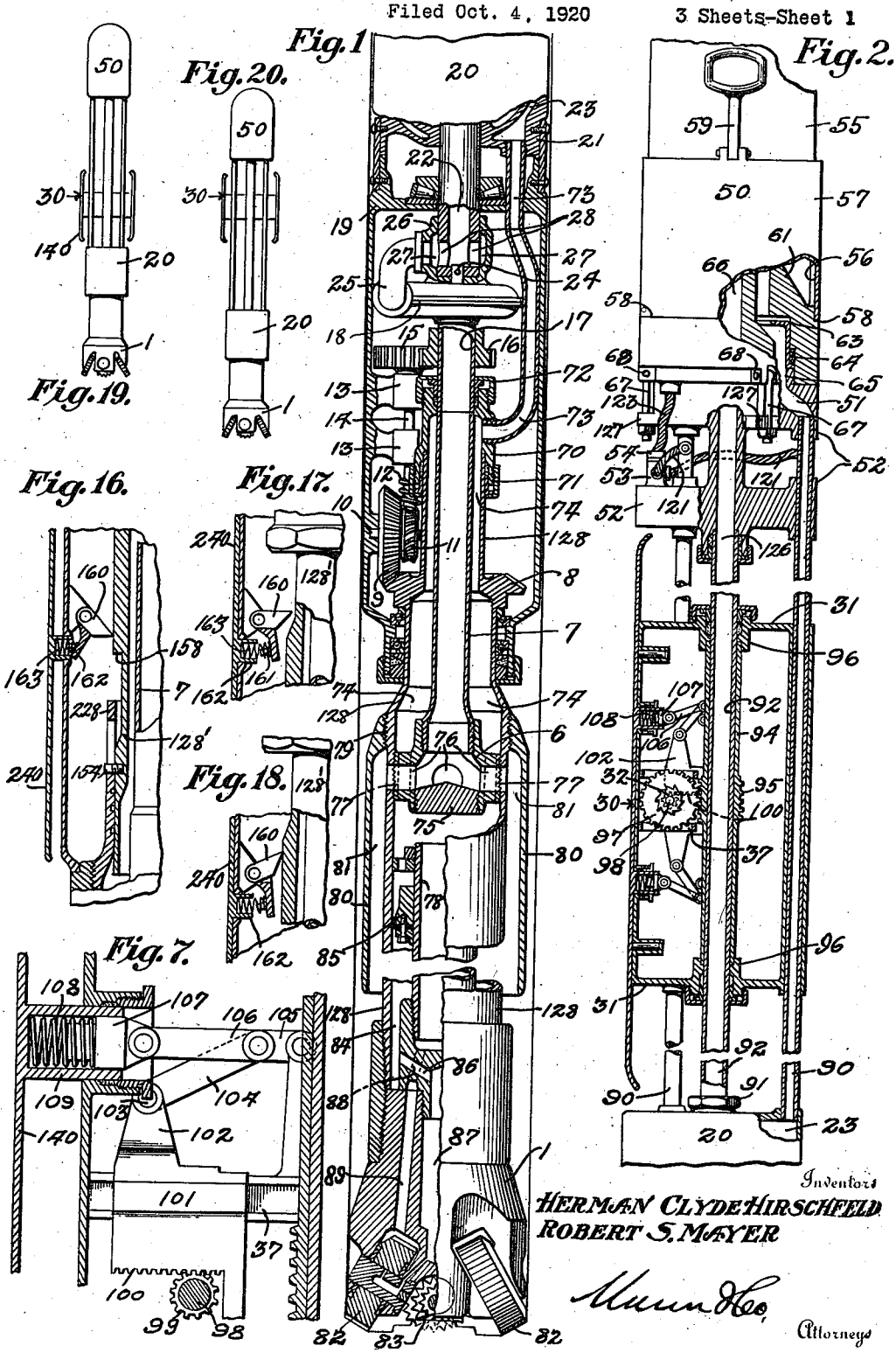
Dec. 18, 1923. 1,477,563

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WELL DRILLING APPARATUS

Filed Oct. 4, 1920 3 Sheets-Sheet 1



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WELL DRILLING APPARATUS

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Fig. 3.

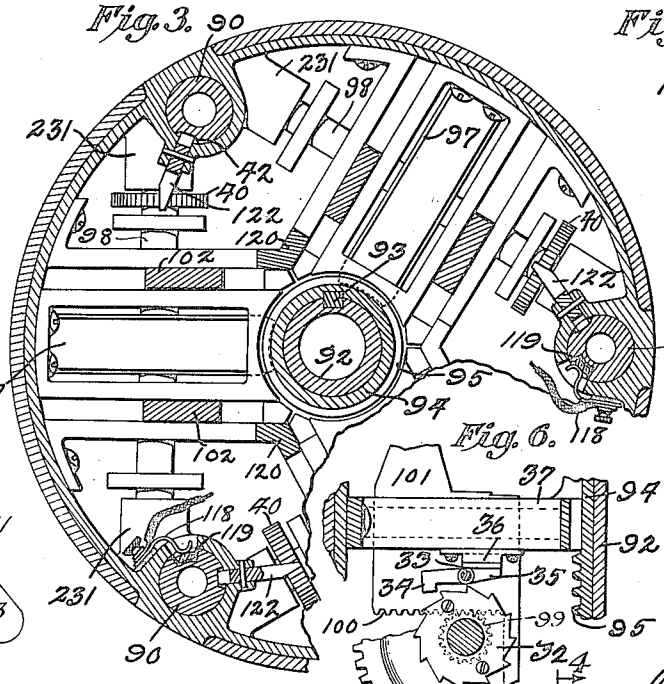


Fig. 8.

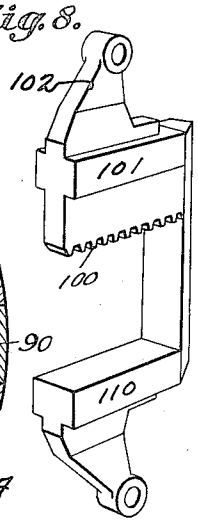


Fig. 9.

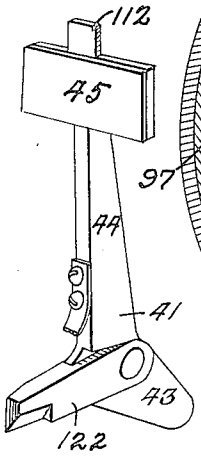


Fig. 6.

Fig. 4.

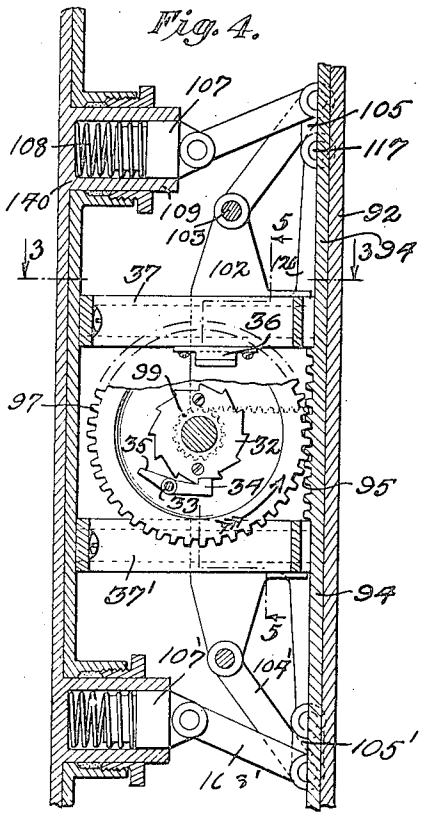
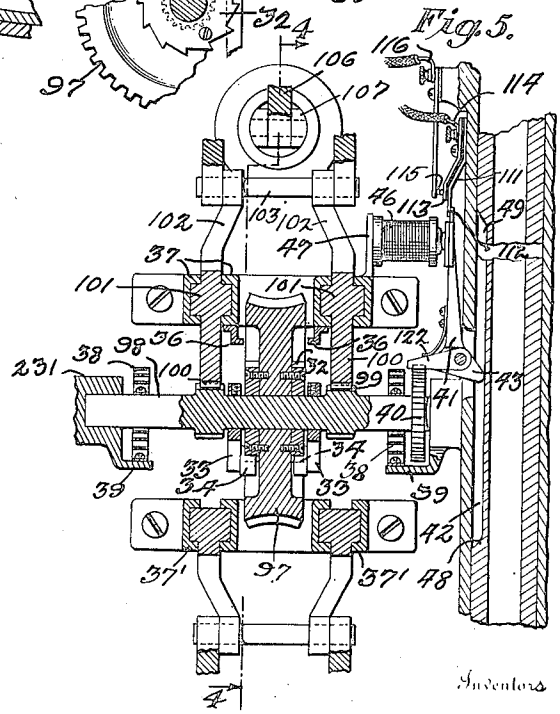


Fig. 5.



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WELL DRILLING APPARATUS

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Fig. 10.

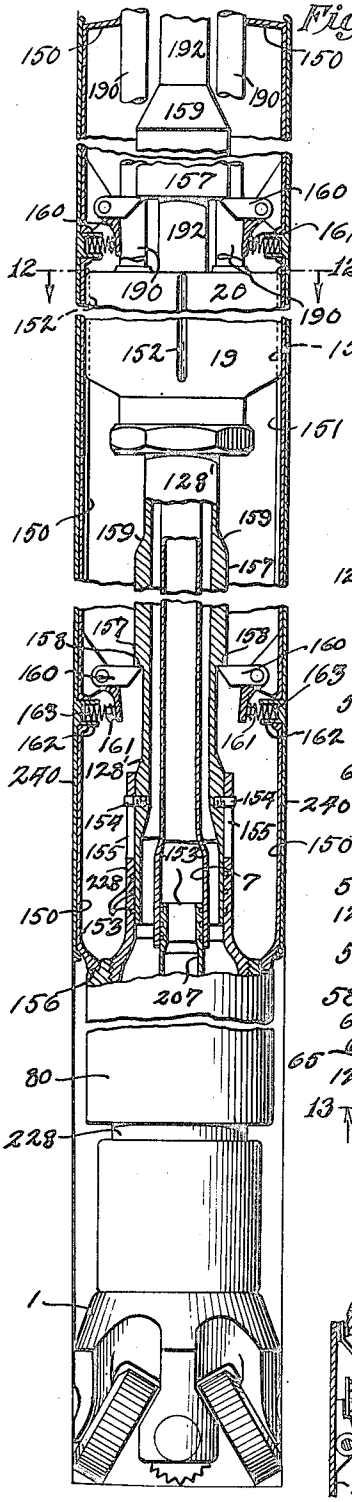


Fig. 11.

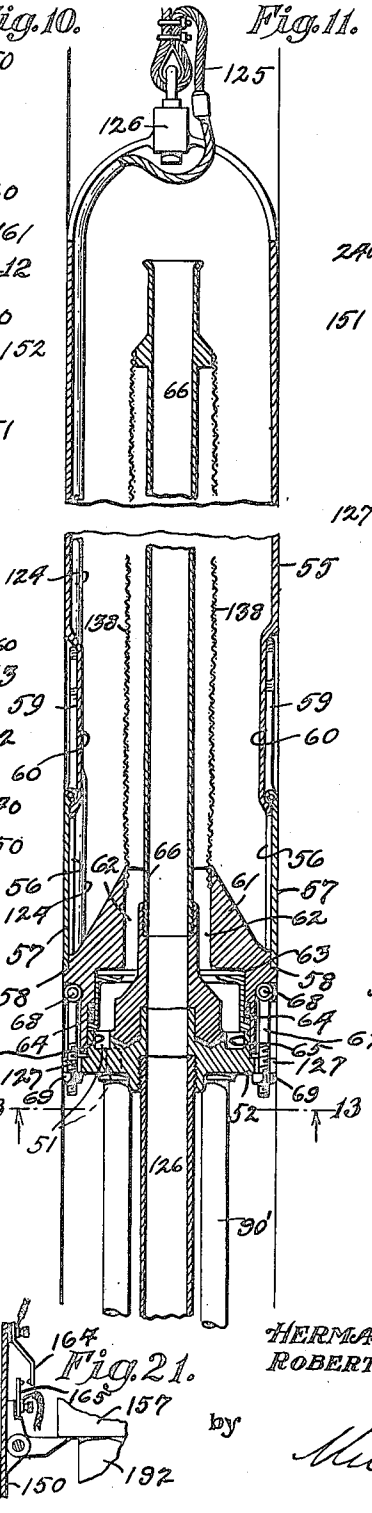


Fig. 12.

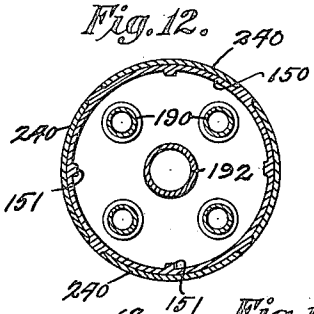


Fig. 13.

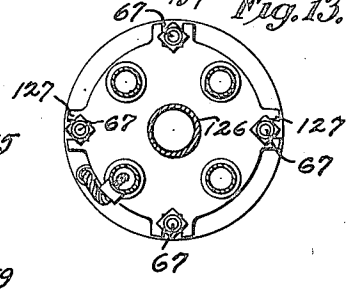


Fig. 14.

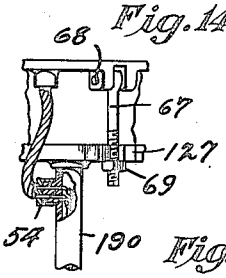


Fig. 15.

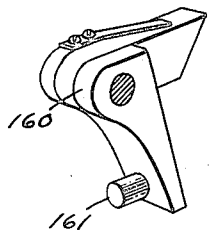


Fig. 21.

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UNITED STATES PATENT OFFICE.

HERMAN CLYDE HIRSCHFELD AND ROBERT S. MAYER, OF EASTLAND, TEXAS.

WELL-DRILLING APPARATUS.

Application filed October 4, 1920. Serial No. 414,578.

To all whom it may concern:

Be it known that we, HERMAN CLYDE HIRSCHFELD and ROBERT STENTEN MAYER, citizens of the United States, and residents of Eastland, in the county of Eastland and State of Texas, have invented certain new and useful Improvements in Well-Drilling Apparatus, of which the following is a specification.

This invention relates to well drilling apparatus and more particularly pertains to the rotary type of machines used in drilling oil, gas and water wells. It is also applicable to diamonds and shot drills and in fact any rotary type machine used in prospecting the subterranean strata.

It is an object of this invention to provide a device in which it will not be necessary to employ extra heavy draw works or hoisting units and extra sheaves for raising long strings of driving pipes from the well and whereby it will be unnecessary therefore to at any time stop the work of drilling for uncoupling great lengths tool joints.

It is a further object of this invention to provide a device which may be operated within the well and in which it is unnecessary to employ the use of steam and a boiler in close proximity to the derrick so that the danger of fire will be eliminated.

Another object of the invention is to provide a device which will be quiet and simple in operation and one in which the power employed will be within a few feet of the resistance and always retaining a constant relationship whereby the bit may be driven faster and provide for a quicker cut when drilling.

It is a further object of this invention to provide a device in which the torsional strains present in long strings of pipe will be eliminated.

Generally speaking, the principle is that of providing an apparatus that enters the hole or bore, comprising a drilling unit, that has directly connected to it a driving unit to provide power, and a clutch unit to react against the drill torque.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings, in which:

Figure 1 is a longitudinal section of the lower portion of one form of the invention that uses the motive power for closing the clutch,

Figure 2 is a similar view of the upper portion of the same form of apparatus with some parts shown in elevation,

Figure 3 is an enlarged transverse cross section through the clutch of the form shown in Figure 1 and Figure 2 taken on the dotted lines 3—3 of Figure 4,

Figure 4 is a fragmentary section showing some details of the clutch used in the apparatus illustrated in Figures 1, 2 and 3, taken on the dotted lines 4—4 of Figure 5,

Figure 5 is a fragmentary section taken on the dotted lines 5—5 of Figure 4,

Figure 6 is a fragmentary detail showing the alternate position of some of the parts illustrated in Figure 4,

Figure 7 is a similar view,

Figure 8 is a perspective view of the sliding member that actuates the connecting links of the clutch shoes,

Figure 9 is a perspective view of the circuit breaking device with the pawl spring broken away for clearness,

Figure 10 is an elevation with some portions broken away, showing the lower portion of one form of the device that utilizes the force of gravity in closing the clutch,

Figure 11 is a section of the upper portion of the device showing the bailer attachment in detail,

Figure 12 is a section taken on the line 12—12 of Figure 10,

Figure 13 is a section taken on the line 13—13 of Figure 11,

Figure 14 is a fragmentary detail of the quick detachable connection of the bailer and drilling unit, and shows the manner in which the circuits can be broken when the bailer is detached for emptying,

Figure 15 is a perspective detail of the arrangement that actuates the clutch shoes in the form of the device shown in Figures 10 and 11,

Figure 16 is a view showing the position the clutch mechanism takes when the device first rests upon the bottom of the hole,

Figure 17 shows the manner in which the clutch is released when a given distance is drilled,

Figure 18 shows the clutch mechanism as it slides by gravity back to its original position after being released,

Figure 19 is a diagrammatic view of the apparatus,

Figure 20 is a similar view in the alternate position, and

Figure 21 is a detail of the circuit breaking device for the simplified form of the machine.

Referring to the drawings in detail, in which like reference characters designate corresponding parts throughout the several views, and more particularly to the construction of the machine as illustrated in Figures 1, 2, 3, etc., the necessary units as described in a preceding paragraph are shown. The bit or cutting unit 1 being the lowermost, the motor or driving unit 20 located in the middle, with the clutch member 30 above it. The armature of the motor is mounted upon a hollow shaft 22 permitting the passage of water, and the motor casing 23 is formed in a water jacket through which circulation is possible. The lower portion of the motor encasement 21 is rigidly connected to another casing 19 in which is mounted a centrifugal pump 18 driven by the rotation of the shaft 22. The inlet to the pump is through the vertical axial pipe 17 which is fastened to and rotates with the impellers of the centrifugal pump, these in turn being made fast to the shaft 22 by the pin 24. The outlet of the pump is through the pipe 25 and casing 26 which has an annular space 27 between itself and the shaft 22. This shaft has openings 28—28 in line with the clearance space 27 and as the shaft rotates the discharge from the pump 18 can find passage through the hollow shaft 22 in an upward direction into the bailer unit 50. Fast to the pipe 17 is a spur gear 16 meshing with a similar gear 15 fixed on jack shaft 14, carried in bearings 13—13, the shaft 14 having at its lower end a worm 12. This worm engages a worm wheel 11, keyed to a stub shaft 10 which also has fixed on it a bevel gear 9. This gear 9 meshes with another bevel gear 8 that is integral with the hollow casing 128 which transmits the rotation to the bit unit 1.

Centrally located in the casing 128 is an axial pipe 7 positioned by the bushing 6 so that it is in line with the inlet pipe 17, of contrifugal pump 18. The pipes 7—17 turn at different rates of speed and to take care of this condition the casing 128 is provided with a cap 70 and stuffing boxes 71 and 72. The cap 70 has one side tapped to receive the pipe 73 that communicates with the water space 23 around the motor 20 and leads into the clearance space 74 between the casing 128 and the pipe 7. The bushing 6 is drilled out centrally and internally threaded or tapped at the top and bottom, the top having the lower end of the pipe 7 threaded or inserted into it and the bottom being provided with a plug 75. The bushing also has radial holes 76—76 and vertical openings 77—77. Thus the water descending from the pipe 73, through the space 74 passes through the openings 77—77 and into the pipe 78. The casing 128 is threaded at 79 and receives a sleeve or ferrule 80 that surrounds the casing 128 but is open at the bottom and provided with a clearance space 81 that leads to the radial holes 76—76 of the bushing 6. This makes the path for the cuttings and water, through space 81, holes 76, the pipes 7 and 17, the pump 18 and thence the pipe 25 and shaft 22 to the bailer 50. The drilling unit 1 illustrated herein is a Reed rotary roller bit of the Caddo type, the side cutters being shown at 82 and stepped cross cutters at 83. At 84 is the oil reservoir, at 85 the plunger that forces the lubricating fluid through the passage 86 and the central opening 87 to the bearing surfaces of pintles that carry the cutters 82—82 and 83—83, as shown particularly in Figure 1. Through the pipe 78 water descends to the openings 88 that lead to the passages 89 where it plays directly on the cutters keeping them cool and softening the formation. It can be readily seen however that with very slight modifications of the casing 8, any rotary bit, fish tail, drag shoe, disk bit, roller bit, or reamer can be applied. Ball bearings and roller bearings are provided to take the longitudinal and radial thrusts and stuffing boxes to keep all moisture away from the mechanism, also are a part of the construction.

In the top of the motor case 20 are fastened a plurality, preferably three, hollow tubes 90—90 that extend upward through the clutch member 30 and are joined to the lower portion 52 of the bailer unit 50. The casing 31 has holes bored through three longitudinal bosses cast integral with it, and the entire unit 30 is free to move in a vertical direction in relation to the rest of the apparatus. However, the tubes 90—90 always maintain the same radial relationship between the clutch and the moving members. The openings in the tubes 90—90 lead at their lower ends into the jacket 23 of the motor 20, and at their upper ends communicate with the outlet passage 51 of the bailer 50. Through a stuffing box 91 located in the center of the top of the motor box 20 extends a hollow shaft or pipe 92, this shaft has a key or feather 93 (best shown in Figure 3) for practically its entire length, and is connected at its lower end with the hollow shaft 22 of the motor armature. The body includes a sleeve 94 having a worm at 95, closely fits the shaft 92 and due to the key 93 turns with the shaft 92. The sleeve 94 bears at each end in bosses 96—96 cast with the casing 31. Engaging the worm 95, are three worm wheels 97—97. These worm wheels 97 turn loosely on three

short shafts 98—98 mounted in bearings 231—231. Fastened to the faces of the worm wheels 97 are ratchets 32 and upon the shafts 98 are set screwed collars 33—33 to which are pivoted pawls 34—34. These pawls engage the ratchets 32 and have their tails 35 offset in such a manner that the rotation of the wheel 97 carries the pawls in the direction of the arrow, and the tails 35 impinge against cam surfaces 36—36. This lifts the pawls from the teeth of the ratchets 32 as shown in Figure 6.

The shaft 98 has machined in it pinions 99—99 that engage racks 100 on sliding members 101. These members 101 slide in guides 37—37 and their upward extensions 102—102 are provided with pivots 103—103. Two flat spiral springs 38 are connected at one end to each of the shafts 98—98 and at the other end to the extensions 39—39 of the bearings 231—231. These springs are so set that their tension is opposed to the movement of the worm wheels 97, and when these latter are turned, through the agency of the ratchets 32—32 and the pawls 34—34 energy is stored in the springs 38—38. To the arms 102 of the sliding members 101 are pivoted at 103 connected levers 104 that are joined to a pair of links 105—106. This linkage is pivoted at 117 on a standard 120 projecting up from the guides 37. The link 106 is pivoted to a plunger 107 that acts against a helical spring 108 in the boss 109 of the clutch shoe 140. These shoes may be made with their surfaces scored, studded, corrugated or cupped to increase their adhesion to the wall of the hole, but for simplicity they are here shown plain.

The unit 101 has a lower part 110 that is symmetrical to the upper part except that there is no rack corresponding to 100. The part 110 works in guides 37′—37′ and simultaneously with the lniks 104, 105, 106 a like arrangement 104′, 105′, 106′, operates a plunger 107′ below. To one end of the shaft 98 another ratchet 40 is attached and against its teeth there works a pawl or catch lever 41. This device which acts as a circuit breaker is shown in detail in Figure 9. It is made in several pieces and pivoted to the longitudinal bosses that guide the tubes 90. These tubes 90 have grooves 42 cut in them and in these grooves the lower extremities 43 of the catch devices 41, slide. The upper arm 44 of the catch device 41 has on it a soft iron armature 45 opposite the poles of a relay or electromagnet 46. This relay is mounted on a lug 47 and is so connected that when the circuit to the driving motor is closed the armature is attracted to the poles of the relay 46. The groove 42 in the tube 90 is in length the same dimension as the vertical movement of the drilling unit in respect to the clutch. When the machine is let down into the hole the clutch is at its lower position as indicated in the diagrammatic Figure 19, and the tongue 43 of the catch 41 is in contact with the lower shoulder 48 of the groove 42, causing the armature 45 to rest against the relay 46 and the leaf spring 111 to be lifted by the lug 112 of the arm 44. This causes the contact 113 that is insulated from the spring 111 and in electrical connection with the binding post 114 to rest against the contact 115 that is connected to another binding post 116. These binding posts are connected by wires to the circuit that feeds the motor, by brushes 118—118 bearing on the exposed surfaces of insulated copper bars 119 set in recesses machined in the tubes 90.

The wiring is so arranged that the relay 46 is on a shunt off the main circuit and this latter is not closed unless the contacts 113 and 115 are together. The shoulder 49 of the groove 42 is so shaped that when the drilling stroke has been completed the part 43 butts against this cam surface 49 and swings the catch 41. This breaks the circuit to the motor, deenergizes the relay 46 and lifts the pawl 122 from the teeth of the ratchet 40. The upper ends of the bars 119—119 that are set in the tubes 90 have soldered to them lead wires 121 that extend to a socket 53 in the lower portion of the bailer 50. This socket is adapted to receive a plug 54, that is readily removable, when the bailer is ready to be dumped. The plug is attached to a cable 123 and the electric leads are carried in this armoured conductor which is itself carried up through the bailer inside a conduit shown at 124 in Figure 11. From the conduit the cable is brought up and the leads joined to the insulated wires in the core of the hoisting cable 125. The cable 125 is fastened by clamps and a thimble to a swivel 126 that is mounted in a boss in the bail of the bailer 50. This bailer is made up of a lower portion and an upper portion 55. The lower portion is a casting so shaped that the tubes 90 can be fastened to it with their openings in line with the passage 51. Also through its central spindle a hole is bored communicating with the opening in the shaft 92 that extends up from the motor and is the outlet of the pump 18. This casting 52 has besides a plurality of two pronged lugs (there shown in Figure 2 and in Figures 11 to 14 which is modified form) 127.

The upper part of the bailer (best seen in Figures 11 and 2) consists of a tubular casing with a bail and swivel attachment at the top as previously described, and having part of its lower end smaller in diameter and with ports 56 cut in this reduced portion. Over this reduced portion slides a sleeve valve 57 that fits water tight around the casing 55 and against the shoulder 58 in the bottom of the bailer. This valve has

a pair of handles 59 attached to it and they are swung out of the recesses 60 when they are to be used to lift up the valve and open the ports 56. The bottom of the upper portion 55 of the bailer differs slightly in the two forms shown because of construction necessities, but in essentials they are the same. A conical shaped bottom 61 has its center formed with a passageway that leads to a valve chamber where a valve 63 loaded with a spring 64 is so located that an annular flange 65 from the lower part 52 of the bailer keeps the valve 63 open when the bailer is assembled, but permits it to spring shut when two members of the bailer are taken apart. A passageway 51 from the valve chamber into the tubes 90 that carry water to the water-jacket 23 of the motor is provided, and in line with the opening in the spindle 126 is the pipe 66. Upward through this pipe the discharge from the pump comes and it flows out the top, the mud and solids falling down into the conical bottom and lodging against the valve 57 while the clear water trickles through the strainer 138. The members of the bailer are fastened together by pivoted bolts 67 pinned at 68 to the upper member 55 and swinging into position between the prongs of the lugs 127—127 (see Figures 13, 14) where nuts 69 are used to clamp them and hold the bailer together.

The operation of this device with motor actuated clutch is as follows:

The entire machine is let down into the hole with the parts in the relative positions in the diagram Figure 19, and when it rests on the bottom of the hole the main switch in the derrick is closed. As the shoulder 48 holds the catch 41 so that the spring 111 is lifted and the contacts 113 and 115 are together, the current passes through the circuit and energizes the relay 46. This makes the armature 45 remain against the poles of the relay. When the current enters the circuit the motor 20 starts and as the shaft 92 is fixed to it, the shaft rotates carrying the sleeve 94 and the worm 95. The worm wheel 97 turns and the part having been in a position as shown in Figure 4, the ratchets 32—32 carry the pawls 34—34 with them in the direction of the arrow. The collars 33 to which are pivoted the pawls 34 are fast to the shaft 98 and with them it turns. The springs 38 are opposed to this motion, and the pawl 122 of the catch 41 is so shaped that it clicks past the teeth of the ratchet 40 and holds it and the shaft from returning under the influence of the springs 38. During this partial turn the pinions 99 cause the rack 100 of the sliding member 101 to move into a position as shown in Figure 7, and the linkage system 104, 105, 106 thrusts the plungers 107 outward. This makes the shoe 140 grip the side of the hole, and prevents the clutch from rotation. The continued rotation of the motor causes the bit to be turned through the following chain of mechanism: the hollow armature shaft 22, the shaft of the centrifugal pump impeller, the pipe 17, the gears 16 and 15, the jack shaft 14, the worm and worm wheel 12 and 11, the bevel gears 9 and 8, and the casing 128. The motor enclosure being rigidly fastened to the tubes 90 that slide in the casing of the stationary clutch 30, does not turn, nor does the casing 19, the centrifugal pump 18, the cap 70 or the bailer 50. As the bit cuts, water from the bailer (or the surface if necessary) flows down through the jacket 23, the pipe 73, the casing 74, the openings 77, the pipe 78, the holes 88 and 89 and out. It mixes with the cuttings, getting them into suspension and the suction of the centrifugal pump draws the mixture up through the space 81, the holes 76 and the pipe 7 to the pump 18, from where it is thrown upward through the elbow 25, the casing 26, the shaft 22, the shaft 92, the pipes 126 and 66, into the bailer 50. From here the clear water trickles through the strainer 138 and past the valve 63 into the tubes 90 that lead to the jacket 23 of the motor 20, etc. This circulating system keeps the motor cool, removes the cuttings from the bottom of the hole where they gum up the bit and it provides the necessary water for the softening of the formations. As the drill cuts, the entire mechanism, except the clutch, slides down by gravitation, until it reaches the position as illustrated in the diagram Figure 20. When this stage has been reached, the tail 43 of the catch 41 strikes against the shoulder 49 of the groove 42 and the whole catch is swung on its pivot. This does several things simultaneously. It disengages the pawl 122 from the ratchet 40 which causes all the parts of the clutch to return to their original positions (shown in Figure 4) at the same time it breaks the circuit stopping the motor. As the clutch retracts itself under the influence of the springs 38—38, it remains unsupported on the tubes 90, and by its weight slides down to the same relative position that it held before drilling commenced. When it reaches this point the mechanism is again in a position to repeat the operation as described. Should it be desired to stop the drilling at any time when the machine is in any stage of the stroke, it is merely necessary to open the switch in the derrick whereupon the circuit is broken and the relay deenergized. This lets the armature move away from the relay, as the spring 111 is under tension and at the same time the pawl 122 is lifted from the ratchet 40 releasing the clutch. Then the parts automatically return to their original positions. On pulling the machine to the surface the procedure would be to pull out the plug 54 and swing the bailer over

the slush pit, first loosening the pivot bolts 67 from the lugs 127 and detaching the two parts of the bailer. Then the sleeve valve 57 would be pulled up by the handles 59 permitting the mud to run out the ports 56.

We have also illustrated a simplified form of the device in which many of the parts of the clutch are eliminated and the power of gravity is used as the means for closing the same. This style device is shown in the Figures 10–18. Here the machine consists of a long tubular casing 150 provided with internal longitudinal ribs 151. Inside this casing or shell, fits a unit that would correspond to the motor casing 20 and the pump and gear casing 19. The outside of this unit has grooves 152 cut in it and in these grooves the ribs 151, slide. Extending through the stuffing box in the bottom of the casing 19 is a tubular shaft 128′ that would correspond to casing 128 and centrally mounted in shaft 128′ is a pipe equivalent to pipe 7. However, these two in this instance are so formed that they are in sliding connection with the pipes 228 and 207, packing rings 153 preventing leakage. Screwed into the tubular shaft 128′ are studs 154 that slide in slots 155 in pipe 228. The lower end of the casing 150 normally rests upon the shoulder 156 of the sleeve or ferrule 80. The connection to the bit is the same as illustrated in Figure 1 and previously described. The motor case 20 has no stuffing box in its top surface but instead the casing is extended upward in the form of a pipe 192, the hole of which leads to the hollow shaft of the motor. Four tubes 190 are shown in lieu of the three tubes 90 but their function is the same, except that one is used entirely as a lead for the cable. The pipes 128′ and 192 are formed with a portion 157 of slightly greater diameter which at its lower end terminates in a shoulder 158 and at its upper end tapers off in a conical frustum 159. This construction is for the purpose of engaging the rocker arms 160 (shown in Figure 15) that actuate the clutch 240. The rocker arms 160 are pivoted to the casing 150, which has openings to accommodate the bosses 162 of the shoes 240. Into hollows or sockets in these bosses and around the pin 161 of the lower arm of the rocker is a spring 163 that establishes a flexible connection between the arm 160 and the clutch shoe 240. There are two sets of these rocker arms, one above the motor and one below, the shoes extending the entire length of the casing. The operation is as follows: The machine is let into the hole with the parts shown in position in Figure 10. The bit comes to rest upon the bottom of the hole, with the casing 150 resting on the shoulder 156 of the sleeve 80. The weight of the casings 20 and 19 and their appurtenances is supported by the cable 125 and as it is slacked off slightly these parts slide down inside the casing 150. The pipe 128′ with its studs 154 assumes a position as shown in Figure 16, which also illustrates what occurs to the rocker arms 160. The arms 160 are swung downwardly, this compressing the springs and forcing shoes 240 outwardly. The clutch shoes are pressed againts the hole walls and the master switch on the surface having been turned on when the machine was let into the hole, the circuit to the motor is completed by the device in Figure 21. Located so that it bears against the shoulder 158 of the spindle 192 above the motor 20, its contacts 164 and 165 are wired to the circuit so that when they are together current flows to the motor, but when they are apart the circuit is broken. When the clutch shoes are pushed out, the contacts are closed and the motor begins to turn. Through a gearing, the same as previously described, located in the casing 19 the shaft 128′ is rotated, and it transmits the turning to the shaft 228 by means of the studs 154 in the slots 155. As the bit drills the cuttings are taken up to the bailer by the suction of the centrifugal pump and the entire apparatus except the casing 150 and the shoes 240 slide down until after a definite distance is drilled, (say 5′). At this time the part 160 rides up to the conical portion 159 of the spindle 192 and swings into a position as illustrated in Figure 17. This releases the clutch, and the casing 150 being unsupported slides downward, the rocker 160 sliding along as shown in Figure 18. The parts again assume their initial position. Should it be desired to stop the drilling when the stroke is incomplete it is merely necessary to take up the slack in the cable 125 and pull the sliding parts up to a position where the rocker arms 160, and the circuit breaking device shown in Figure 21, swing in under the shoulders 158 stopping the motor, releasing the clutch and making it possible to pull the machine out of the hole.

In view of the foregoing, it is thought that the operation of the device will be readily understood, and in view of the simplicity and practical value that it will commend itself to those skilled in the art.

Having thus described our invention, what we claim is:—

1. In a well drilling apparatus that enters the hole or bore, a bit or drilling unit, a motor or driving unit to provide power, and a slidable clutch unit to react against the torque of drilling, and to control the operation of the motor.

2. A well drilling apparatus, a drilling unit adapted to enter the hole or bore of a well, a driving unit directly connected to the drilling unit to provide power, means for supporting the drilling and driving

units and to permit sliding movement of said units downwardly in the bore, a clutch unit slidably associated with the driving and drilling units to grip the wall of the bore and react against the drill torque to prevent rotation of the associated parts, and means operated by the sliding units to cause release of the clutch.

3. A well drilling apparatus, a drilling unit adapted to enter the hole or bore of a well, a driving unit directly connected to the drilling unit to provide power, means for supporting the drilling and driving units and to permit sliding movement of said units downwardly in the bore, a clutch unit slidably associated with the driving and drilling units to grip the wall of the bore and react against the drill torque to prevent rotation of the associated parts, means operated by the sliding units to cause release of the clutch, and means operated by the sliding units to cause inaction of the driving unit.

4. A drilling apparatus of the class described, a body, a bit or cutting unit disposed lowermost and supported from the body, a central motor or driving unit operatively connected thereto, and a clutch member above the motor and adapted when the device is in use to hold the bit or cutting unit support against rotating with the bit and rotating parts associated therewith, said body being slotted and said clutch member being movable in said slot for a considerable portion of the length of the body, substantially in the manner as and for the purposes specified.

5. A drilling apparatus of the class described, a body, a bit or cutting unit disposed lowermost and supported from the body, a central motor or driving unit operatively connected thereto, and a clutch member above the motor and movably mounted to control the operation of the motor and resist the torque of drilling, said body being provided with opposed slots and said clutch member comprising a plurality of shoes slidably mounted in said slots and adapted to gravitate therein.

6. In a drilling apparatus of the class described, a cutting unit, a driving unit therefor, a bailing unit, and means associated in a single assembly with the aforesaid and adapted to enter the hole or bore to cause parts of the device to remain stationary and slidable relative to said parts and effective when sliding to control operation of the motor.

7. In a drilling apparatus of the class described, a cutting unit, a driving unit therefor, a bailing unit, said driving unit including an electric motor, and a clutch movably associated with the casing of the apparatus to grip the wall of the bore or hole, and releasable for controlling the operation of the motor.

8. In a drilling apparatus of the class described, a cutting unit, a driving unit therefor, a bailing unit, said driving unit including an electric motor, an electric circuit including the motor, and means operative to start and stop the motor and cutting unit, and when released being adapted to effect operation of said motor.

9. In a drilling apparatus of the class described, a cutting unit, a driving unit therefor, a bailing unit, said driving unit including an electric motor, an electric circuit including the motor, and means automatically operative to start and stop the motor and cutting unit, said means including a clutch having limited play relative to the motor casing and parts, and a circuit breaking device operative when the cutting unit has completed its stroke or operation at the limit of the play to automatically stop the motor.

10. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a clutch unit associated therewith to grip the wall of the hole and react against the drill torque whereby the rotation of parts is prevented, means to supply lubrication to the bearings of the cutters, means to supply water or like fluid to the cutters in the hole or bore, and means for bailing the hole.

11. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a clutch unit associated therewith to grip the wall of the hole and react against the drill torque whereby the rotation of parts is prevented, means to supply lubrication to the bearings of the cutters, means to supply water or like fluid to the cutters in the hole or bore, and means for automatically controlling the operation of the driving unit and drilling unit driven thereby, at predetermined times.

12. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a clutch unit movably associated therewith to grip the wall of the hole and react against the drill torque whereby the rotation of parts is prevented, and a circulating system for supplying water to the cutters of the drilling unit and for bailing the water and removing the cuttings from the bottom of the hole.

13. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a circulating system for supplying water to the cutters of the drilling unit and for bailing the water and removing the cuttings from the bottom of the hole, a clutch with which said mechanisms are slidably connected to permit said mechanisms to slide down by gravitation, said clutch being adapted to grip the wall of the bore, and means operated by the gravitation of the clutch to cause stopping and starting of the driving unit and drilling unit.

14. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a circulating system for supplying water to the cutters of the drilling unit and for bailing the water and removing the cuttings from the bottom of the hole, a clutch with which said mechanisms are slidably connected to permit said mechanisms to slide down by gravitation, said clutch being adapted to grip the wall of the bore, said driving unit including an electrically operated motor, a circuit breaker for the circuit including said motor, means to apply the clutch, means for actuating said circuit breaker, and means for retracting the clutch to cause closing of the circuit and continued operation of the motor and drilling unit.

15. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a clutch unit associated therewith to grip the wall of the hole and react against the drill torque whereby the rotation of parts is prevented, means to supply lubrication to the bearings of the cutters, means to supply water or like fluid to the cutters in the hole or bore, said driving unit including an electrically operated motor, a circuit breaker for the circuit including said motor, means for actuating said circuit breaker, said clutch having shoes to engage the bore wall, means for applying and releasing the clutch shoes, means for bailing the bore or hole through the device, means for discharging the bailer, and means to cause intermittent release of the clutch shoes and simultaneous stopping of the driving unit, and application of the clutch shoes to resist torque and simultaneous starting and continued operation of the driving unit and drilling unit.

16. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a clutch unit associated therewith to grip the wall of the hole and react against the drill torque whereby the rotation of parts is prevented, means to supply lubrication to the bearings of the cutters, means to supply water or like fluid to the cutters in the hole or bore, said driving unit including an electrically operated motor, a circuit breaker for the circuit including said motor, means for actuating said circuit breaker, said clutch having shoes to engage the bore wall, means for bailing the bore or hole through the device, means for discharging the bailer, said releasing means normally opposing said applying means and adapted upon release of the latter to come into play.

17. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a clutch unit associated therewith to grip the wall of the hole and react against the drill torque whereby the rotation of parts is prevented, means to supply lubrication to the bearings of the cutters, means to supply water or like fluid to the cutters in the hole or bore, said driving unit including an electrically operated motor, a circuit breaker for the circuit including said motor, means for actuating said circuit breaker, said clutch having shoes to engage the bore wall, means for applying and releasing the clutch shoes, means for bailing the bore or hole through the device, means for discharging the bailer, said driving unit consisting of an electric motor associated in the mechanism as an integral part thereof and adapted to enter the bore, said motor having an external source of current supply suitably coutrolled, driving connections between the driving unit and drilling unit, cooling means for the motor, a pump operated by the motor to circulate water around the cutters of the drilling unit, remove the cuttings, soften the formations in the hole, and cool the motor, and a bailer for receiving mud, water, etc., and adapted for discharging the same.

18. A well drilling apparatus, more particularly of the rotary type used in drilling oil, gas and water wells, a drilling unit adapted to enter the hole or bore, a driving unit directly connected to the drilling unit to provide power, a clutch unit associated therewith to grip the wall of the hole and react against the drill torque whereby the

rotation of parts is prevented, means to supply lubrication to the bearings of the cutters, means to supply water or like fluid to the cutters in the hole or bore, said driving unit including an electrically operated motor, a circuit breaker for the circuit including said motor, means for actuating said circuit breaker, said clutch having shoes to engage the bore wall, means for bailing the bore or hole through the device, means for discharging the bailer, means to cause intermittent release of the clutch shoes and simultaneous stopping of the driving unit, and application of the clutch shoes to resist torque and simultaneous starting and continued operation of the driving unit and drilling unit, said driving unit consisting of an electric motor associated in the mechanism as an integral part thereof and adapted to enter the bore, said motor having an external source of current supply suitably controlled, a circulating system for water between opposite ends of the device and including driving connection between the driving unit and drilling unit to rotate the latter, and means operable by the relative shifting of the clutch and other mechanism to apply and release the clutch and to operate and stop the motor and thus the drilling unit.

19. In a well drilling apparatus that enters the hole or bore, a bit or drilling unit, a motor or driving unit to provide power, a clutch unit to react against the torque of drilling, and means operable by relative sliding movement between the clutch and casing of the apparatus to cause the automatic application and release of the clutch and whereby when the clutch is released, the motor is inoperative and when the clutch is applied the motor is running.

20. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower end, operative connections between the driving element and the cutting and reaming element, and means for holding the body against movement when the apparatus is operating, said means being slidably mounted throughout a major portion of the body.

21. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower end, operative connections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, and a bailer having a supporting means and a strainer for the water.

22. In a drilling apparatus of the class set forth, a casing, a driving element therein, a cutting and reaming element at the lower end, operative connections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, a bailer detachably connected to the body at the upper end, supporting and controlling means connected to the bail at the bailer, and means for emptying the bailer and straining the water therefrom.

23. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower end, operative connections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, power supply means for the driving element, a bailer at the upper end of the casing and provided with a movable section, and supporting means for suspending the device in a hole.

24. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower end, operative connections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, power supply means for the driving element, a bailer at the upper end of the casing, and clutch elements associated with the casing and stationary parts and held against turning with respect thereto, said clutch elements being operative to grip the wall of the hole or bore to hold the casing against turning when the device is operating and resist the drilling torque.

25. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower end, operative connections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, power supply means for the driving element, a bailer at the upper end of the casing, a clutch including shoes vertically movable relative to the casing and stationary parts, guide means for said shoes, and means cooperative with the clutch shoes to cause the intermittent operation of the device.

26. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower

end, operative connections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, power supply means for the driving element, a bailer at the upper end of the casing, a clutch including shoes vertically movable relative to the casing and stationary parts, guide means for said shoes, said guide means forming conduits for said circulating system, a bailer having a strainer to which said conduits extend, said driving element including an electric motor having a source of current supply from the surface of operations, and means to control the action of the motor and clutch.

27. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower end, operative connections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, power supply means for the driving element, a bailer at the upper end of the casing, a clutch including shoes vertically movable relative to the casing and stationary parts, said driving element including an electric motor having a source of current supply from the surface of operations, and means to control the action of the motor and clutch, said clutch shoes being lowered and adapted to permit downward movement of the other parts and drill elements when the latter are operating and to automatically cause inoperation of the same at a lower limit, and means for controlling said circuit.

28. In a drilling apparatus of the class set forth, a body, a driving element therein, a cutting and reaming element at the lower end, operative conections between the driving element and the cutting and reaming element, said connections including a conduit, a circulating pump operated by the driving element to supply water to the cutting and reaming element and drain the bottom of the bore, power supply means for the driving element, a bailer at the upper end of the casing, a clutch including shoes vertically movable relative to the casing and stationary parts, said driving element including on electric motor having a source of current supply from the surface of operations, means to control the action of the motor and clutch, said casing being raised with respect to the clutch shoes when the device is let into the hole when closing of the circuit will cause the shoes to be forced outwardly to grip the wall of the hole, said casing moving downwardly during the drilling and cutting operation and thereafter caused to be released to permit the shoes to drop, downward movement of the casing relative to the shoes causing inoperation and dropping of the shoes causing the operation to be continued, and a separable bailer having supporting means for suspending the device and a separable connection for the motor circuit wires.

29. In a well drilling apparatus, a casing, a drill unit, an electric motor above the drill unit and having a hollow axial drive shaft, a bailer at the top having means for suspending the casing and parts associated therewith, a clutch member between the motor and bailer, and a pump driven by the shaft to supply water to and draw water from the drill unit and bottom of the hole.

30. In a well drilling apparatus, a casing, a drill unit, an electric motor above the drill unit and having a hollow axial drive shaft, a bailer at the top having means for suspending the casing and parts associated therewith, a clutch member between the motor and bailer, and a pump driven by the shaft to supply water to and draw water from the drill unit and bottom of the hole, said clutch being slidable with respect to the casing and shaft and adapted to control the operation of the motor.

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