal sheet and rough wall of the wellbore forming the casing. The bladder can stay inflated as needed until the curing of concrete is completed. This process can be repeated as needed. The drilling process can continue except for a short interruption during positioning metal sheets for the casing. The circular cage has a motor compartment with gears that are synchronized with a cable system for sliding the cage up and down. The cage also has a locking system. Several cages, with air containers when locked to the excavation line, can provide buoyancy for the whole apparatus controlling the drilling force and eliminating difficulties caused by the weight of the apparatus during the disassembling process.

The diameter of the excavation line and rate of flow of mud and cuttings through it and the diameter of the fluid delivery line and rate of fluid flow through it are in balance requiring only a limited fluid column at the bottom of the wellbore. The fluid column may exist through the whole wellbore to sustain the wellbore during the drilling process and for better conduction of heat but is not necessary for the excavation purpose. The excavation process continues regardless of the diameter of the drill head (wellbore); therefore, this method eliminates well-known drilling limitations relative to the depth and diameter of the wellbore (See FIG. 1-8).

2. DISCLOSURE - ILLUSTRATIONS OF THE SYSTEM FOR DRILLING DEEPER, AND WIDER WELLBORES. (SEGMENT III)

Segment (III)

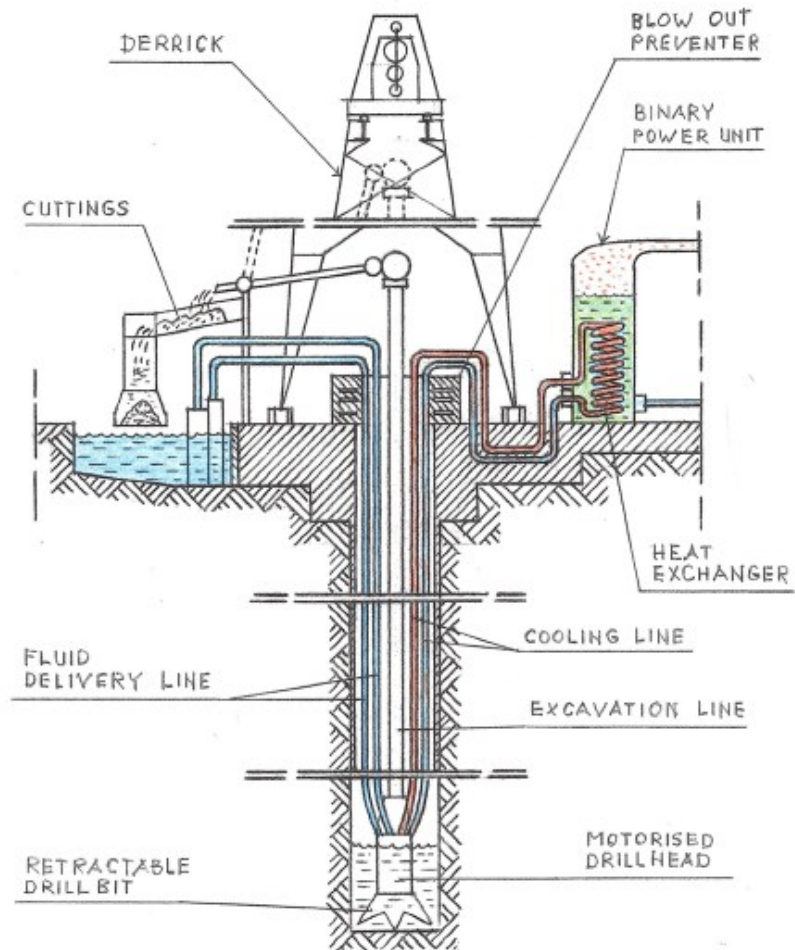


Figure 1: Schematic view of an apparatus for drilling faster, deeper and wider wellbore.

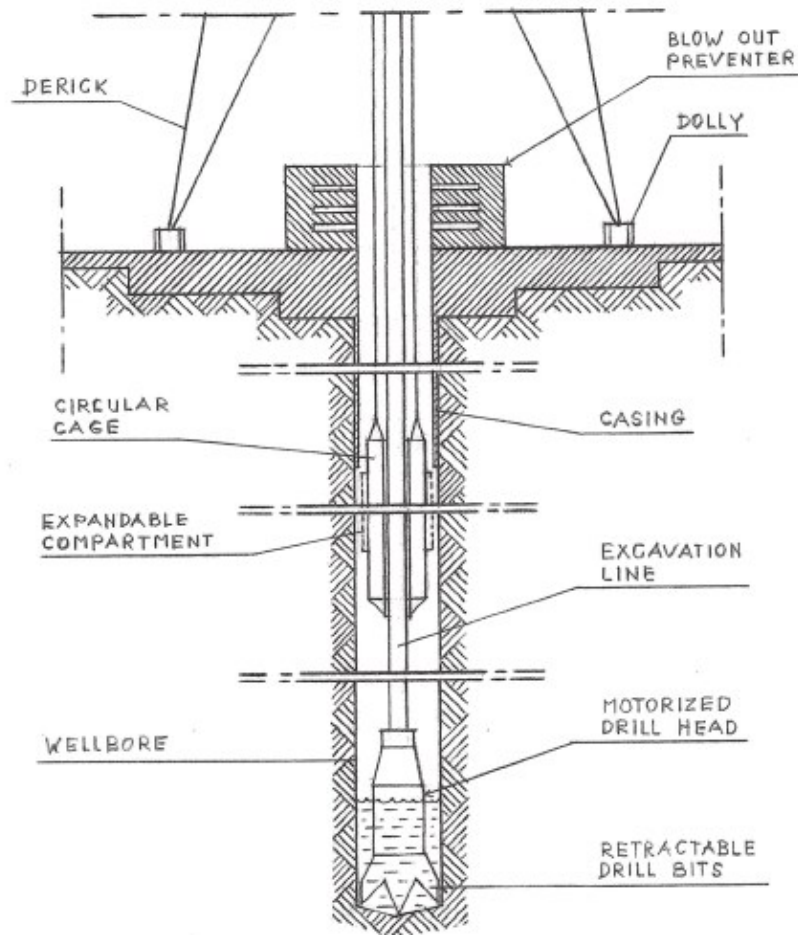


Figure 2: Schematic view of an apparatus for drilling faster, deeper and wider wellbore with cage for casing.

Segment (III)

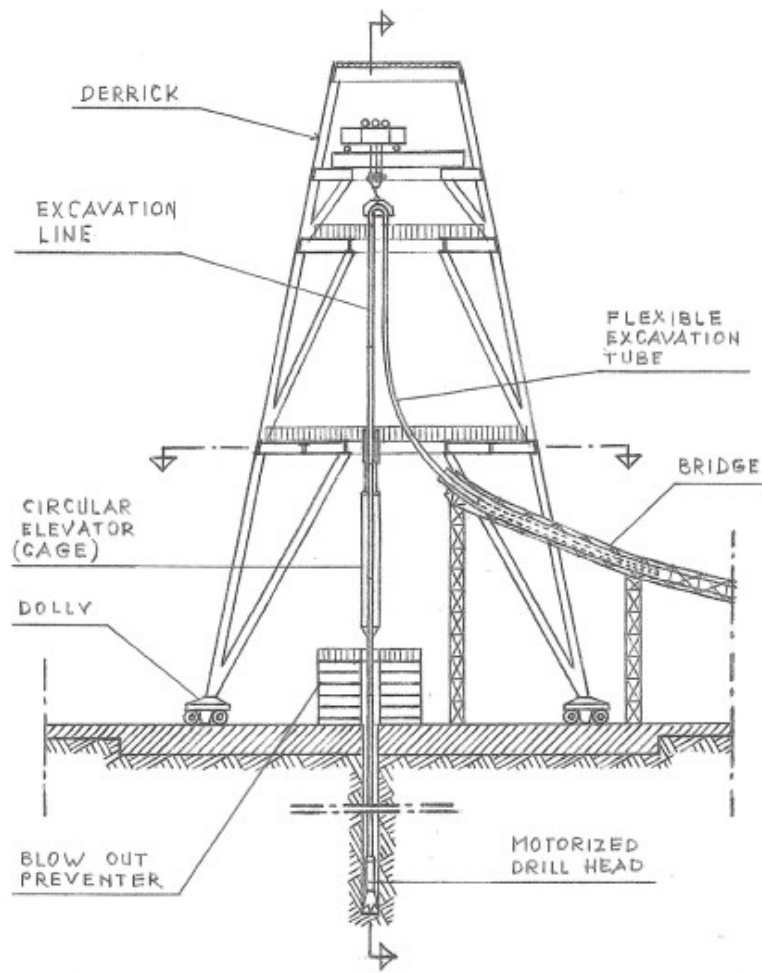


Figure 3: Another schematic view of an apparatus for drilling faster, deeper and wider wellbore with cage for casing.

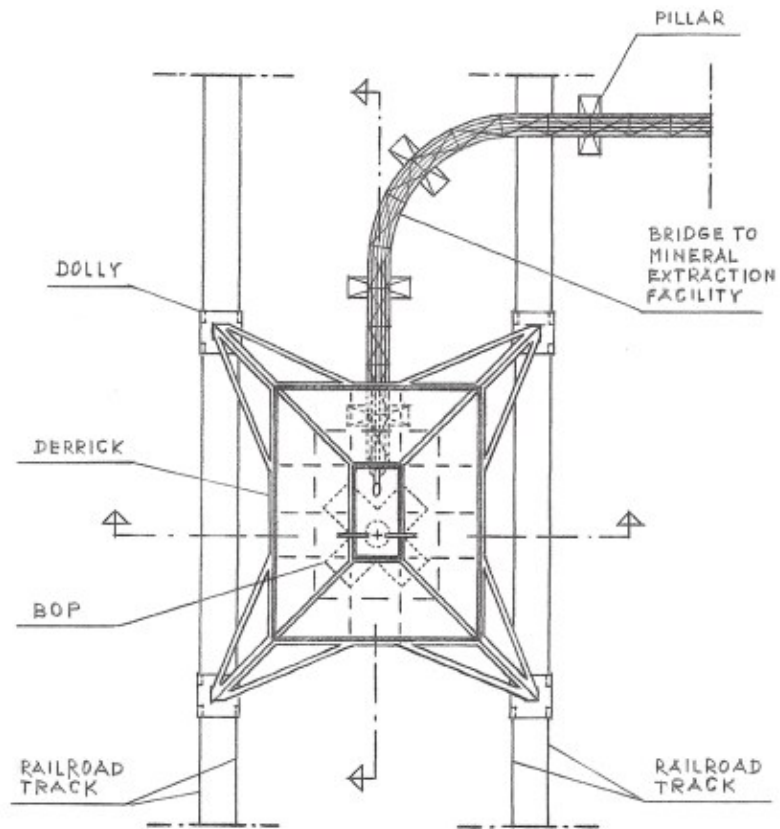


Figure 4: Plain cross-sectional view of an apparatus for drilling faster, deeper and wider wellbore.

Segment (III)

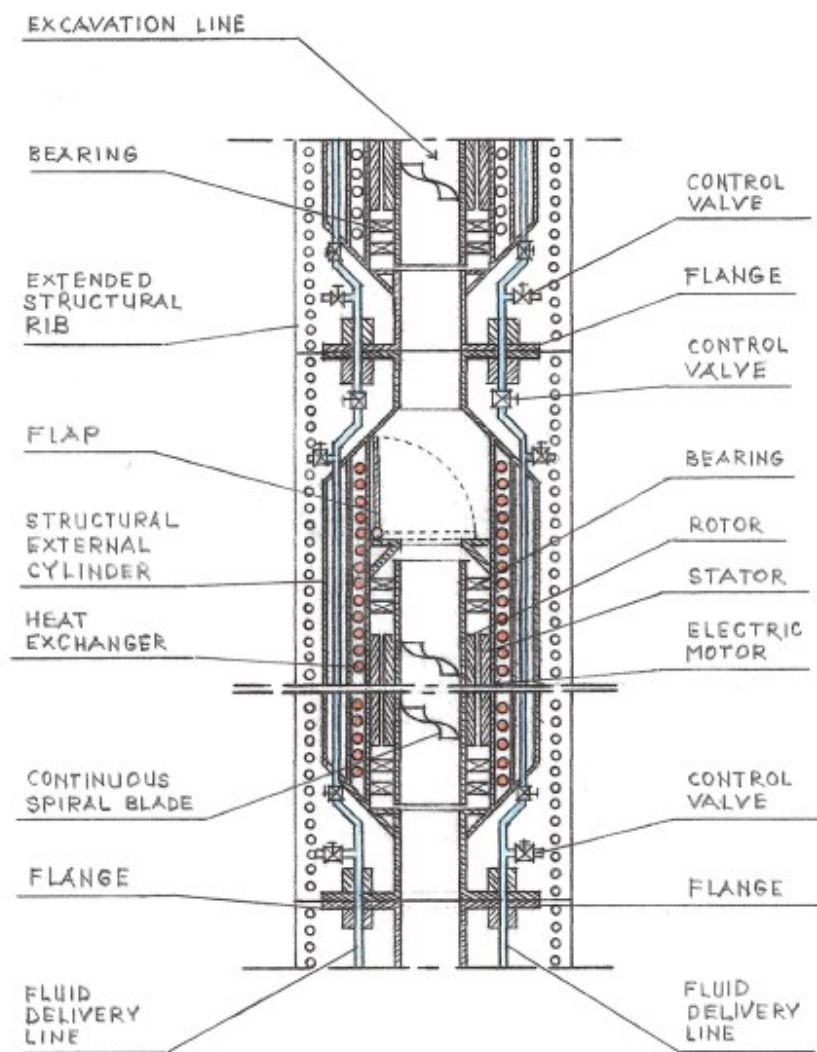


Figure 5: Cross-sectional view of an excavation line of the apparatus for drilling faster, deeper and wider wellbore.

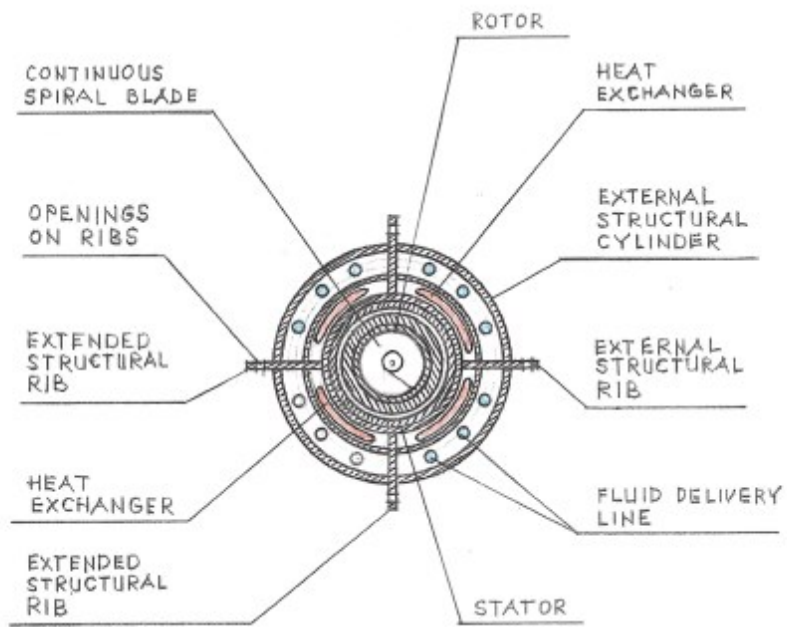


Figure 6: Cross-sectional view of an excavation line of the apparatus for drilling faster, deeper and wider wellbore.

Segment (III)

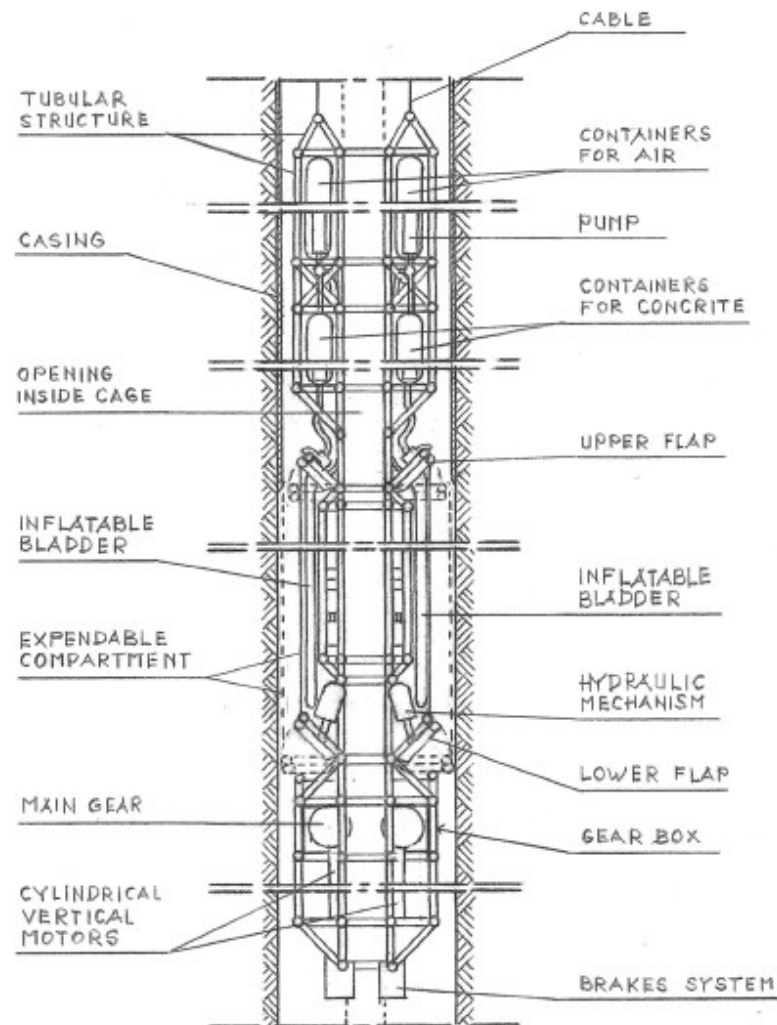


Figure 7: Cross-sectional view of a circular cage to be assembled on the excavation line of the apparatus for drilling faster, deeper and wider wellbore.

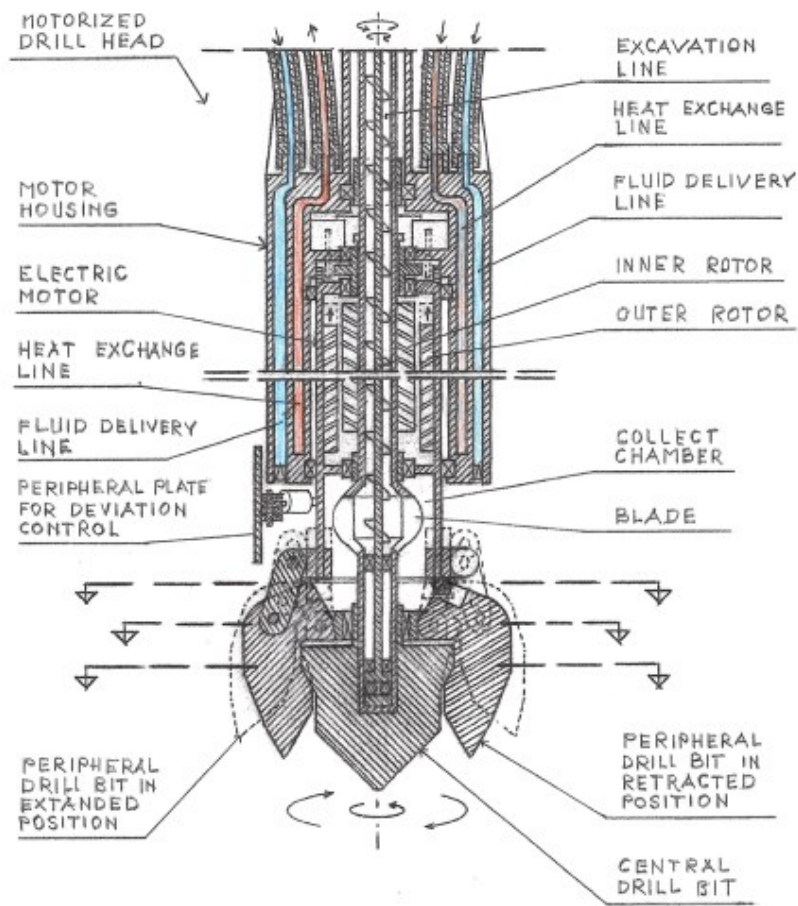


Figure 8: Cross-sectional view of the motorized drill for drilling faster, deeper and wider wellbore.

3. CONCLUSION

The essence of the presented methodology is that the presented proposal provides a solution for drilling deeper and wider wellbores. Also, the system provides a solution for drilling wellbores and building the casing at the same time. Also, the system provides a solution for drilling wellbores with constant diameter without having a reduction of the diameter.

Also, the essence of the presented methodology is having permanent motorized drill-head with retractable drill-bits at the bottom of the drilling apparatus moving whole apparatus deeper, as needed, in search for higher temperatures and transferring heat from heat sources to the power units on the ground surface with completely closed-loop systems.

Also, the essence of the presented methodology is having motorized excavation line.

Although the presented system is a part of geothermal power plant designed to include the local condition of the Salton Sea area to generate electricity, to generate potable water and to generate the brine which can be used for the extraction of lithium the presented system is not limited to this particular application.

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