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Draftsma

H. E. DIEHL.

ELECTRIC WELL DRILL.

APPLICATION FILED JAN. 29, 1913.

1,083,200.

Patented Dec. 30, 1913.

3 SHEETS—SHEET 1.

Fig. 1.

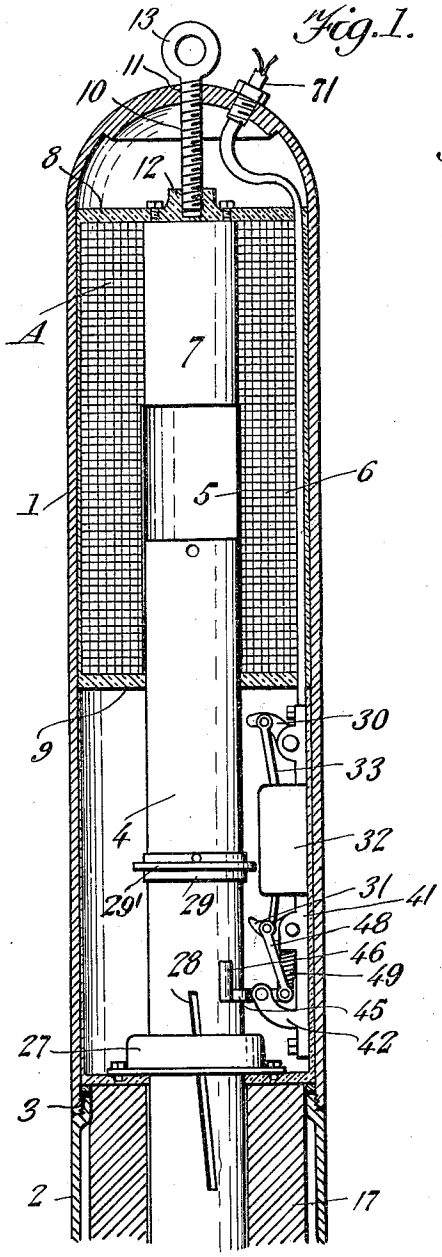
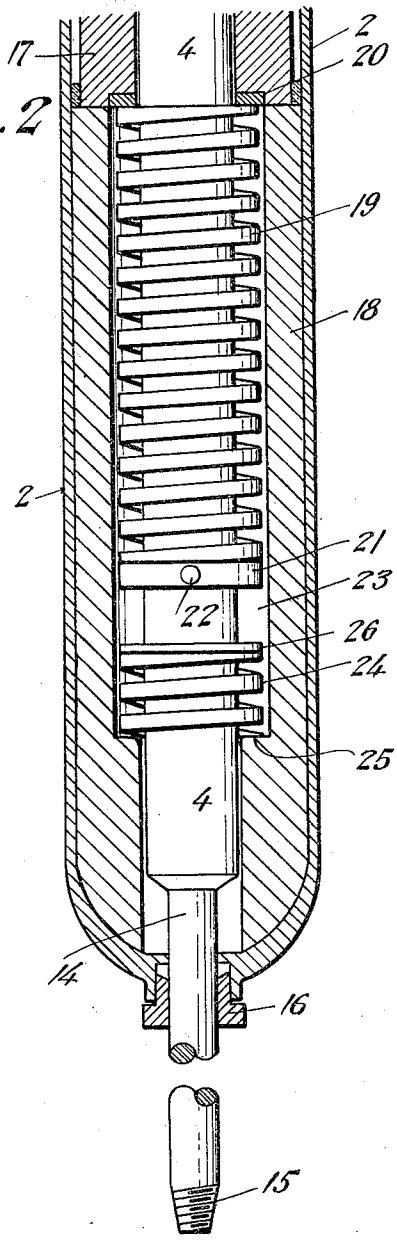


Fig. 2



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Fig. 3.

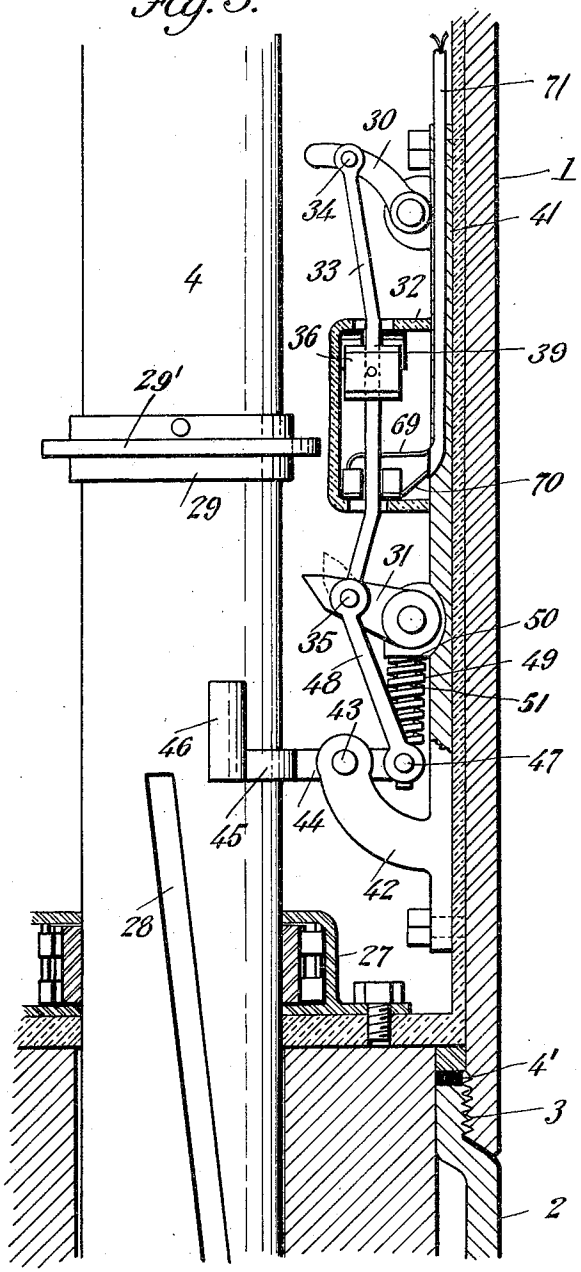
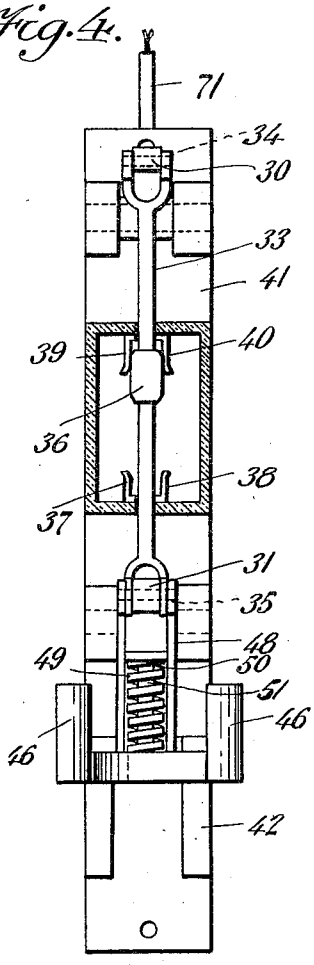


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

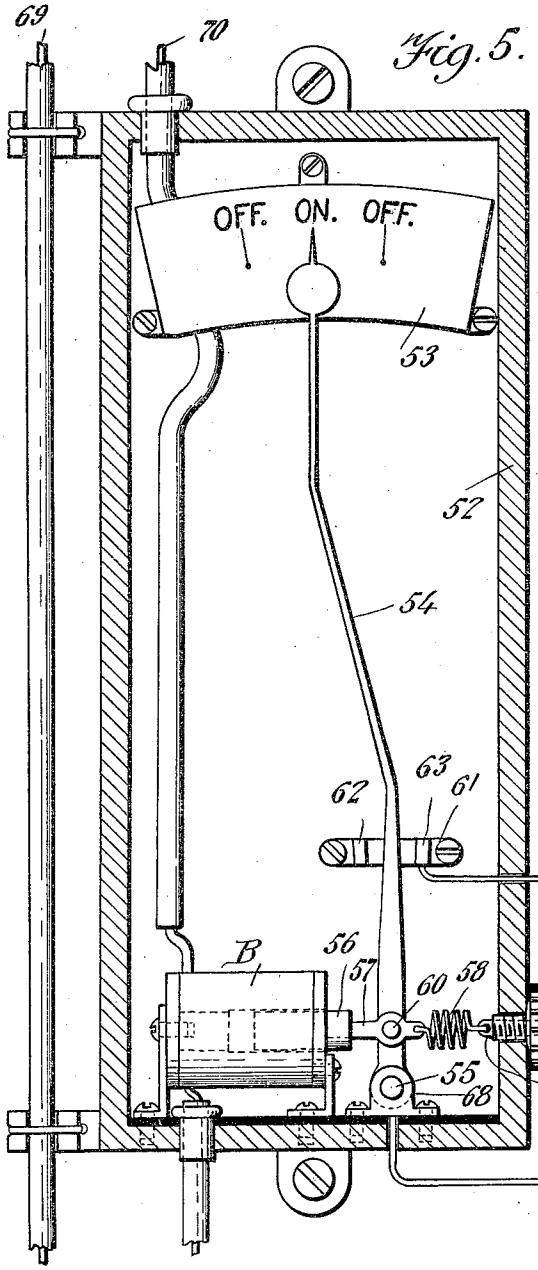
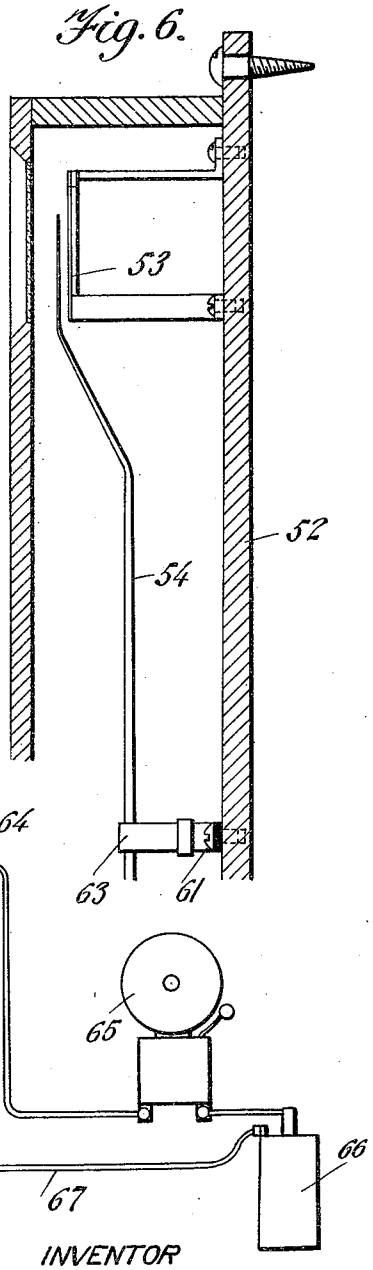


Fig. 6.



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ELECTRIC WELL-DRILL.

1,083,200. Specification of Letters Patent. Patented Dec. 30, 1913.

Application filed January 29, 1913. Serial No. 744,993.

To all whom it may concern:

Be it known that I, HIRAM E. DIEHL, a citizen of the United States, residing at Lawton, in the county of Comanche and State of Oklahoma, have invented new and useful Improvements in Electric Well-Drills, of which the following is a specification.

This invention relates to well drills, and particularly to electrically operated devices of the class referred to, the object of the invention being to provide means for controlling the current which energizes and de-energizes the plunger retracting solenoid, combined with means for tripping the current controlling switch mechanism, in order that the current may be automatically cut out when the device is not operating properly, as when the reciprocating plunger, which carries the drilling bit, moves beyond its normal degree of thrust or working stroke.

A further object of the invention is to provide an indicator which may be located at any desired distance from the drill mechanism, and which will visibly and audibly indicate whether or not the drill is operating properly, or failing to operate, the said indicator also notifying the operator when the drill becomes stuck and is rendered inoperative for that reason.

With the above and other objects in view, the invention consists in the construction, combination and arrangement of parts, as will be hereinafter more fully described, illustrated in the accompanying drawings, and pointed out in the claims hereunto appended.

In the drawings: Figure 1 is a vertical longitudinal section through the upper portion of the drill, showing the casing, solenoid, bit carrying plunger, switch mechanism, and adjacently located parts. Fig. 2 is a similar view of the lower section of the drill. Fig. 3 is a sectional view on an enlarged scale, illustrating the arrangement and operation of the switch mechanism and trip. Fig. 4 is a section taken at a right angle to Fig. 3 and showing the switch mechanism, the switch box being shown in section. Fig. 5 is a vertical sectional view of the indicator. Fig. 6 is a vertical section of the indicator taken at right angles to Fig. 5.

In Figs. 1 and 2 I have shown the complete drilling tool, which comprises a sectional casing, 1 designating the upper section and 2 the lower section of the casing, the two sections having a threaded connection, at 3, to enable them to be disconnected from each other for giving access to the interior mechanism, and a gasket 4′ of rubber or like material being interposed between the meeting faces of the sections to provide a water-tight joint, it being important to prevent the entrance of water to the interior of the casing, so as to avoid interference with the electrical connections and devices, hereinafter described. Extending longitudinally and centrally of the casing is a reciprocatory plunger 4, the upper end of which is received slidingly in a tubular core 5, preferably of brass, around which is wound the wire 6 forming a solenoid. In the upper portion of the solenoid is mounted a solid magnet core 7, the solenoid also comprising the upper and lower heads 8 and 9, respectively. A suspending or supporting rod 10 is threaded, at 11, through the hemi-spherical upper end of the casing 1, as shown in Fig. 1, the lower end of said rod being threaded into an extension 12 on the upper head 8. The rod 10 is provided at its outer and upper end with an eye 13, to which a hoisting and lowering cable may be attached for the purpose of lowering the drill into the well and withdrawing the same therefrom, said cable being also used for properly positioning the drill in the well and dislodging the drilling bit, when the same becomes stuck. At its lower end, the reciprocating plunger 4 is reduced, as shown at 14, and the lower extremity thereof is threaded, as at 15, to enable a bit of any desired formation or construction to be detachably mounted thereon. A stuffing box 16 is also provided at the bottom end of the casing section 2 to prevent the entrance of water at that point. In the upper portion of the lower section 2 of the casing is mounted a ballasting cylinder 17 of metal, and in the lower portion of said section is mounted another ballasting cylinder 18, the cylinder 17 being centrally bored out to receive the plunger 4, and the lower ballasting cylinder 18 being provided with a relatively larger bore, adapting it to receive a thrust spring 19 which is interposed between a ring 20 set into a rabbet in the lower end of the cylinder 17, as shown in Fig. 2, and an abutment ring or collar 21 secured to the plunger 4 by means of a set screw 22, or its

equivalent. In the bottom of the cavity 23 in the cylinder 18 is arranged a cushioning or buffer spring 24, the lower end of which is seated against a shoulder 25, where the cavity 23 is reduced in size to form a bearing for the lower portion of the plunger 4. Upon the upper end of the spring 24 is an impact ring 26 which receives the blow from the collar 21, as the plunger 4 is thrust downwardly. It will be understood that the thrust spring 19 by its expansive action will impart the necessary downward thrust to the plunger 4 to effect an operation of the bit carried by the lower end of said plunger, while the spring 24 will act as a buffer to cushion the downward stroke of the plunger.

While I have shown only a single ring 20 at the upper end of the thrust spring 19, it will be understood that any desired number of rings 20 may be inserted at the point shown, for the purpose of increasing or diminishing the tension and thrust of the spring 19 in accordance with the character of the substratum being operated upon.

27 designates a stationary ring-shaped guide mounted in fixed position near the lower end of the upper section 1 of the casing, and provided at two or more points with inwardly extending ribs or teeth, not shown, which engage guideways or grooves 28 in the opposite sides of the plunger 4, the said grooves 28 being disposed obliquely or spirally of the plunger 4, as indicated in Figs. 1 and 3, so that in the reciprocatory movements of the plunger, a partial rotative movement is also imparted thereto which will assist in the drilling operation of the bit, imparting to the latter a partial boring action.

Mounted fast on the plunger 4 at a suitable point is a collar 29 provided with a circumferential flange 29′, which is adapted to contact with an upper switch lever 30, and a lower switch lever 31, the projecting ends of said levers 30 and 31 being arranged in the path of the flange 29′ on the collar 29, as clearly shown in Fig. 3.

At one side of the plunger 4 and within the upper casing section 1 is a switch box 32 having openings in the top and bottom thereof, as shown in Figs. 3 and 4, through which reciprocates a connecting link 33. This link is pivotally connected, at 34, to the upper switch lever, and, at 35, to the lower switch lever, so that when one of said levers is moved, a corresponding movement is imparted to the other lever.

Mounted fast on the link 33 and operating within the switch box 32 is a switch block 36 which, in its downward movement, comes into contact with and lies between a pair of oppositely located contacts 37 and 38 which are in the circuit, hereinafter referred to, and when the link 33 moves upwardly, the block 36 is received between oppositely located jaws 39 and 40 at or near the top of the switch box 32. The switch box 32 and the levers 30 and 31 are all connected to and supported by a bracket plate 41 secured to the inner wall of the casing section 1, as clearly shown in Fig. 3. The said bracket plate also carries near its lower end a bracket arm 42 having pivotally mounted thereon, at 43, a trip lever 44. This lever is forked, as shown at 45, and provided with two contact fingers or extensions 46 located at opposite sides of the plunger and adapted to be depressed by the flange 29′ on the collar 29, when the plunger moves downwardly beyond its normal stroke, for a purpose which will hereinafter appear. At the opposite side of the pivot 43, the lever 44 has pivotally connected thereto, at 47, a link 48 which is connected to the pivot 35 of the lever 31, as clearly shown in Fig. 3. The forked end of the lever is normally upheld by means of an expansive spring 49 interposed between a fixed shoulder 50 on the bracket plate 41 and the outer end of the lever 44, 51 designating a guide pin for the spring 49 to hold the latter in position.

The indicator illustrated in Figs. 5 and 6 comprises a suitable box or casing 52 containing a graduated plate or dial 53, and an indicating hand 54 which is pivotally mounted, at 55, adjacent to the bottom of said casing. Arranged in the lower portion of said casing is a solenoid B, the armature 56 of which is extended, as shown at 57, and has attached thereto one end of a contractile spring 58, the opposite end of which is connected to a fixed point 59, the tension of the spring 58 being normally exerted to withdraw the armature 56 from the solenoid B. The extension 57 of the armature is pivotally connected, at 60, to the indicating hand 54, so that the movement of the armature of the solenoid and the contractile action of the spring will have the effect of moving the indicating hand in opposite directions and across the face of the graduated plate or dial 53. At a suitable point intermediate of the ends of the hand 54 is a contact plate 61 having oppositely located contacts 62 and 63 in spaced relation to each other. From the contact 63 an alarm circuit wire 64 runs to an alarm bell 65, and from said bell through a battery 66, the return wire 67 leading from the battery to a bearing member 68 which pivotally supports the indicator hand 54. By the construction just described, when the hand 54 touches either one of the contacts 62 or 63, the alarm bell 65 is sounded, thus notifying the attendant that the current has been interrupted or broken.

69 and 70 represent the current or circuit wires which lead from any suitable source of electrical energy to the mechanism in the following manner: The wire 70 leads down-

wardly through the indicator casing 52, and passes through the solenoid B, as shown, so as to energize the same, and then out through the bottom of the casing. The wire 69 leads downwardly until both wires are combined or brought together adjacent to the upper casing section 1, said wires being insulated from each other, however, and passing through a stuffing box 71 in the upper end of the casing section 1, said stuffing box being utilized to provide a water-tight joint at such point. The wires then lead downwardly within the casing of the drill, one wire leading to the wrapping around the solenoid A, and then returning to the other wire at a point below the solenoid, where both wires enter the switch box 32 and connect electrically to the contacts 37 and 38.

From the foregoing description, it will now be understood that as the plunger 4 is thrust downwardly, during its working stroke by means of the expansion spring 19, the collar on the plunger comes into contact with the lower switch lever 31, thereby moving said lever downwardly and drawing the switch block 36 between the contacts 37 and 38. This closes the circuit and energizes the solenoid A, whereupon the plunger is attracted upwardly by the solenoid and restored to the initial end of its stroke. In such upward movement, the collar on the plunger comes into contact with the upper switch lever 30, and thereby draws the switch block 36 out of touch with the contacts 37 and 38. Immediately the solenoid is deënergized, and the spring 19 again acts to thrust the plunger downwardly. During this rapid make and break action of the current, the indicating hand 54 is balanced between the spring 58 and the solenoid B, and stands at the position "On" in Fig. 1. Should the bit become stuck in the downward movement of the plunger, before moving the lever 31 downwardly, the current will be cut off, and, therefore, there will be no current passing through the solenoid B, thus permitting the spring 58 to draw the hand 54 to the right, until it registers with the word "Off". The drilling machine as a whole will then be raised and lowered, until the tool has been dislodged, whereupon it will resume its operation and the hand 54 will return to the "On" position. Should the bit not be long enough to come into contact with the strata being operated upon, the collar on the plunger would pass by the lower switch lever, after throwing on the current, and force the trip lever down, thus throwing off the current, whereupon the indicating hand, by reason of the deënergization of the solenoid B, would move to the right and register with the word "Off". Should the bit or tool stick after striking, the current would flow continuously through the circuit, and such continuous current would act on the solenoid B to fully retract the armature 56, causing it to entirely overcome the tension of the spring 58 and move the indicating hand 54, so as to register with the word "Off" at the left hand side of Fig. 5. This would indicate that the bit was stuck, and the operator would thereupon proceed to dislodge the bit by moving the casing up and down.

The mechanism hereinabove described will be found very useful to the operator, particularly when the drilling mechanism is considerably below the surface of the ground, where the strokes of the plunger cannot be heard. As long as the drilling mechanism is operating properly, the indicating hand will stand on the word "On", but just as soon as the bit becomes stuck, the indicator will register with the word "Off", thus visually indicating the fact, and at the same time the alarm bell 55 will be sounded, so as to audibly advise the operator that the drilling mechanism is not operating properly.

What is claimed is:

1. In well drilling apparatus, a drill casing, a reciprocatory bit carrying plunger, a solenoid for retracting said plunger, a spring for imparting the working stroke to said plunger, a collar on said plunger, and electric switch mechanism embodying upper and lower switch levers, a link connecting said levers, a circuit closing and breaking block carried by said link, and an indicator controlled by the same circuit and embodying a solenoid, and an indicating hand influenced thereby in accordance with the operation and position of the plunger.

2. In well drilling apparatus, a drill casing, a reciprocatory bit carrying plunger, a solenoid for retracting said plunger, a spring for imparting the working stroke to said plunger, a collar on said plunger, and electric switch mechanism embodying upper and lower switch levers, a link connecting said levers, a circuit closing and breaking block carried by said link, and an indicator controlled by the same circuit and embodying a solenoid, and a spring tensioned indicating hand influenced thereby in accordance with the operation and position of the plunger.

3. In well drilling apparatus, a drill casing, a reciprocatory bit carrying plunger, a solenoid for retracting said plunger, a spring for imparting the working stroke to said plunger, a collar on said plunger, and electric switch mechanism embodying upper and lower circuit breaking and closing levers in the path of said collar, and a trip lever also arranged in the path of said collar and acting to break the current when the plunger exceeds its normal working stroke.

4. In well drilling apparatus, a drill casing, a reciprocatory bit carrying plunger, a

solenoid for retracting said plunger, a spring for imparting the working stroke to said plunger, a collar on said plunger, electric switch mechanism embodying upper and lower circuit breaking and closing levers in the path of said collar, a trip lever also arranged in the path of said collar and acting to break the current when the plunger exceeds its normal working stroke, and means for restoring said trip lever to its normal position after the collar moves out of contact therewith.

5. In well drilling apparatus, a drill casing, a reciprocatory bit carrying plunger, a solenoid for retracting said plunger, a spring for imparting the working stroke to said plunger, means for increasing or decreasing the thrust of said spring, a collar on said plunger, and electric switch mechanism embodying upper and lower switch levers, a link connecting said levers, a circuit closing and breaking block carried by said link, and an indicator controlled by the same circuit and embodying a solenoid, and an indicating hand influenced thereby in accordance with the operation and position of the plunger.

6. In well drilling apparatus, a drill casing, a reciprocatory bit carrying plunger, a solenoid for retracting said plunger, a spring for imparting the working stroke to said plunger, a collar on said plunger, electric switch mechanism embodying upper and lower switch levers, a link connecting said levers, a circuit closing and breaking block carried by said link, and an indicator controlled by the same circuit and embodying a solenoid, and an indicating hand influenced thereby in accordance with the operation and position of the plunger, and electrically operated alarm mechanism controlled by the movement and position of the indicating hand.

7. In well drilling apparatus, a drill casing, a reciprocatory bit carrying plunger, a solenoid for retracting said plunger, a spring for imparting the working stroke to said plunger, a collar on said plunger, electric switch mechanism embodying upper and lower circuit breaking and closing levers in the path of said collar, and an indicator controlled by the same circuit and embodying an indicator hand, a solenoid for moving said hand in one direction, and means for moving said hand in the opposite direction when the current is broken.

In testimony whereof I affix my signature in presence of two witnesses.

HIRAM E. DIEHL.

Witnesses:
OWEN MCNALLY,
CHAS. G. JOY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."