

Aug. 15, 1933.

H. D. SANDSTONE

1,923,015

ADVANCING MOTOR DRILLING STRUCTURE

Filed Feb. 3, 1931

3 Sheets-Sheet 1

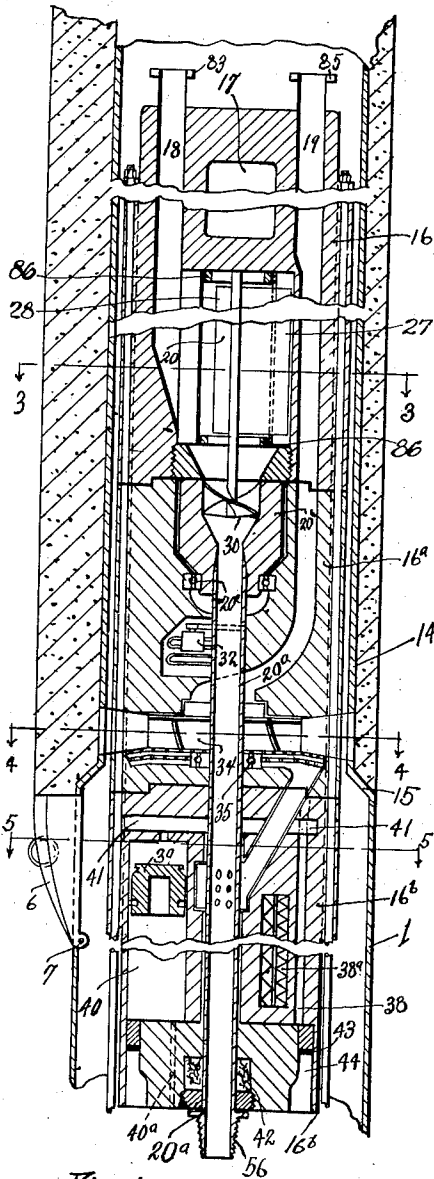


Fig. 1.

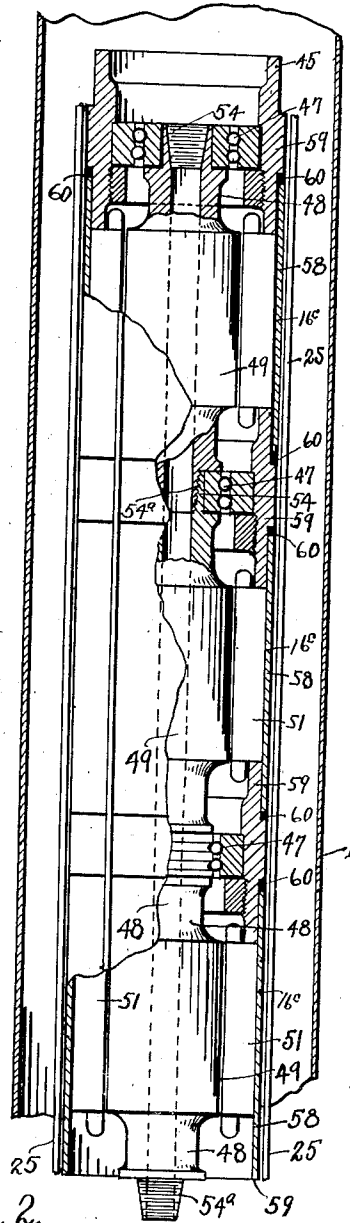


Fig. 2.

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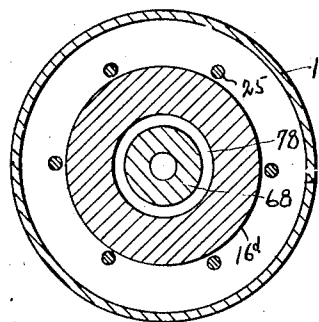
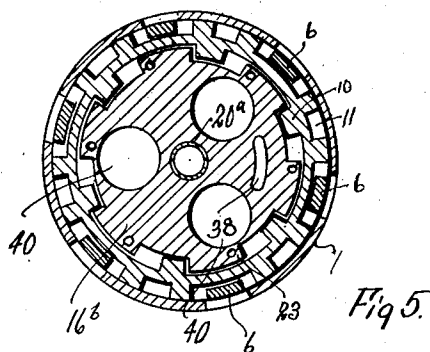
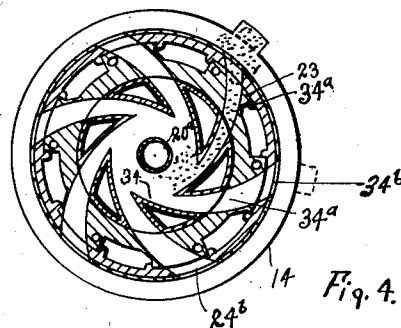
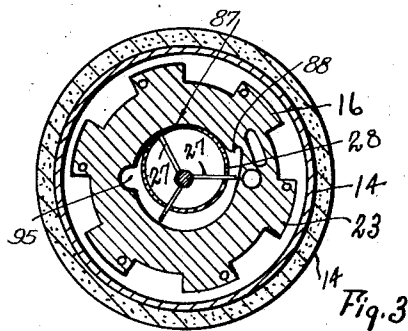
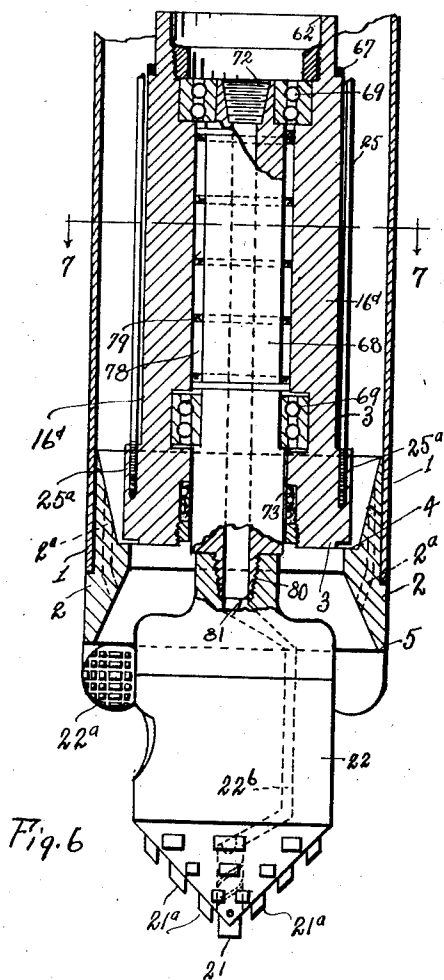
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3 Sheets-Sheet 2



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ADVANCING MOTOR DRILLING STRUCTURE

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3 Sheets-Sheet 3

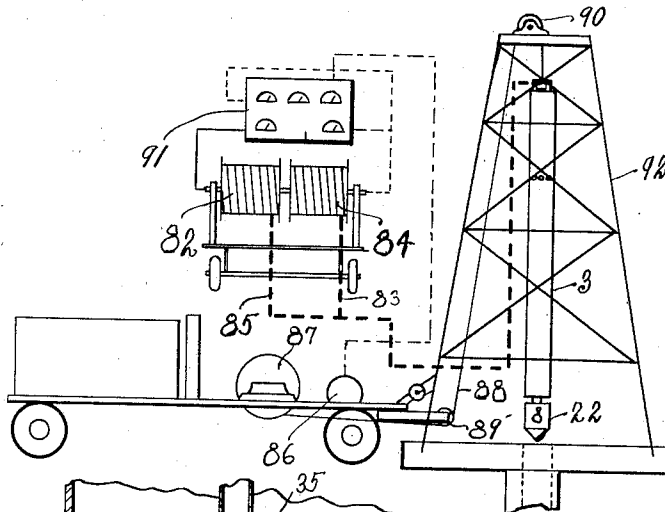


Fig. 8.

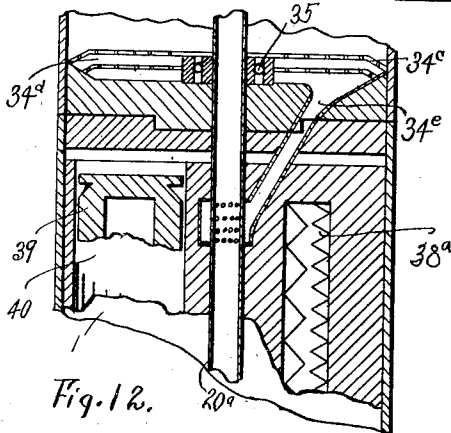


Fig. 12.



Fig. 9.

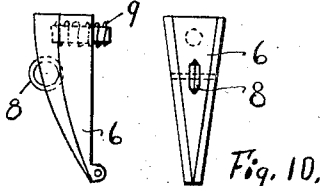


Fig. 10.

Fig. 11.

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1,923,015

ADVANCING MOTOR DRILLING STRUCTURE

Harvey David Sandstone, Los Angeles, Calif.

Application February 3, 1931. Serial No. 513,110

15 Claims. (Cl. 255—4)

This invention has to do with an "advancing motor drilling structure", and relates to an application filed by me on May 22, 1930, Serial Number 454,841, entitled "Method and apparatus for drilling and casing wells".

An object of the invention is to provide means for drilling holes, and especially deep holes in the earth's formation which will have the same size throughout its entire length.

A further object of the invention is that it is provided with its own power unit which is located near the point of contact, delivering the maximum degree of power and efficiency.

Another important feature of the invention resides in the provision of means for eliminating drill stems, boilers, high derricks, expensive installations, crooked holes, tapering holes and fishing jobs.

Another object is to provide a well drilling equipment, portable, not excessive in cost and upkeep, with a fast cutting speed bit.

Another object is to provide an oil well drilling unit with its own derrick, pumps, hoisting gear, electric generating oil driven set, and capable of cutting the present cost of producing the hole, in half.

A salient feature of this invention is, that in its construction, nuts, bolts, set screws and gears are entirely eliminated from the inner working parts.

Another object is to provide a drilling structure, simple, strong, economical and reasonable in price, built and repaired by the average machine shop.

Another object of the invention is to provide a drilling rig allowing its operator to remove the bit from a deep hole in a fraction of the present time needed for such an operation.

An important feature of my invention is to provide means which are effective for drilling a hole at any depth, and straight, regardless of underlying formation, or at any selected angle.

Another important feature of this equipment resides in the provision of means for compressing the greater part of the hole's formation into the walls as the drill is making the hole, thus building up a solid, non-collapsible wall and eliminating the necessity of bringing all the drillings to the surface.

An economic and scientific feature provides for the operating of a plurality of motors of high speed and high voltage, thus, first, increasing the life of the drill, and in case one motor goes out, the remainder are capable of continuing the work without laying up the equipment.

Second, high speed eliminates the use of reduction gears, slip joints and stuffing boxes within its working parts. Third, the high voltage can be carried to a much greater distance in a much smaller cable than the same amount of H. P. could be handled using low voltage.

The object of the relatively superposed section construction is to eliminate all unnecessary cost of labor in manufacturing, repairing, assembling, making the sections in duplicate, as well as the motors and sectional shaftings.

Another important feature of the invention resides in the provision of means for seating the drill in a hollow self-supporting torque-resisting unit about the length of the drill body, and filling the diameter of the hole.

Another object is to provide a mechanism for lining the walls of a well with a plastic non-metallic substance during the drilling operation, which is equipped with a drill supporting seat at its lower end, and an anti-torque means at its mid-section.

Another object is to eliminate the high pressure pumps at the top of the well, stepping up pressure with a booster located below in the drill body, thus doing away with the strain on the above equipment and hose line.

Another object of this invention is to provide an automatic, hydrostatic, regulated inward pressure equalizer, so constructed as to be able to carry liquid of cooling and non-conductive properties under pressure in the motor chambers.

Another object is to provide an actuating pressure-developing means adapted to thoroughly mix the plastic casing forming materials, and compress same within its form and into the earth formation with such force as to force the liquid out of the same and tamp same firmly into position, leaving a solid compressed mass to set and harden properly.

Another object is to provide a drilling unit so equipped that circulation can be applied at all times without breaking any connections when drill is being raised or lowered into the hole.

Another object is to provide a drilling unit adapted to start a hole without spudding in, and every foot of hole is finished and cased complete as drill passes on.

Another object is to provide water sealing and gas sealing means accompanying the drilling operation.

Another object is to provide a porous cementitious casing to be applied when the oil sands are encountered and want to be saved. Thus elim-

inating the use of steel fabricated oil screen casing.

The invention is not limited to the specific construction shown, and it is understood that forms of embodiment other than those shown may be employed without departing from the invention or from the principles herein disclosed and embodied in the mechanism herein set forth and claimed.

Other objects, advantages and features of the invention may appear from the accompanying drawings, the subjoined details and the appended claims.

The accompanying drawings illustrate the invention.

Fig. 1 is a fragmental vertical sectional elevation of the invention, showing the drilling mechanism comprising the head section including the circulating pump, the cement distributing section, including the refrigerating system, the equalizer section including the plunger equalizers and transformers, and also shows the anti-torque means making contact with the formation.

Fig. 2 is a fragmental vertical intermediate sectional elevation of the drilling mechanism showing three motor sections.

Fig. 3 is a section on line 3—3 of Figure 1, showing the water pump.

Fig. 4 is a section on line 4—4 of Figure 1, showing the cement distributor.

Fig. 5 is a section on line 5—5 of Figure 1, showing anti-torque seat, equalizing plungers, circulation ducts and power leads.

Fig. 6 is a fragmental vertical sectional elevation of the lower end section of the drilling mechanism showing the bit in operation.

Fig. 7 is a section on line 7—7 of Figure 6, showing the hollow driving shaft, shaft housing and also shows the anti-torque clamping rods.

Fig. 8 is a diagrammatical side elevation of the invention showing the drill mechanism in position just after having been removed from the hole, a meter board and hose reels and hoisting rig trailer are also shown.

Fig. 9 is a plan detail view of the anti-torque clamp.

Fig. 10 is a side elevation of the anti-torque clamp.

Fig. 11 is a front elevation of the member shown in the two preceding views.

Fig. 12 is a longitudinal section showing the liquid extracting means with vacuum by-pass, check valve, and sucking pores in bottom of cement distributor.

The invention includes an elongated tubular traveling unit 1. This has mounted within its lower end a supporting driving-seat gauge 2 provided with a seat 4 upon which seats the drill 3, drill 3 being spaced somewhat from the inner wall of unit 1. Ducts 2a in the gauge provide a fluid passageway to the spacing between drill and unit 1. A driving point or edge 5 at the lower end of said gauge determines the cross sectional area of the hole to be drilled. Projecting from the outer wall of unit 1, at its upper end, are a plurality of anti-torque clamps or blades 6, preferably equally spaced about the perimeter of unit 1, which are pivotally mounted thereto as indicated at 7. These clamps or blades are provided with cutters or rollers 8 which engage the formation through which the unit 1 passes and serve to overcome axial movement or rotation thereof. Springs 9 at the upper ends of the clamps afford them a required

amount of yieldability as the unit passes through various formations. To avoid rotation of drill body 3 with regard to unit 1, this unit is provided with spline seats 10 which are engaged by the splines 23 of the member 3. Fluid passageways 11 are provided through seat 10.

Attached to the upper end of unit 1 is a tubular follower 14. This follower is of somewhat less diameter than the other member, and, as a consequence there is an annular spacing between its perimeter and the face of the drilled hole, member 1, as before stated determining the diameter or cross section of such hole.

It is the purpose of this invention, as the drill descends through the earth formation, and as required by the nature of such formation, to line the hole being drilled with a cement lining or facing. For this purpose the follower 14 acts as a mold during the initial hardening thereof. The operation in this respect will be described later.

Drill 3 is an assembly of a number of units which are interchangeable with other like or standard units. One unit contemplates ejecting cement against the wall of the hole being drilled for the purpose of lining the same, in doing so an inner form must be provided, and for this purpose the member or follower 14 is provided. This is of sufficient length to allow setting of the concrete or cement as it travels downward with unit 1. A conical junction 15 is provided between members 1 and 14, this member acting as a base for the cement as it is being poured.

The drill here illustrated comprises an assembly of units or sections, as, for instance, a top and pump section 16, a refrigerant and cementing section 16a, a hydrostatic equalizer and transformer section 16b, one or more motor sections or units 16c, and a lower bearing section 16d. Top section 16 is provided with a hoisting eye 17 for cable attachment. A water supply passageway 18 is provided therein to which is connected a water hose 83 running to a supply source. Likewise is shown a cement passageway 19 connected to a supply hose 85, it in turn being connected to a source of supply. Passageway 18 leads to the inlet port 95 of a rotary pump 20 which is provided with rotatable blades 27 axially connected and actuated by the hollow shaft 20a. Said blades extend through slots in a cylindrical body 28 which is mounted for rotation eccentrically of the pump-shaft on guides 86. Said body bears upon the pump-walls at 87 to form a barrier between the port 85 and the outlet port 88 so that the rotary movement of the blades from the inlet to the outlet port will impel the entering water towards the latter and increase the pressure thereof in the hollow-shaft 20a with which the outlet port connects. Shaft 20a is connected with other hollow shafts, hereafter described, located between it and such bit. An enlargement or head 20b on shaft 20a rotates in bearings 20c. This head carries a rotary or spiral check valve 30 controlling back pressure.

Passageway 19 leads through section 16 into section 16a to the centrifugal cement distributor or expeller 34. Cement mixture delivered thereto is forced out through passageways 34a and 34b to the sidewall of the hole which is being drilled. Distributer 34, rotated by shaft 20a, is journaled in bearings 35. The bed 34c of the distributor 34 is perforate to allow communication to a chamber 34d therebelow. Chamber 34d communicates with passageway 34e which in

turn is connected with the passageway in shaft 20a. The passage of water through shaft 20a creates a suction in passageway 34e thereby reducing an excessive water content in the cement solution handled by the distributor.

The next section is 16b the transformer and hydrostatic equalizer section. This section accommodates a high voltage transformer 38a which is connected with the motors in section 16c. A power lead passageway 38 is provided for the necessary power cables. This section is provided with a plurality of cylinders 40 in each of which operate a plunger 39. Passageways 41 communicatively connect to the cylinders above the plungers with the space between the lower sections and the tubular unit 1. Below the plungers the cylinders form an oil reservoir in communication by means of passageway 40a to the interior of the motor housing 16c and thereby maintain an equilibrium of pressures between the interior of the sections and the exterior thereof.

The motor section 16c connects with the transformer section 16b at the bottom thereof, the motor shaft 48 being connected to shaft 20a by the threaded connections 54 and 56. Section 16c is provided with an annular flange 45 which enters the annular socket 44 of member 16b and bears upon the packing 43. A packing gland 42 located at the lower end of member 16b prevents water seeping into the motor chambers. Shaft 48 consists of three alike interchangeable sections, each provided with female threads 54 at one end and male threads 54a at the other end. These shafts are arranged end to end as shown in Figure 2. Shafts 48 revolve in bearings 47. Shafts 48 carry armature windings 49 associated with the field windings 51. The motors are carried in shells 58 mounted upon bearing castings 59. Water tight gaskets 60 are provided to keep water out of the motor chambers. The shells and castings are held in mounted position by the tie rods 25 hereafter referred to.

Section 16d is attached to the lower end of section 16c, it having an annular flange 62 fitting within the end of lowermost shell 59 and is held in such position by the aforementioned tie rods 25, the shell engaging gasket 67 to provide a water-tight joint. This section carries for rotation a hollow shaft 68 complementing the previously described hollow shafts. This shaft has a female thread 72 for threading with the male thread 54a on shaft 48. Shaft 68 is mounted in bearings 69. A stuffing gland 73 is provided for keeping out foreign material. A space 78 is provided about shaft 68 between rings 79 for a hard grease packing. The lower end of shaft 68 is provided with threads 80 which thread with threads 81 of bit 22.

The several sections of the drill body just described are held together by the tie rods 25. These rods pass through splines 23 on sections 16, 16a and 16b, and along sections 16c and 16d, and have their lower ends threaded into the short splines 25a at the lower end of section 16d.

Bit 22 is provided with a point cutter 21 connected by a passageway 22b to the hollow shafts already described. This allows water to be fed to the cutting or drilling region. In addition thereto, bit 22 is furnished with additional cutters 21a at the sides of cutter 21, and pivoted side reamers 22a.

The apparatus used in connection with the drill just described is shown in Figure 8, show-

ing a hose reel 84 for hose 83 supplying water to the drill; and a reel 82 for the cement mixture hose 85. Drill 3 is suspended to cable 88 which passes over crown block 90 and lower sheave 89 to hoisting drum 87. Motor 86 drives drum 87. A power panel 91 is associated with the foregoing apparatus.

In practical operation, to start a hole, the drill is put into the traveling unit 1, which at its lower end is the same diameter as the rough unfinished hole to be drilled, and extends its length from the shoulder of the drill bit 22 upward to the lower end of the cement distributor outlets 34a. The upper end tapers to the desired size of the inside of the finished cased well, the difference being the thickness of the cement casing. Traveling unit 1, is provided around its outer diameter with equally spaced clamps 6 which compress against the formation when traveling, thereby preventing unit 1 rotating, and in addition these clamps cut a substantial corrugation or indenture in the formation which fills with cement and furnishes a fastening for the cement to hang to while curing.

In the progress of the drill, follower 14 moulds and supports the walls during the setting interval.

The drill is positioned in the traveling unit 1, resting on seat 4 and the bit 22 revolving at the proper speed. Lower cutters 22a operate in the water cushion furnished through the flexible conduit 83 heretofore referred to. The under reamers 22a when centrifugally expanded cut the proper sized hole to allow the gauge 5 to enter, and in addition acting as governors to regulate the motor load and speed. They also beat a substantial part of the formation into the walls, thus building up a solid wall surface and eliminating the need of removing the entire refuse from the well. When gas or water pressure is encountered cement material in solution can be applied through the water supply system to the point of bit 21 for the purpose of allowing the under reamers to beat and force the cement into the crevices, thereby shutting off the gas and water pressure if such is not desired.

When the desired liquid bearing formation is encountered, in place or the non-porus cement, a porous cementitious material can be used, thereby allowing the encountered liquid to freely enter through the porous casing into the well. There are many ways this porous casing may be made, I claim only the process of eliminating the steel perforated sand-screen casing and applying a porous cementitious casing so constructed as to allow the passage freely of the desired liquid as naturally as nature has provided for its movement, it being also a non-sand clogging casing.

When the drill is raised from the hole by the hoisting cable 88, the flexible cement conveyor is reeled upon power driven reel 82, and the liquid conductor 83 on power driven reel 84. These reels have hollow liquid transmitting shafts fastened to respective pumps.

What I claim is:

1. In drilling mechanism, a drill body consisting of superposed sections connected together by male and female joints, one of said sections being a cement distributing section having rotative actuating means, a revolving bit carried by the body, sealing means between said joints and means for revolving the bit.

2. In mechanism of the class described, a rotary drill bit, a superstructure supporting the drill bit, means for feeding cement to the super-

structure, and rotative means for discharging cement from the structure by centrifugal action for applying same to the walls of a hole formed by said drill bit.

3. In a mechanism of the class described, a rotary drill bit, a sectional superstructure supporting said bit, one section being provided with rotary means for discharging cement for lining the wall of the bore made by said drill bit, vacuum forming means to remove an excessive liquid content from said cement before applying same to the walls, pumping means to force liquid through the bit to the bottom of the well bore, and to operate said vacuum forming means.

4. In well-drilling apparatus, the combination of a lower section including a bit, an upper section including a pump, an intermediate section including cement distributing devices, an intermediate section including a plurality of motors operatively connected with said bit, and an intermediate section including a cylinder and plunger therein to equalize the pressures between the exterior of the apparatus and the interior of the sections containing said motors.

5. In well-drilling apparatus, the combination of a tubular unit, a lower section within said unit including a bit, an upper section including a pump, an axially disposed, rotatable, hollow shaft to which the rotor of said pump and said bit are connected and through which water is supplied to said bit, an intermediate section including a plurality of motors of which the armatures are connected for the operation of said shaft, and an intermediate section including a rotary cement distributing device arranged to deposit cement by centrifugal action exteriorly of said tubular unit.

6. In well-drilling apparatus, a combination of a tubular unit, a lower section within said unit including a bit, an upper section including a pump, an axially disposed, rotatable, hollow shaft to which the rotor of said pump and said bit are connected and through which water is supplied to said bit, an intermediate section including a plurality of motors of which the armatures are connected for the operation of said shaft, an intermediate section including a rotary cement distributing device arranged to deposit cement by centrifugal action exteriorly of said tubular unit, spaced perforated plates forming the lower wall of said cement distributing device and a suction tube communicatively connecting the space between said perforated plates and the bore of said hollow shaft whereby the flow of water in said shaft will cause a suction to form in said tube to extract excess moisture from concrete mixture in said distributing device.

7. In well-drilling apparatus, a tubular unit having its upper portion of relatively reduced diameter, a lower drilling section within said unit including a bit, an upper section including a pump, an axially arranged rotatable, hollow shaft to which the rotor of said pump and said bit are connected and through which water is supplied under pressure from said pump to said bit, an intermediate section including a plurality of motors of which the armatures are connected for the operation of said shaft, and an intermediate section including a rotary cement distributing device arranged to deposit cement by centrifugal action exteriorly of said tubular unit within an annular space formed by the reduced portion of the unit.

8. Well-drilling apparatus, consisting of a cas-

ing movable longitudinally of the well-bore, expansible clamps hingedly connected upon the exterior of the casing and spring-pressed into engagement with the wall of the well-bore to prevent the rotation of the casing in the well-bore, a sectional body received in said casing and slidably connected thereto to prevent relative rotation, a rotatable shaft extending through said body, a drill bit mounted upon said shaft, and a motor in said body to actuate said shaft.

9. Well-drilling apparatus, consisting of a casing movable longitudinally of the well-bore, a sectional body received in said casing and slidably connected thereto to prevent relative rotation, a rotatable shaft extending through said body, a drill-bit mounted upon said shaft, a motor in said body to actuate said shaft, and a centrifugal cement distributing device operated by said shaft.

10. Well-drilling apparatus, consisting of a casing movable longitudinally of the well-bore, a sectional body received in said casing and slidably connected thereto to prevent relative rotation, a hollow, rotatable shaft extending through said body, a drill-bit mounted on said shaft, a motor in said body to actuate said shaft, a pump in said body the rotor of which is operatively connected to said shaft to supply water under pressure to said bit, a rotary cement distributing device arranged to deposit cement by centrifugal action exteriorly of said casing, spaced perforated plates forming the lower wall of said device, and a suction tube communicatively connecting the space between said plates and the bore of said shaft whereby the flow of water in said shaft will cause suction to form in said tube to extract the excess water from the concrete mixture in said device.

11. Well-drilling apparatus as specified in claim 10, wherein the casing adjacent the outlets of the cement-distributing device and thereabove is of reduced diameter to provide a space within which the cement is deposited to form a lining for the well-bore.

12. Well-drilling apparatus, consisting in a casing movable longitudinally of the well-bore, a body slidably received in said casing and held therein against relative rotation, a shaft rotatably mounted in said body, a drill-bit mounted upon said shaft, a motor operatively connected to said shaft, a cement-distributor in said body actuated by said shaft to discharge cement upon the walls of the well-bore exteriorly of said casing, and means to supply plastic cement to said distributor.

13. Well-drilling apparatus as set forth in claim 12, characterized by the casing having its upper portion of reduced diameter to provide an annular space between the casing and the wall of the well-bore, and wherein the cement-distributor is positioned and adapted to discharge cement material upon said walls and within said space.

14. A drilling mechanism, consisting of bearing journaled sections, motors mounted on said bearings and within said sections; sealing means connecting the ends of said section together, providing a sealed chamber of sections in which said motors operate; said motors so constructed as to allow their being submerged, and operating in a suitable liquid; an equalizing means adapted to compress said interior chamber liquid in conformity with the outer or hydrostatic pressure thereof; a cooling medium adapted to hold the interior mechanism at a given temper-

ature best suited for its proper functioning; a shaft rotatably connected to said motors and adapted to accommodate a bit at its lower end.

15. A mechanism adapted to cause the forming of holes in the earth's formation, said mechanism comprising a body; a distributor therein adapted to apply a cementitious material to the walls of said holes, forming a liner therein; actuating means within said body and adapted

to rotate a shaft connected thereto; a bit detachably mounted to the lower end of said rotated shaft and adapted to successfully attack the formations when rotated, the above mechanism detachably mounted within a traveling unit, adapted to move longitudinally of the well's bore with the progression of the drilling mechanism.

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