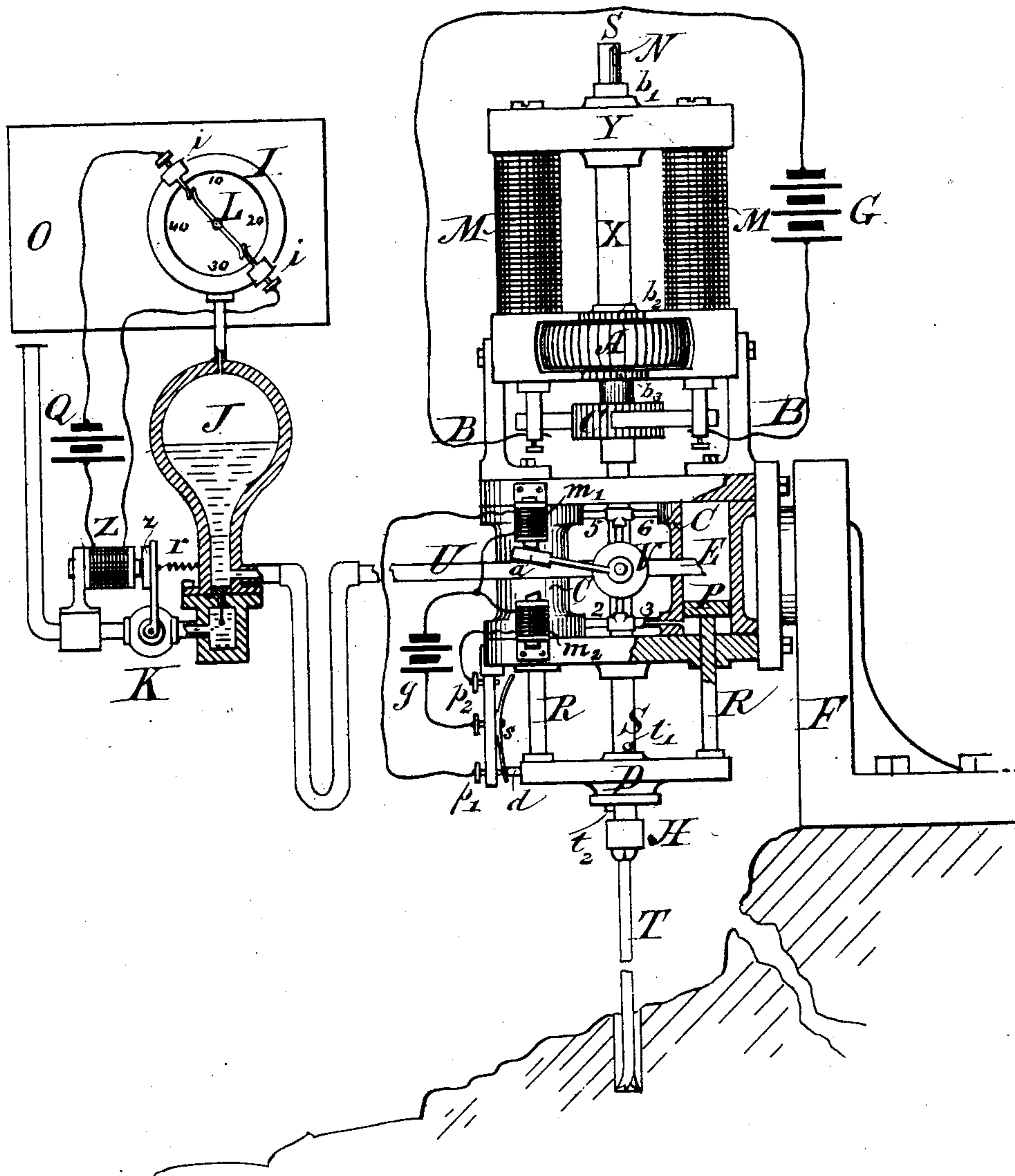


(No Model.)

C. E. BALL.
ELECTRIC DRILL.

No. 255,236.

Patented Mar. 21, 1882.



Witnesses:

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UNITED STATES PATENT OFFICE.

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ELECTRIC DRILL.

SPECIFICATION forming part of Letters Patent No. 255,236, dated March 21, 1882.

Application filed December 31, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. BALL, a citizen of the United States, residing in the city and county of Philadelphia, and in the State of Pennsylvania, have invented certain new and useful Improvements in Electric Drills, of which improvements the following is a specification.

My invention relates to drills of the class actuated by electro-magnetism, and to those in which the functions of the several parts are controlled and regulated by electricity.

The primary object of my invention is simultaneously to impart two distinct motions to the drill-tool, the first being a rotary motion about its own axis, the second being a reciprocating motion in the direction of its length.

To these ends my invention consists in a novel organization of well-known instrumentalities, the essential elements of the improved organization being a generator of electric currents, an electric motor actuated by said currents and imparting the said rotary motion to the drill, and a motor alternately feeding the drill forward and retracting it, said motors acting simultaneously and without mutual interference.

My invention farther includes an electrical device for automatically regulating the pressure of the water-supply which actuates the hydraulic motor, and an electrical device for automatically effecting the reciprocating action of said motor.

The particular subject-matter claimed is hereinafter specifically designated.

The accompanying drawing shows a drilling apparatus involving the principles of this invention in elevation, certain parts being shown in section, while others—viz., the electrical circuits and generators—are shown theoretically.

The apparatus is represented as mounted upon a suitable frame or standard, F. An electro-magnet, M Y M, an armature, A, and a commutator, C, constitute an electric motor of well-known construction, which is actuated by currents from an electric generator, G. The axle X, which carries the armature and commutator, revolves in bearings b' in the yoke Y of the magnet, and b^2 and b^3 in braces of brass or other diamagnetic material connecting the poles of the magnet. The axle X has an axial perforation in which the drill-stock S S is fitted, which drill-stock is capable of sliding

longitudinally within the hollow axle; but by means of a spline, N, or other kindred device, it is compelled to revolve therewith. The drilling-tool T is secured to the drill-stock by the chuck H, or other convenient coupling. A rotary motion will thus be imparted to the drill-tool T whenever the motor is in action; but this motion does not prevent the said tool from being moved at the same time in the direction of its length.

The electric motor is firmly attached by braces B B to the frame-work of a hydraulic motor or other feed mechanism. The form shown in the drawing consists of two cylinders, C C, within which two pistons (one of which is seen in section at P) move back and forth under the action of hydraulic pressure. The piston-rods R R are attached to a cross-head, D, having a central aperture, through which the drill-stock passes. Suitable stops or shoulders, t' and t^2 , prevent any longitudinal motion of the drill-stock within the said aperture, while at the same time it is left free to revolve under the action of the electric motor. By this arrangement the drill may be advanced and retracted, complying with every motion of the pistons.

The water which actuates the hydraulic motor or feed mechanism is conveyed thereto by a supply-pipe, U, leading to a two-way valve, V. The handle of this valve constitutes an armature common to two electric magnets, m' and m^2 , and the valve V is so constructed that when the armature a is in contact with the magnet m' the water from the supply-pipe J enters the cylinders by way of the pipes 2 and 3, causing the pistons to ascend in their respective cylinders. At the same time the water above the pistons escapes by way of the pipes 5 and 6, which are then in communication with the exhaust E. When the armature a is in contact with the magnet m^2 the reverse effect is produced and the pistons descend. Thus by moving the armature a back and forth between the poles of the electro-magnets m' and m^2 a reciprocating motion may be imparted to the pistons. This back-and-forth movement of the armature is produced automatically by the following device: The cross-head D carries a stud, d , which at the end of its downward stroke presses one end of a spring, s , against a contact-point, p' , thereby completing the electric circuit of the battery g through the

coils of the magnet m' . The armature a is accordingly attracted by said magnet, and the pistons are caused to ascend in the manner described. At the end of the upward stroke the stud d presses the other end of the spring s into contact with the point p^2 , thereby closing the circuit of the battery g through the coils of the electro-magnet m^2 , and as the magnet is no longer charged the armature a is attracted to the pole of the magnet m^2 and the action of the motor reversed, as described above. By this means a reciprocating or alternate traversing motion of the pistons is automatically maintained so long as the hydraulic pressure is sufficient.

The water-supply which actuates the motor comes from a pump or reservoir, O , through a supply-pipe, Q , provided with a regulating-valve, K , the handle of which carries the armature of the electro-magnet Z . Normally this armature is held from the poles of the magnet Z by a retracting-spring, r , and when in this position the valve K is open and the water enters a compression-chamber, J . A pressure-gage, I , communicates with the compression-chamber J , so that when the pressure reaches the highest desirable degree the index-finger L comes in contact with the springs i , which may be set at the proper points on the perimeter of the gage, thereby completing an electric circuit through the magnet-coils Z , and attracting the armature z . This motion closes the valve K and prevents any further increase of pressure. With this device an important end is accomplished. Should the drill-tool meet with an abnormal resistance, the hydraulic pressure in the cylinders C and compression-chamber J would increase; but the pressure could not exceed that necessary to cause the index-finger L to close the circuit, and thereby cut off the water-supply. By this means the drill automatically adjusts itself to the requirements of the work to be done.

In place of the hydraulic motor herein shown for producing the traversing feed motion, any well-known form of motor adapted to advance or retract the drill, either automatically or otherwise, may be substituted. Thus a motor similar in principle to that shown in Letters Patent No. 235,195, granted to me December 7, 1880, might be used. In said patent I have shown an electrical device for producing a rapid reciprocating movement; but this device may also be employed to produce the traversing feed motion, there being no difference between the two motions, except in regard to the uses to which they are applied. The object of the feed motion is to advance the tool, while the object of the rotary movement is to effect the cutting, and accordingly the latter movement is made more rapid than the former.

It is evident that the details of the apparatus may be varied in many particulars without departing from the principles of my invention.

I do not herein broadly claim a rotary drill

or a drill rotated by electricity, one form of drill so rotated being shown in Letters Patent No. 159,028, granted January 26, 1875. In that patent, however, no feed mechanism is shown or necessary, as the motor and drill move together, there being no traversing movement of the drill tool or stock relatively to the electrical rotator; but

I claim as of my own invention—

1. The combination, substantially as herein set forth, of an electromotor, a drill stock or tool rotated thereby, mechanism for alternately advancing and retracting the tool, and electro-magnetic feed mechanism controlling said movements.

2. The combination, substantially as herein set forth, of a generator of electric currents, an electromotor, circuit-wires connecting said generator and motor, a drill stock or tool rotated thereby, a hydraulic feed mechanism, and automatic electro-magnetic regulating mechanism controlling said feed mechanism.

3. The combination, substantially as herein set forth, of a drilling-tool, an automatic hydraulic feed mechanism, a feed-valve, electro-magnets controlling said valve, a generator of electric currents, and circuit-connections between said generator and magnet to actuate said valve.

4. The combination, substantially as herein set forth, of the hydraulic feed-cylinders, the water-supply pipe, the feed-valve, its stem or handle constituting an armature, electro-magnets on opposite sides thereof to reverse the feed, a generator of electric currents, and circuit-wires connecting the generator and magnets.

5. The combination, substantially as herein set forth, of a generator, an electromotor, a drill rotated thereby, automatic hydraulic feed mechanism interposed between the drill and motor, a feed-valve, electro-magnets controlling said valve, and electrical connections between the valve and motor automatically to reverse the feed.

6. The combination, substantially as herein set forth, of an electromotor, a drill rotated thereby, hydraulic feed mechanism interposed between the motor and tool, a water supply pipe, a compression-chamber, a valve, an electro-magnet controlling said valve, an electric circuit, a gage included therein, and mechanism actuated by pressure in the compression-chamber automatically to open or close said circuit to operate said valve, and thereby to regulate the water-supply, and consequently the feed.

In testimony whereof I have hereunto subscribed my name this 8th day of December, A. D. 1881.

CHAS. E. BALL.

Witnesses:

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