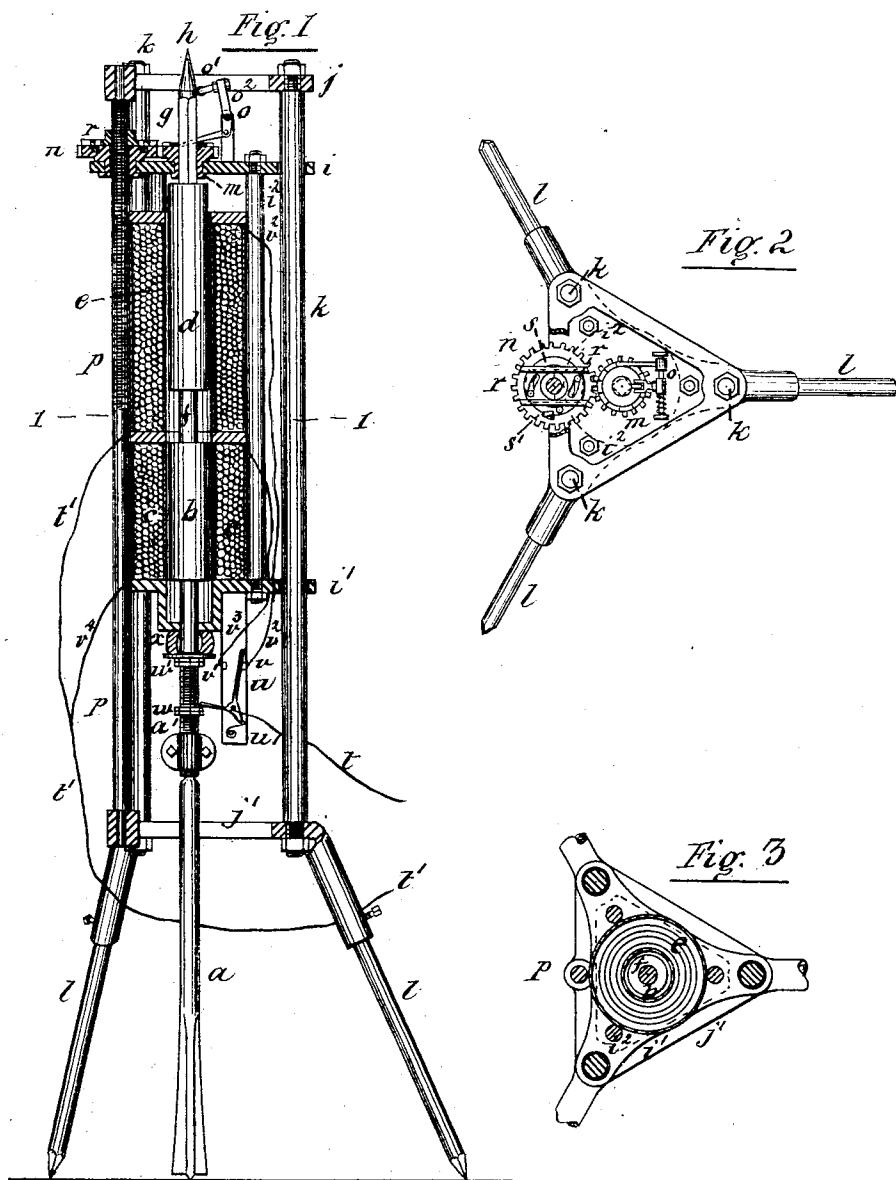


(No Model.)

A. G. HOLCOMBE & C. A. CHEEVER.
Electrical Rock Drill.

No. 235,947.

Patented Dec. 28, 1880.



Witnesses.

John D. Shoemaker
J. D. Williams

Alfred G. Holcombe

Charles A. Cheever

Inventors.

per Alfred Shoemaker

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. 235,947, dated December 28, 1880.

Application filed July 30, 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 reciprocated by electro-magnetism. The application, No. 8,370, of Charles E. Ball, for electric rock-drills, filed April 26, 1880, shows such a reciprocating drill as having the capacity of being driven positively in both directions by electro-magnetism. Our own application, No. 10,663, filed May 28, 1880, of which application this constitutes a division, likewise shows such a drill, together with mechanism for feeding it. We do not, therefore, broadly claim herein positively actuating the drill in both directions by electro-magnetism, nor, broadly, the feed mechanism, but limit our claims to the novel combinations and organizations of old elements designated in the claims at the end of this specification, which relate, first, to an organization of mechanism whereby the drill, when fed forward, may rapidly be retracted to commence a new forward movement; and, secondly, to certain improvements in the construction of the drilling part of the apparatus.

In the accompanying drawings, which represent our improvements as embodied in the best way known to us at the date of filing this application, Figure 1 represents a longitudinal central section through so much of an electric drill embracing our improvements as is necessary to illustrate the subject-matter herein claimed. Fig. 2 represents a plan thereof, and Fig. 3 a transverse section therethrough on the line 1 1 of Fig. 1.

The mechanism is shown as mounted in a skeleton-frame consisting of two heads or plates, *j j'*, united by rods *k*. The lower or forward head or plate, *j'*, is provided with sockets, in which are inserted longitudinally-adjustable legs *l*, 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.

Two properly-insulated coils or helices, *c e*, constituting ordinary electro-magnets, are mounted in a sliding stock or frame, shown as consisting of head-pieces *i i'*, having the capacity of sliding upon the frame-rods *k*, and being united by rods *i²*. The apparatus in this instance is organized to actuate the drill positively in both directions by electro-magnetism, and is shown as reciprocating vertically. The coil *c* retracts the drill and its appurtenances, and actuates the feed mechanism, while the coil *e* imparts to the drilling-tool its forward working stroke. The latter coil is therefore preferably made larger or longer. Under the organization shown the effectiveness of the stroke is increased by the weight of the cores and their appurtenances supplementing the magnetic force.

The drilling-tool *a* is secured in suitable well-known ways to a drill-stock, *a'*, constituting an axial extension of the cores *b d*, which are similar to the soft-iron cores usually employed in electro-magnets. They are shown as united by a bar or connecting-piece, *f*, of brass or other suitable non-magnetic material, so as to cause them to move together. The drill, cores, connecting-piece, and feed-bar all reciprocate in the same axial plane.

A polygonal guide-rod or feed-bar, *g*, constituting an axial prolongation of the core *d*, works freely endwise through a corresponding aperture in the feed-wheel *m*, so as to compel both the feed-bar and feed-wheel to revolve together in order to actuate the feed mechanism, as hereinafter more fully described. The relative organization of the coils and cores is such that when the front core, *b*, is wholly within its coil *c*, the rear or lifting core, *d*, projects backward beyond the coil, as shown in Fig. 1, and when the core *d* is wholly within its coil the core *b* projects beyond the forward end of the coil *c*.

The automatic feed mechanism employed is similar to that described in our prior application, with the exception hereinafter noted. The conical end *h* of the guide-rod, by its reciprocation, actuates a pawl on the feed-wheel *m* through a tappet or wiper, *o'*, and arm *o²* on a rock-shaft, *o*, provided with a retracting-spring. The polygonal form of the guide-rod compels it and the tool-holder to rotate with

the feed-wheel m , which latter wheel gears with a screw-wheel, n , likewise mounted on the same adjustable stock or arm as the feed-wheel. A screwed spindle, p , fixed rigidly in the head-pieces $j j'$, passes freely through a central hole in this screw-wheel n , on the upper surface of which two half-nuts, r , slide in suitable guides, being controlled by means of a ring, s , provided with studs arranged to work in cam-slots in the nuts, (see Fig. 2,) so that as the screw-wheel rotates the half-nuts, being carried with it, gradually move forward on the screw p , carrying the entire working mechanism with them. By reversing the movements of the ring the half-nuts release their grasp on the screw, and the working parts can be rapidly retracted. The half-nuts are locked on the screw by a pawl, f' , catching in a notch in the ring s . The parts are so proportioned that the normal feed imparted to the drill is equal to the distance it would penetrate the softest substance upon which it is designed to operate. The conical head h is so shaped and the stud or roller o on the arm o^2 so adjusted relatively thereto that the pawl will move the wheel m the distance of one ratchet-tooth for each full stroke of the tool, and should the substance be hard enough to prevent the tool from making its full stroke the pawl will not catch over the succeeding tooth of the ratchet until the tool penetrates its full depth. The percentage of the stroke lost by the failure of the tool to catch on the ratchet-tooth is very small, so that it does not materially affect the momentum of the tool. By this organization the feed is perfectly regulated by the depth of penetration of the tool, and prevents the straining or breaking of the apparatus.

The coils $c e$ are connected with a suitable generator of electricity in usual well-known ways by conductors $t t'$, the current being alternately shunted through each coil, so as to move the drill positively in both directions. Our prior application, above mentioned, shows a rheotome or circuit-breaker for producing this alternation of currents disconnected from the drill. The application of Ball, above mentioned, shows a circuit-breaker actuated directly by the drill-stock.

Fig. 1 of the accompanying drawings shows a method not only of actuating the circuit-breaker from the drill-stock, but also of regulating its action. This we do by means of adjustable tappets or wipers, consisting of screw-nuts $w w'$, working on the screwed drill-stock. These screw-nuts act alternately on one arm of an elbow-lever or bell-crank lever, u , with which one of the conductors is connected, which bell-crank lever rocks on a pivot in a bracket or arm connected with the sliding stock or head i . The conducting-arm of this bell-crank lever vibrates between two insulated binding-posts, $v v'$, against either of which it is alternately held by a spring, u' , and by a ring on a projection on the bell-crank

lever, in a well-known way. Conductors $v v^2$ lead from the binding-posts to the terminals of their respective coils $c e$, to the other terminals of which the conductors $t' v^4$ are respectively connected.

The relation of the parts shown in Fig. 1 is such that when the drilling-tool and cores are retracted to their greatest extent the forward or lower nut, w , presses the actuating-arm of the bell-crank lever backward and causes its conducting-arm to come in contact with the binding-post v , thus allowing the current to flow through the wire v^2 to the rear coil, e , and through the conductor t' back to the generator. This current causes the coil to act magnetically on the core d , causing it to advance, thus driving the tool forward to its work, and at the same time pushing the core d partly out of its coil e . Just before the tool completes its forward stroke the rear nut, w' , on the tool-stock strikes the actuating-arm of the bell-crank lever and moves its actuating-arm from contact with the post v to contact with the post v' , which latter is connected by the wire v^3 to the forward coil, c , through which the current passes by the wire v^4 to the return-wire t' . The current is thus shunted through the coil c to the coil e , and its action retracts the core b within the coil e , correspondingly retracting the tool, and at the same time moving the rheotome or circuit-breaker back to the position shown in Fig. 1, when the operation above described is repeated. The tool is thus positively reciprocated in both directions at measured intervals so long as the coils are in circuit. The rapidity of the stroke can be regulated by moving the screw-nuts backward or forward on the drill-stock, it being obvious that as they are brought nearer together the rapidity of the stroke will be quickened, while the contrary movement would diminish such rapidity.

The actuating-arm of the bell-crank lever is made somewhat flexible, to enable it to yield slightly after the conducting-arm has come in contact with the pieces w by the pressure of the nut w' on it when the tool is working at its full stroke, the effect of which is to give the maximum degree of feed, as the stud o' is thereby caused to descend on the conical point h , and thus give a longer stroke to the feed-pawl o , hereinbefore described. A buffer-spring of suitable material interposed between the nut w' and the sliding stock counteracts the jar which would otherwise occur were the rapid backward motion given to the tool by the magnet unchecked. The recoil of this spring obviously would impart additional force to the forward stroke of the tool.

We claim as of our own invention—

1. The combination, substantially as herein set forth, of the coils or helices, the cores reciprocating endwise therethrough, the connecting-piece of non-magnetic material, and the drilling-tool connected with the cores, whereby the cores and drilling-tool are caused to move

together and the momentum utilized on the working stroke.

2. The combination, substantially as herein set forth, of the coils or helices, the cores reciprocating therethrough, the drilling-tool connected with the cores, and the interposed buffer-spring, which diminishes the shock of the tool on its backward motion, and the resilience of which spring increases the momentum of the working stroke.

3. The combination, substantially as herein set forth, of the coils, the cores, the drilling-tool carried thereby, adjustable tappets or wipers on the drill-stock, the circuit-breaker, and the connecting-wires, whereby the rapidity of the stroke may be regulated.

4. The combination, substantially as herein set forth, of the main frame, the stock or tool holder adjustable therein, the coils, the cores, the drilling-tool and feed-bar mounted thereon, a feed-screw fixed on the frame, half-nuts

embracing said screw, and mechanism, substantially such as described, for rotating the half-nuts by the reciprocation of the feed-bar, automatically to regulate the feed of the tool.

5. The combination, substantially as herein set forth, of the frame, the stock adjustable therein, the coils carried by the stock, the cores reciprocating in the coils, the drilling-tool carried by the core, the feed-bar, also carried by the core, automatic feed mechanism, substantially such as described, and a rheotome actuated by the drill-stock to render the feed and the working of the drill both automatic.

In witness whereof we have hereunto set our hands this 28th day of July, 1880.

ALFRED G. HOLCOMBE.

CHAS. A. CHEEVER.

Witnesses:

WILLARD L. CANDEE,
ALFRED SHEDLOCK.