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UNITED STATES PATENT OFFICE

HYDROGEN PEROXIDE DRILLING TOOL

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8 Claims. (Cl. 255—4.4)

1 This invention relates to a well-drilling apparatus and method of operation. In one specific aspect, it relates to a self-contained and unitary well-drilling apparatus. In another aspect, it relates to a well-drilling apparatus which is completely self-contained, including a source of driving power.

2 Well-drilling apparatus of the prior art is powered from the surface of the ground. In electrically operated well-drilling apparatus, the lead wires for carrying electricity to the apparatus must extend from the apparatus to the surface of the ground. In rotary drilling apparatus, tubing extends the entire distance from the drilling bit to the surface of the ground, and this entire length of tubing is rotated from an above ground source of power. Cable tools drills are suspended and operate from an above ground source of power. Drilling apparatus powered by flow of fluids must have provision for transmission of fluid from a compressor or pump at the surface to the drilling apparatus at the bottom of the well. Some apparatus also includes provision for the return of the fluid exhausted from the drill to the surface of the ground for either disposal or reuse.

3 I have devised an apparatus in which a fluid or fluids are stored, and this fluid, or fluids, operates a motor which in turn actuates the actual drilling bit. This entire apparatus is a relatively small and completely self-sufficient mechanism which may be lowered into the well by a cable. The drilling mechanism then operates to drill the well in a manner entirely independent from any source of power extending to the surface of the ground.

4 An object of my invention is to provide a well drilling apparatus the operation of which is independent from surface equipment.

5 Another object of my invention is to provide a well drilling apparatus which contains its own driving fuel and motor.

6 Still another object of my invention is to provide a well drilling apparatus which is unitary and self-contained as regards motor and fuel for powering the motor.

7 Still other objects and advantages of my invention will be apparent upon reading the following disclosure, which taken with the attached drawing and claims, forms a part of this specification.

In the drawing, Figure 1 is a longitudinal view, partly in section and partly in elevation, of one embodiment of my well-drilling apparatus. Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1. Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 1. Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 1. Figure 5 is a cross-sectional view of one piece of apparatus from Figure 1. Figure 6 is a cross-sectional view of an assembly of apparatus parts illustrated in Figure 1.

Broadly speaking, my drilling apparatus consists of a drilling bit fastened to one end of a piston rod with a piston on the other end. A reservoir is provided for storing a supply of such a power liquid as hydrogen peroxide. Means is provided for admitting small quantities of hydrogen peroxide from its reservoir to an expansion cylinder. A quantity of catalyst adapted to decompose hydrogen peroxide into its component parts is provided on the piston head. Since the decomposition temperature of hydrogen peroxide is relatively high at the time of decomposition, the decomposition products are in the gaseous state and under the conditions of temperature and pressure existing in the cylinder, tremendous pressures are exerted against the head of the piston. This pressure then causes the piston to move and its movement is transmitted directly through the piston rod to the drill bit. At the point near the bottom of the stroke exhaust ports in the side wall of the cylinder are opened and the power fluid is expelled. The piston and drill bit are moved upward and at a point near the top of the stroke peroxide injection apparatus operates to inject a new charge of hydrogen peroxide into the decomposition chamber or cylinder. In this disclosure by the use of such a term as “the piston and drill bit move upward” the meaning intended is that the upward movement of the piston is with respect to its containing cylinder 58 regardless of whether it is the piston or the cylinder which is doing the actual moving.

Downward movement of the piston is also with respect to the cylinder 58. The length of time of continuous operation of this apparatus without recharging peroxide is, of course, dependent upon the size of the storage tank. In deep wells when time and energy are expended in raising apparatus out of or lowering apparatus into the well, my drilling apparatus may be provided with a relatively large peroxide supply tank. My apparatus may be used in drilling operations in which cable tool type of drilling may be used.

When hydrogen peroxide is decomposed into water vapor and oxygen, a tremendous amount of energy is released. Hydrogen peroxide may be decomposed in the presence of certain catalysts by admitting small amounts of hydrogen peroxide
into a chamber in which is disposed a hydrogen peroxide decomposition catalyst. I am able to control the release of energy and adapt this energy to useful purposes. Such a catalyst as finely-divided silver and finely-divided platinum may be used. The release of energy can then be controlled by regulating the rate of flow of hydrogen peroxide to the catalyst.

Referring now to the apparatus and specifically to Figure 1, the apparatus consists of a self-contained source of power, a motor, and a drilling mechanism referred to in the figures by reference numeral 11. A drill-raising and lowering mechanism 16 includes a cable 18a which extends from the top of the apparatus to the surface of the ground. An upper housing 12 is the side wall for chambers 20 and 21 while the lower housing 13 is the wall for the power cylinder 58. The chamber 20 is a vessel in which is stored the supply of hydrogen peroxide feed for the operation of the drill. Chamber 21 is a vessel in which any other fluid such as a hydrocarbon oil may be stored, in case a combustible fuel is used in conjunction with the hydrogen peroxide. A plate 73 is held firmly in place by some cap screws 71 and this plate serves as a partition separating chambers 20 from 21. Threads 72 provide one means for construction and assembly of the top portion of my apparatus. The cylinder 58 is a decomposition chamber or cylinder in which the hydrogen peroxide decomposes to water vapor and oxygen. A piston 51 is provided in this chamber 58 for transforming the energy of the decomposing hydrogen peroxide into mechanical energy. The piston 51 may be disposed directly on the surface of the piston, if desired, or it may be disposed on the surface of a supporting material 55. This corrugated support metal is provided so that the upper surface of the piston will not become overheated and also so that expansion or contraction due to temperature changes will not destroy this portion of the mechanism. When a charge of peroxide is decomposed, the force of the gases pushes the piston 15 downward and forces the drill bit 14 against the earth formation to be drilled. When the top surface of the piston 57 reaches the exhaust ports 81, the water vapor and oxygen pass from within the chamber and a spring 87 then operates to raise the piston on its compression stroke. The apparatus is then in position for another charge of peroxide to be admitted to the chamber. When the upper surface 51 of the piston 15 approaches the top of its stroke, a pin or push rod 41 is contacted, and this rod extends vertically to a small cylinder 46a. To the upper end of this rod and in the cylinder is attached a small piston 40. The small chamber in which is disposed the piston 40 is the peroxide feed chamber and through previous operation this chamber is full of hydrogen peroxide. When the piston 40 rises, some hydrogen peroxide is forced from this chamber and flows through a line 37, a line 47, and through a check valve-orifice member assembly 51. This orifice member assembly 51 is illustrated in detail in Figure 5 of the drawing. This member contains a small, more or less capillary, conduit 52 and some small holes 53. The holes 53 are for the accommodation of a wrench for screwing the member 51 into position at the bottom end of the conduit 47. A check valve 35, 36 is hinged to the bottom of a plug 50 in such a manner that fluid can flow from line 38, 47 through capillary 52, but not in the reverse direction. In the top of the plug 50 are holes 49 for assembling this plug. When the peroxide is forced by the piston 40 through the orifice member 51, the peroxide is squirted onto the surface of the catalyst 54 on the head of the piston. When the peroxide contacts the catalyst, decomposition into steam and gaseous oxygen is immediate and the pressure exerted by this decomposition is, of course, dependent upon the concentration of the peroxide solution and upon the amount of hydrogen peroxide liquid injected into the chamber 58. Since pressure is developed in the chamber 58, the piston 16 starts on its downward stroke with the result that the drill bit 14 is forced downward against the earth formation at the bottom of the drill hole. At the bottom of the stroke of the piston, the gases of decomposition are vented through the ports 61 and when this pressure is vented, the springs 17 operate in conjunction with the weight of the apparatus body to raise the piston again to contact the lower end of the push rod 41 and to introduce a new charge of peroxide into the decomposition chamber. The check valve 35 is intended to permit flow of peroxide from the tank 20 through conduits 31, 41, and through the orifice 51. This check valve is further intended not to permit the flow of fluid backward through these conduits even at the pressure obtained within the chamber 58. At the bottom of the peroxide tank 20 is disposed a check valve assembly 31 which is illustrated on an enlarged scale in Figure 6. In this figure the check valve assembly is shown as a longitudinal section on an enlarged scale. In this assembly a check valve 35a is intended to permit flow of peroxide from the chamber 20 into the chamber 40a, containing piston 45 but is further intended not to permit the flow of peroxide from the chamber 40a into the reservoir 20. The top surface 57 of the piston pushes the push rod 41 and piston 40 upward to inject a charge of peroxide into the cylinder 58. A compression spring 39 is intended to push the piston 40 and its push rod 41 downward and during this downward movement, liquid peroxide is drawn from the chamber 20 into the cylinder 40a containing piston 40. A screen 33 is provided for preventing the passage of any solid material from chamber 20 into the check valve assembly 31. In the embodiment illustrated in Figure 1, element 37 is a tube passing through chamber 21, and this tube is attached by coupling assembly 46 to the conduit 47. This conduit 47 passes through a solid metal member 45. This metal member 55 is relatively long in order to give weight to my drilling apparatus. Since the decomposition of hydrogen peroxide is accomplished by the evolution of large quantities of heat, the metal member 55 is provided with fins 52 for heat exchange purposes, with the liquid contents of the well. The fins may be seen upon inspection of Figures 1, 3, and 4. While my drilling apparatus is on the surface of the ground and being made ready for use, the plug 23 is removed from the top of the upper housing 12 and the space 20 is filled with liquid hydrogen peroxide. The plug 23 is inserted in its normal position and tightened so that the hydrogen peroxide will be retained in the vessel 23 to the exclusion of other fluids. The drill bit 14 is pulled downward by hand to compress the spring 17 to
such an extent that the hole 19 in the shaft 15 is
not to permit leakage of any undesired material
through.

Since my drilling apparatus is usually s ulcer-
water or other liquid in the bottom of the
well, this liquid will be drawn in or expelled
through the exhaust ports 61 at such times when
the piston 16 is above these ports. Radial
members 62 in the bottom of the housing 13 are
provided so that open spaces 63 between them will
permit additional free flow of fluids into and out
of the space beneath the piston.

The piston rod 15 may be attached to the un-
derside of the piston in any manner desired, for
example, by a weld 18.

In the operation of this apparatus when using
hydrocarbon fuel in conjunction with the oxi-
cide, the piston at the top of its stroke pushes
push rods 41 and 44 to inject a charge of hydro-
carbon oil and a charge of peroxide simultane-
ously into the chamber 15. When the peroxide is
sprayed against the catalyst, oxygen and water
vapor are evolved at a relatively high tempera-
ture and under these conditions, the oxygen im-
mediately combines with the hydrocarbon which
burns with explosive force. Under these condi-
tions, the piston is forced downward and the drill
bit 14 performs its desired function. At the
bottom end of the stroke, the piston passes the ex-
haust ports 61 and combustion gases are vented.

Then as the piston again rises and touches the
push rod 41 and 44, new charges of oil and per-
oxide are admitted.

When the apparatus is charged with a fresh
charge of peroxide and a charge of oil before
lowering into the well, the shear pin is inserted
through hole 18 in the shaft 15 in a manner here-
before described. When the apparatus is lower-
ed into the well and the bit 14 hits against the
bottom of the well, the shear pin is sheared off
and the apparatus is automatically in operation.

I prefer to employ relatively concentrated forms
of hydrogen peroxide. At present it is possible to
purchase 98 per cent hydrogen peroxide, the other
2 per cent consisting of water and various well-
known materials which inhibit the decomposition
of the peroxide. I find, however, that valuable
results can be obtained as long as the solution
employed contains at least 70 per cent by weight
of hydrogen peroxide. Seventy per cent hydrogen
peroxide can release about 4,000 times its volume
of hot steam and gaseous oxygen when suitably
contacted with a catalyst, and the 98 per cent
peroxide will evolve even larger volumes of gas.

The injection of the peroxide into the decom-
position chamber 68 is closely controlled by the in-
jection apparatus described above.

The above-described drilling apparatus is given
for illustrative purposes and should not be re-
garded as limiting the invention, the scope of
which is set forth in the following claims.

Having described my invention, I claim:

1. An earth boring drill for drilling deep wells
comprising, in combination, a body member hav-
ing a fluid-tight reservoir attached at its upper
end, a quantity of hydrogen peroxide power
liquid in said reservoir, a cylinder attached to
the lower end of said body member, a conduit
leading from said reservoir to said cylinder,
an exhaust port in the wall of said cylinder, said
body member, reservoir and cylinder being dis-
posed along a common axis and being adapted
to be lowered into a well, a reciprocating pump
in said conduit for pumping liquid from said
reservoir to said cylinder, a reciprocating piston
disposed operatively in said cylinder, a catalyst.
mounted on the head of said piston, said catalyst being adapted to promote decomposition of hydrogen peroxide, an earth boring means secured to and actuated by said piston mounted to move relative to said cylinder, said boring means being disposed to extend into boring relation with the earth formation, a pushpin for actuating said reciprocating pump, said pushpin being actuated by said reciprocating piston and a compression spring biasing said reciprocating piston to the top of said cylinder for actuating said pushpin.

2. An earth boring drill for drilling deep wells comprising, in combination, a body member having a fluid-tight reservoir attached at its upper end, a quantity of hydrogen peroxide power liquid in said reservoir, a cylinder attached to the lower end of said body member, a conduit leading from said reservoir to said cylinder, a reciprocating spring biased piston disposed operatively in said cylinder, a catalyst mounted on the head of said spring biased piston, said catalyst being adapted to promote decomposition of hydrogen peroxide, an earth boring means secured to and actuated by said spring biased piston mounted to move relative to said cylinder, said boring means being disposed to extend into boring relation with the earth formation, a pushpin for actuating said reciprocating pump, said pushpin being actuated by said spring biased piston and said spring of said spring biased piston biasing said piston at the upper end of its stroke to actuate said pushpins.

3. An earth boring drill for drilling deep wells comprising, in combination, a body member having a fluid-tight reservoir attached at its upper end, a quantity of hydrogen peroxide power liquid in said reservoir, a cylinder attached to the lower end of said body member, a conduit leading from said reservoir to said cylinder, an exhaust vent in the wall of said cylinder, said body member, reservoir and cylinder being disposed along a common axis and being adapted to be lowered into a well, a reciprocating pump in said conduit for pumping liquid from said reservoir to said cylinder, said reciprocating pump comprising a spring loaded first piston attached to one end of a pushpin and the other end of said pushpin extending through said body member into said cylinder, a reciprocating spring biased piston disposed operatively in said cylinder, a catalyst mounted on the head of said spring biased piston, said catalyst being adapted to promote decomposition of hydrogen peroxide, an earth boring means secured to and actuated by said spring biased piston mounted to move relative to said cylinder, said boring means being disposed to extend into boring relation with the earth formation, said spring biased piston being so disposed with respect to said other end of said pushpin that said second piston contacts said pushpin at a point near the upper end of the piston stroke to actuate said reciprocating pump means, and said spring of said spring biased piston biasing said piston at the upper end of its stroke to actuate said pushpin.

4. An earth boring drill for drilling deep wells comprising, in combination, a body member having a pair of fluid-tight reservoirs attached at its upper end and a cylinder attached at its lower end, a quantity of hydrogen peroxide in one of said reservoirs, a quantity of hydrocarbon fuel in the other of said reservoirs, a first conduit leading from one of said reservoirs to said cylinder, a second conduit leading from the other of said reservoirs to said cylinder, an exhaust vent in the wall of said cylinder, said reservoirs, body member and cylinder, being disposed along a common axis and being adapted to be lowered into a well, a first reciprocating pump in said first conduit for pumping liquid from one of said reservoirs to said cylinder, a second reciprocating pump in said second conduit for pumping liquid from said other reservoir to said cylinder, a reciprocating piston disposed operatively in said cylinder, a catalyst mounted on the head of said piston, said catalyst being adapted to promote decomposition of hydrogen peroxide, an earth boring means secured to and actuated by said piston mounted to move relative to said cylinder, said boring means being disposed to extend into boring relation with the earth formation, a first pushpin for actuating said first pump, a second pushpin for actuating said second pump, said pushpins being actuated by said reciprocating piston, and a compression spring biasing said reciprocating piston to the top of said cylinder for actuating said pushpins.

5. An earth boring drill for drilling deep wells comprising, in combination, a body member having a pair of fluid-tight reservoirs attached at its upper end and a cylinder attached at its lower end, a quantity of hydrogen peroxide in one of said reservoirs, a quantity of hydrocarbon fuel in the other of said reservoirs, a first conduit leading from one of said reservoirs to said cylinder, a second conduit leading from the other of said reservoirs to said cylinder, an exhaust vent in the wall of said cylinder, said reservoirs, body member and cylinder being disposed along a common axis and being adapted to be lowered into a well, a first reciprocating pump in said first conduit for pumping liquid from said one reservoir to said cylinder, a second reciprocating pump in said second conduit for pumping liquid from said other reservoir to said cylinder, a reciprocating spring biased piston disposed operatively in said cylinder, a catalyst mounted on the head of said spring biased piston, said catalyst being adapted to promote decomposition of hydrogen peroxide, an earth boring means secured to and actuated by said spring biased piston mounted to move relative to said cylinder, said boring means being disposed to extend into boring relation with the earth formation, a first pushpin for actuating said first pump, a second pushpin for actuating said second pump, said pushpins being actuated by said reciprocating piston, said spring of said spring biased piston biasing said piston at the upper end of its stroke to actuate said pushpins.

6. An earth boring drill for drilling deep wells comprising, in combination, a body member having a pair of fluid-tight reservoirs attached at its upper end and a cylinder attached at its lower end, a quantity of hydrogen peroxide in one of said reservoirs, a quantity of hydrocarbon fuel in the other of said reservoirs, a first conduit connecting one of said reservoirs with said cylinder, a second conduit connecting the other reservoir with said cylinder, an exhaust vent in the wall of said cylinder, said reservoirs, body member and cylinder being disposed along a common axis and being adapted to be lowered into a well, a first reciprocating pump in said first conduit for pumping liquid from said one reservoir to said cylinder, a second reciprocating pump in said second conduit for pumping liquid from said other reservoir to said cylinder, a catalyst mounted on the head of said piston, said catalyst being adapted to promote decomposition of hydrogen peroxide, an earth boring means secured to and actuated by said piston mounted to move relative to said cylinder, said boring means being disposed to extend into boring relation with the earth formation, a first pushpin for actuating said first pump, a second pushpin for actuating said second pump, said pushpins being actuated by said reciprocating piston, said spring of said spring biased piston biasing said piston at the upper end of its stroke to actuate said pushpins.
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cylinder, a second reciprocating pump in said second conduit for pumping liquid from said other reservoir to said cylinder, each of said reciprocating pumps comprising a spring loaded piston attached at one end of separate pushpins and the other end of said pushpins extending through said body member into said cylinder, a reciprocating spring biased piston disposed operatively in said cylinder, a catalyst mounted on the head of said spring biased piston, said catalyst being adapted to promote decomposition of hydrogen peroxide, an earth boring means secured to and actuated by said spring biased piston mounted to move relative to said cylinder, said boring means being disposed to extend into boring relation with the earth formation, said spring of said spring biased piston biasing said piston at the upper end of its stroke and said spring biased piston being so disposed with respect to said other end of said pushpins that said spring biased piston contacts said pushpins at a point near the upper end of its stroke to actuate said first and second reciprocating pumps.

7. An advancing motor earth boring drill comprising in combination a housing, means for lowering and supporting said housing adjacent the bottom of an earth bore, a tank secured to said housing for containing catalytically decomposable fuel, an expandable chamber internal combustion motor comprising a cylinder and a piston member reciprocable in said cylinder, and a piston member having a drill bit secured thereto, a catalyst member positioned on one of said cylinder and piston members in said expandable chamber of said motor adapted to decompose said fuel, means adapted and disposed to bias said piston relative to said cylinders to reduce the volume of said expandable chamber and to be overcome by gas pressure therein due to said decomposition of said fuel, and means to inject fuel from said tank into said chamber into contact with said catalyst when said piston reduces the volume of said chamber to a predetermined value.

8. The combination of claim 7 in which the fuel is hydrogen peroxide.

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