(No Model.) 2 Sheets—Sheet 1.

A. G. HOLCOMBE & C. A. CHEEVER.

Electrical Rock Drill.

No. 235,948. Patented Dec. 28, 1880.

Fig. 1

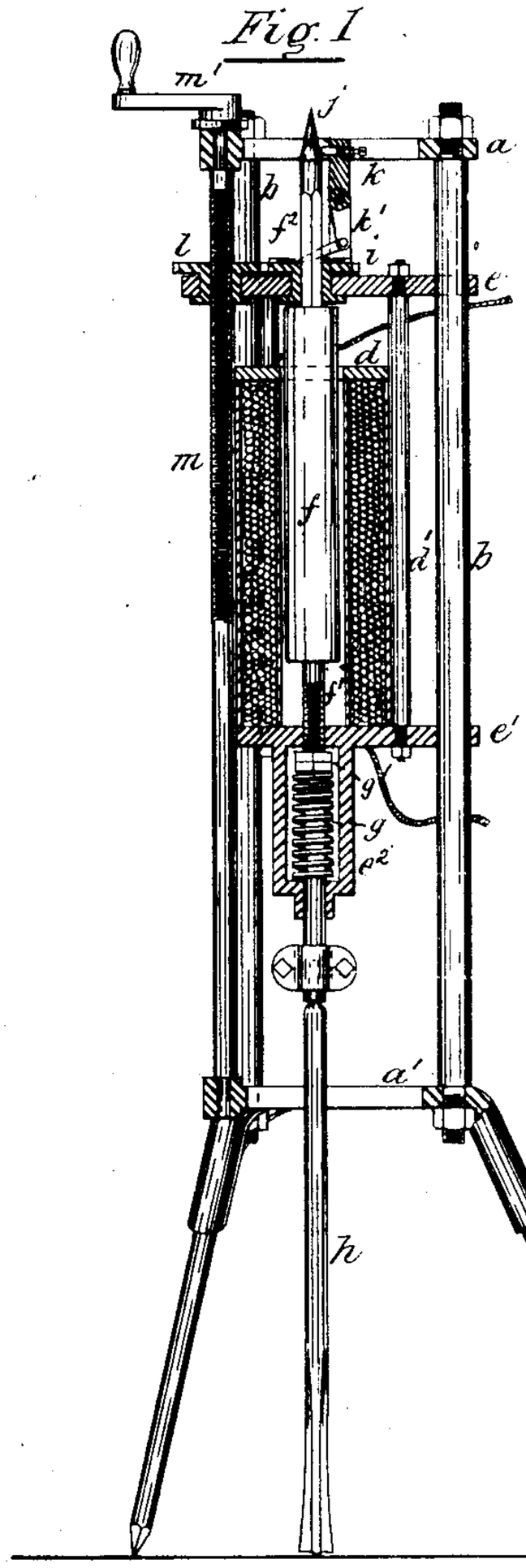


Fig. 2

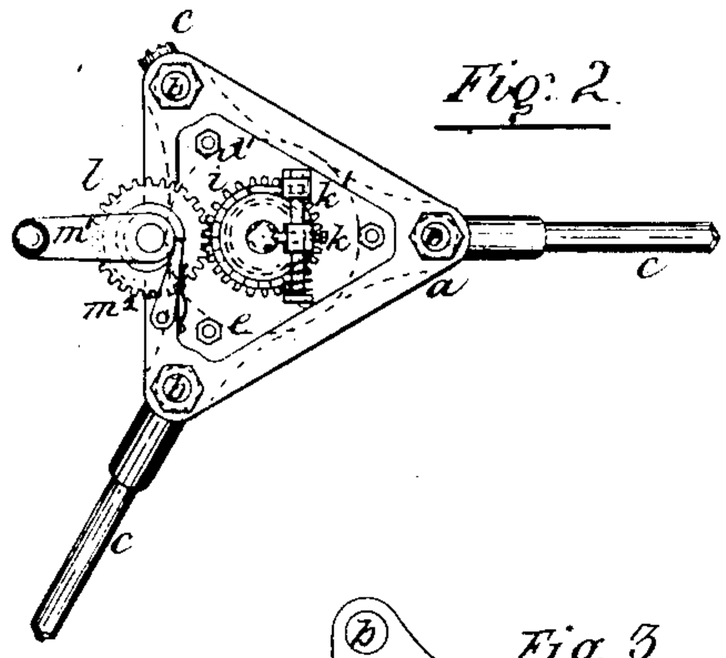


Fig. 3

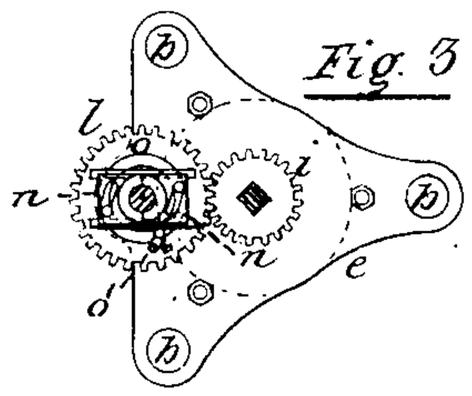


Fig. 4

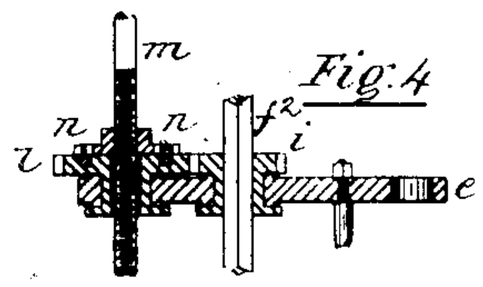
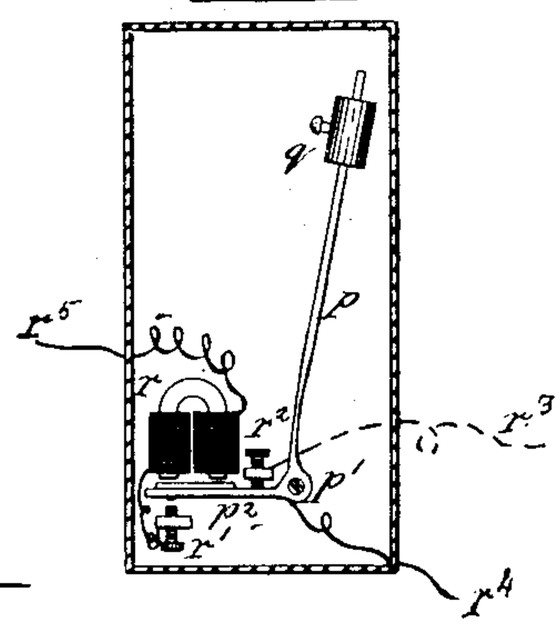


Fig. 5



Witnesses.
John D. Shedlock
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(No Model.) 2 Sheets—Sheet 2.

A. G. HOLCOMBE & C. A. CHEEVER.

Electrical Rock Drill.

No. 235,948. Patented Dec. 28, 1880.

Fig. 6

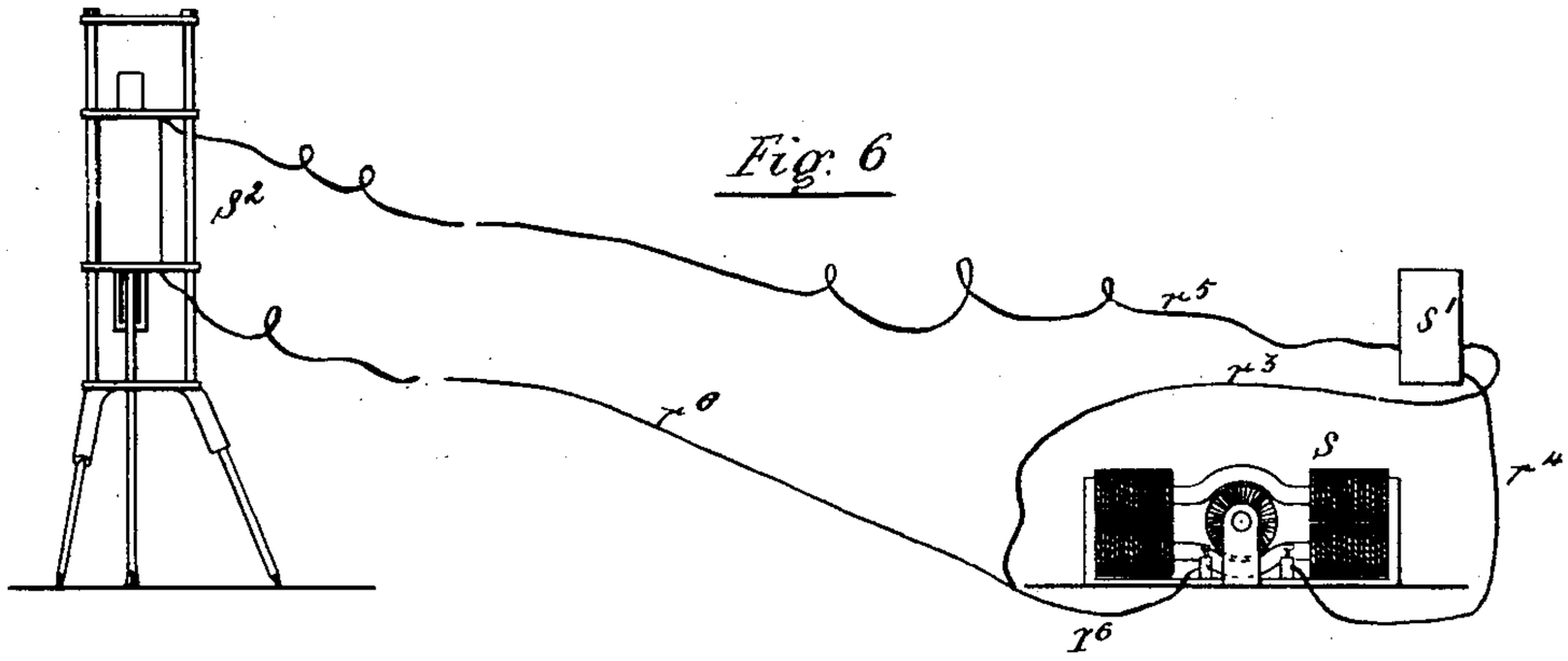
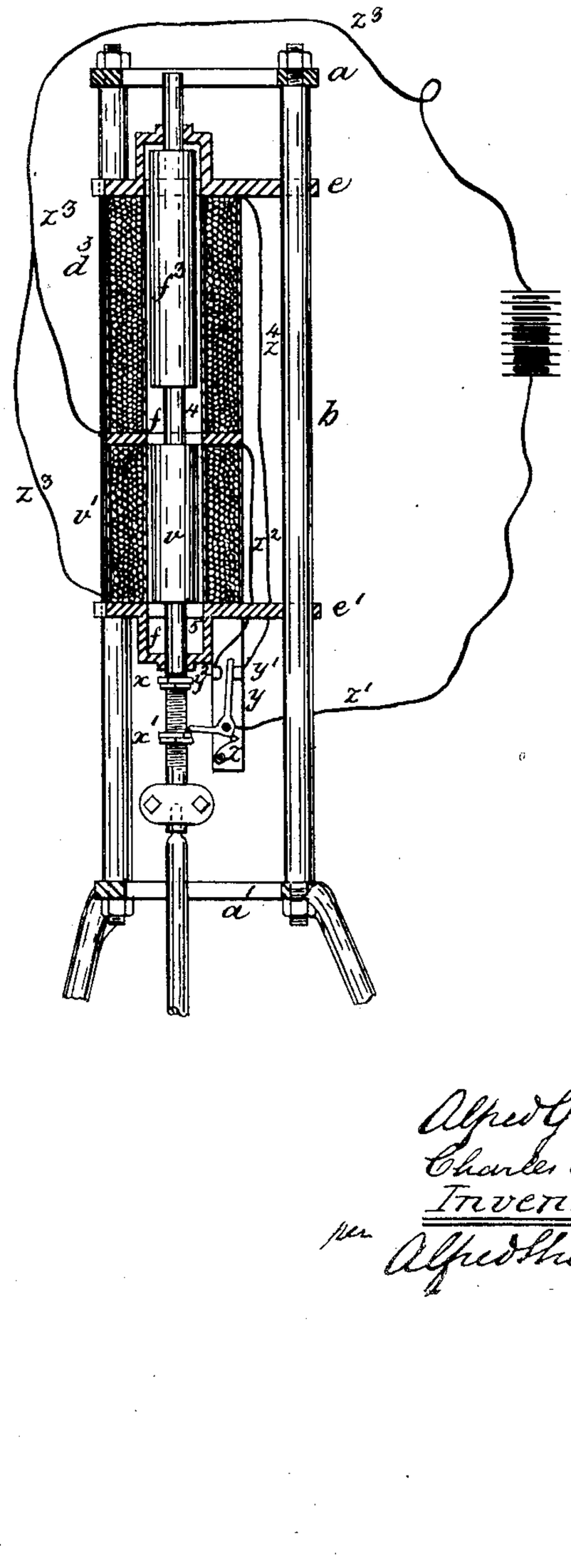


Fig. 7.



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UNITED STATES PATENT OFFICE.

ALFRED G. HOLCOMBE, OF GRANBY, CONN., AND CHARLES A. CHEEVER, OF NEW YORK, N. Y., ASSIGNORS TO SAID CHARLES A. CHEEVER, TRUSTEE.

ELECTRICAL ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 235,948, dated December 28, 1880.

Application filed May 28, 1880. (No model.)

To all whom it may concern:

Be it known that we, ALFRED G. HOLCOMBE, of Granby, in the county of Hartford and State of Connecticut, and CHARLES A. CHEEVER, of the city, county, and State of New York, both citizens of the United States, jointly have invented certain new and useful Improvements in Electric Drills, of which the following is a specification.

Our invention relates to drills of the class actuated by electro-magnetism. Its object is to secure a simple, efficient, and durable machine, which ends we attain by certain novel combinations and organizations of old instrumentalities, designated by the claims at the end of this specification.

In the accompanying drawings, Figure 1 represents a longitudinal central section through an electric drill embracing our improvements. Fig. 2 is a plan view of the same. Fig. 3 shows a plan view, and Fig. 4 a vertical central section through a device by which the drilling-tool may be retracted. Fig. 5 represents a side elevation of a rheotome or circuit-breaker for regulating the speed of the drill. Fig. 6 is a diagram showing one method of organizing the apparatus, and Fig. 7 represents a modified form of the drill. The apparatus shown in Figs. 3, 4, and 7 is not claimed here, as it constitutes the subject-matter of a division of this application filed by us July 30, 1880, serial No. 14,531.

The mechanism is shown as mounted in a skeleton-frame consisting of two heads or castings, *a a'*, united by rods *b*. The lower or forward head or casting is provided with sockets, in which are inserted longitudinally-adjustable legs *c*, constituting a base or tripod, upon which the mechanism is supported and by means of which it may be adjusted at the proper angle relatively to its work.

A coil or helix, *d*, of properly-insulated wire, constituting an ordinary electro-magnet, is mounted in a sliding stock or frame (shown as consisting of head-pieces *e e'*) having the capacity of sliding upon the rods *b*, and united by suitable rods, *d'*. A screw-rod, *m*, turning in suitable bearings in the frame, is provided with a crank-handle or winch, *m'*, by which to turn it when desired. The screw of this spindle works in a corresponding screw in a spur-wheel, *l*, which turns in suitable bearings in the head *e* of the sliding stock or frame, by which means the stock can be moved longitudinally in either direction desired. The wheel *l* is normally prevented from turning backward by a spring-pawl, m^2, taking into ratchet-teeth therein or other suitable locking device.

An ordinary soft-iron core, *f*, has the capacity of sliding freely endwise through the center of the coil or helix, as usual in instruments of this class. A rod, *f'*, constituting an axial extension of the core, passes through the lower plate or casting, *e'*, and through suitable guides in a box or bracket, e^2, secured to said casting. A spiral spring encircles this rod, and bears at one end against the bracket and at the other against the screw-nut *g* on the rod. By this means the resilience of the spring may be adjusted until it is sufficient to act as a counterpoise to the weight of the core and its appurtenances, so as normally to hold the parts in the position shown in Fig. 1—that is, in a retracted position—in which position it will be seen a portion of the core projects beyond the coil.

A drilling-tool is secured to the rod *f'* by suitable well-known means. A polygonal rod, f^2, constituting an axial extension of the core, passes axially through a gear-wheel, *i*, turning in suitable bearings in the head *e*. This polygonal rod has the capacity of sliding freely endwise through the spur-wheel, the two, however, being compelled to turn together. This spur-wheel *i* gears with the spur-wheel *l*, hereinbefore referred to.

The head *j* on the rod f^2 on each back-stroke acts on an adjustable stud, wiper, or plug fitted on a lever, *k*, rocking on a suitable pivot or rock-shaft, *k'*, on the frame. A pawl carried by this lever acts on a series of ratchet-teeth on the face of the wheel *i*, and thus imparts to it an intermittent rotary movement in a well-known way. The feed-pawl is retracted at each stroke by a suitable recoil-spring on its rock-shaft. The distance which the rod is carried at each stroke of the drill, and consequently the feed of the drill, is regulated partly by the distance the plug projects

from the rocking lever and partly by the length of the stroke of the drill itself. The parts are so proportioned that the normal feed imparted to the drill is equal to the distance which it would penetrate the softest substance upon which it is designed to operate. Should from any cause the drill not penetrate its full distance, the conical point of the rod f^2 would prevent the pawl from feeding its full distance until the next stroke, or until the drill had penetrated to the desired depth, when the full feed would be resumed. This automatic correlation of parts prevents the straining or breaking of the apparatus. It will, of course, be understood that the wheel i gears into the wheel l and revolves it. As the screw m is normally locked from turning, the frame is necessarily fed forward by the turning of the wheel on its screwed spindle. By this means our improved drill has imparted to it the capacity of being automatically fed forward by the revolution of the screw-wheel l on the screw, and of being retracted by the revolution of the screw-spindle m in the screw-wheel, while the latter is prevented from turning.

Under the organization above described it will be seen that the drilling-tool is partially rotated automatically on each back-stroke. Instead of the polygonal shaft-and-ratchet arrangement above described for producing this result, it might be accomplished by a curved slot or groove on the rod f^2, in which a spline on the feed-wheel works in a well-known way.

Figs. 3 and 4 represent a device by which the adjustability of the stock, after completing its forward movement, may instantaneously be retracted to its starting-point. This end is attained by making the hole through the wheel l large enough to enable it to slide freely on the feed-screw m, and providing two half-nuts, n, sliding in guides on the face of the wheel l, their movements being controlled by pins on a ring, o, fitting in the half-nuts, so that they embrace the screw when the ring is in proper position—that is, in the position shown in Fig. 3—in which position they are held by a pawl, o'. The half-nuts are released from the screw by releasing the pawl and turning the ring backward, which allows the wheel l to slide freely on the screw and the stock to slide freely in its bearing. This last-described device is applicable to drills working in horizontal or inclined rather than in vertical positions, unless the drills have their moving parts sufficiently light to be readily lifted. The drill is thrust forward to do its work by electro-magnetism, the electric current being derived from a suitable generator in a well-known way. Fig. 6 represents one organization of the apparatus for accomplishing this result. The coil or helix is shown as included in an electric circuit in which is also included a suitable generator of electricity, such as a dynamo-electric or magneto-electric machine, and a rheotome or circuit-breaker, s'.

Fig. 1 represents the parts in their normal position ready to begin work. The passage of an electric current through the coil or helix C draws the core f' forward, driving the drill against the surface to be perforated. As the drill completes its stroke the circuit is broken, and the core and tool are retracted by the action of the counterbalancing-spring g. The operation above described is then repeated, by which means the drill may be driven with any desired degree of rapidity. The operation above described may be reversed in well-known ways, so as to cause the core to compress an actuating-spring on its back-stroke, the forward thrust of the drill being given by the recoil of the spring.

Fig. 5 shows an adjustable rheotome or circuit-breaker, by means of which the rapidity of the stroke may be varied; but other well-known forms of circuit-breakers might be employed instead.

An elbow-lever, $p\,p^2$, rocking on a pivot, p', is provided with an adjustable weight, q, capable of sliding endwise on the arm p of the elbow-lever, and provided with a set-screw or other locking device to secure it the desired distance from the pivot. The arm p^2 constitutes or carries the armature of an ordinary horseshoe electro-magnet, r, the coils of which are connected with circuit wires or conductors $r^4\,r^5$. Under the organization shown the current passes along the wire r^4 to the pivot p', and along the arm p^2, by the contact-screw r', to the helices of the electro-magnet r, and from thence, by the conductor r^5, to the helix of the drill, and back to the generator. When the current passes, the electro-magnet r attracts the armature p until it strikes the arm r^2, thus breaking the contact between the arm p^2 and the screw r', and throwing the rod p and weight q into its rearmost position, the resilience of the arm allowing it to bend according to the position of the weight q. The reaction of this spring throws the armature down again, closing the contact at r', and allowing the current to pass through the helix of the drill again, the duration of the passage of the current being governed by the resilience of the rod p and the position of the weight thereon. The weight, moreover, causes the rod to act as a pendulum, and consequently regulates the number of pulsations allowed to pass in a given time. The rod p might be marked with the number of vibrations incident to a given adjustment of the weight, so as to admit of its being readily adjusted to the desired number of strokes. The rheotome is inclosed in a box or casing to protect it from dust or injury.

Two drills might be operated from one rheotome constructed on this principle, by forming another circuit through the stop r^2, as shown by the dotted line r^3, in which circuit a second drill is placed. The return-conductor from this second drill would in this case pass directly to the generator, or join the return-conductor of the first drill. Under this ar-

rangement the two drills would be alternately operated, one when the armature of the lever p^2 is in contact with the screw r', and the other when it is in contact with the stop r^2. The rheotome might be placed near the generator, if desired, or be placed near the drill, so as to be readily adjusted by the attendant; or the rheotome might be mounted directly upon the drill itself.

In Fig. 6 the generator is shown as consisting of a dynamo-electric or magneto-electric machine, *s*, connected by a conductor or circuit-wire, r^4, to the rheotome s', which is, in turn, connected with the helix of the drill by the conductor r^5, the circuit being completed from the drill to the generator by the conductor r^6. This diagram shows one drill only in circuit; but it is evident that any number of drills the generator is sufficiently powerful to operate may be placed in circuit.

In Fig. 6 a shunt-wire or short circuit, r^3, is shown as connecting the generator and rheotome, so that the entire current may pass through the generator when the drill is not acting. The conductors r^5 r^6 constitute the drill-circuit, and the conductors r^3 r^6 constitute the short or shunt circuit. These circuit-connections may be varied in various well-known ways.

Fig. 7 shows a modified form of the apparatus, in which the drill is driven positively in both directions by electro-magnetism and the circuit-breaker is actuated directly by the drill-stock. We disclaim, broadly, these features, as they are shown in an application, No. 8,370, for Letters Patent of the United States, filed by Charles E. Ball, April 26, 1880.

We claim as our own invention—

1. The combination, substantially as herein set forth, of the frame, the stock adjustable therein, the coil or helix mounted in the stock, the core reciprocating endwise through the coil, the drilling-tool carried by the core, and the recoil-spring.

2. The combination, substantially as herein set forth, of the frame, the stock adjustable therein, the coil or helix mounted in the stock, the core reciprocating endwise through the coil, the drilling-tool carried by the core, the recoil-spring, the generator, the circuit-connections, and the automatic circuit-breaker.

3. The combination, substantially as herein set forth, of the frame, the stock adjustable therein, the coil or helix mounted in the stock, the core reciprocating endwise through the coil, the drilling-tool carried by the core, the recoil-spring, and automatic feeding mechanism, substantially such as described, automatically to regulate the feed according to the depth of penetration of the drill at each stroke.

4. The combination, substantially as herein set forth, of the coil or helix, the core reciprocating endwise therethrough, the drilling-tool carried by the core, the polygonal rod constituting a prolongation of the core and movable freely endwise through the feed-wheel, but turning therewith, and mechanism, substantially such as described, for automatically feeding the drilling-tool.

5. The combination, substantially as herein set forth, of the core, the drilling-tool, the polygonal rod, constituting a prolongation of the core, its conical head, the feed-wheel through which the rod reciprocates and with which it turns, and the feed-pawl actuated by the rod intermittently to rotate the wheel.

6. The combination, substantially as herein set forth, of the frame, the stock adjustable therein, the core, the drilling-tool carried thereby, the polygonal rod projecting from the core, the feed-wheel through which it reciprocates and with which it rotates, the screw-wheel gearing with the feed-wheel, and the feed-screw passing therethrough.

7. The combination, substantially as herein set forth, of the frame, the stock adjustable therein, the coil or helix mounted in the stock, the core reciprocating endwise through the coil, the drilling-tool carried by the core, the polygonal rod, constituting an extension thereof, the feed-wheel through which it passes and with which it turns, automatic mechanism, substantially such as described, for intermittently rotating the feed-wheel, the screw-wheel gearing with the feed-wheel, the screw passing therethrough, and a pawl or other suitable detent for locking the screw while the drill is automatically being fed forward, but which allows the screw to be rotated to retract the drill.

8. The combination, substantially as herein set forth, of the stock, the coil mounted therein, the core reciprocating endwise through the coil, the drill-stock attached directly to the core, and the recoil-spring mounted on the tool-stock.

9. The combination, substantially as herein set forth, of the generator, the electric drill, and the circuit-connections of the automatic pendulum circuit-breaker, the circuit of which is closed by the attraction of the magnet and broken by the recoil of the spring-arm carrying the pendulum.

In testimony whereof we have hereunto set our hands this 22d day of May, A. D. 1880.

ALFRED G. HOLCOMBE.
CHAS. A. CHEEVER.

Witnesses:
JOHN D. SHEDLOCK,
H. D. WILLIAMS.