(No Model.)

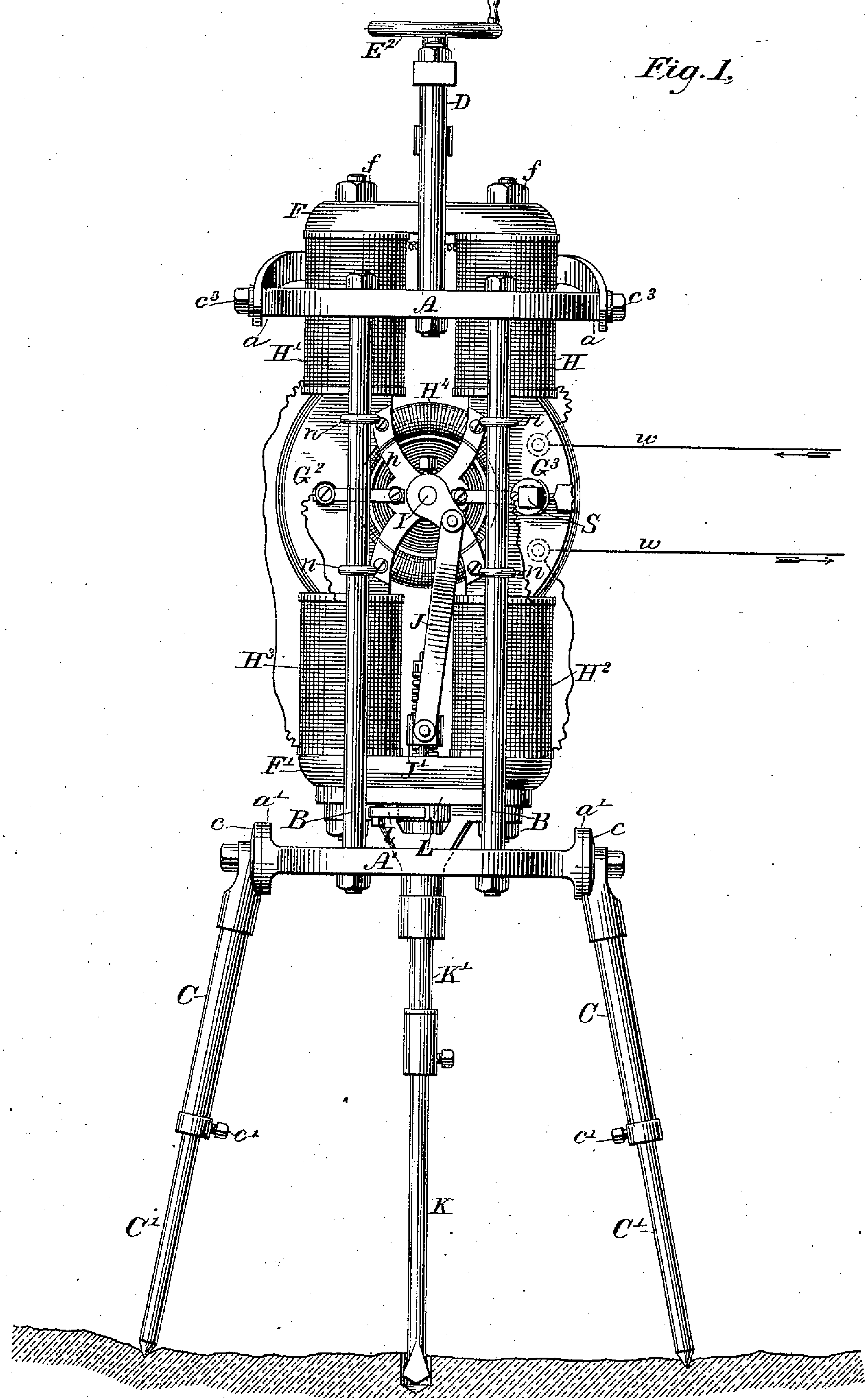
3 Sheets—Sheet 1.

L. J. PHELPS.

ELECTRIC ROCK DRILL.

No. 366,184.

Patented July 5, 1887.



Witnesses,

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(No Model.)

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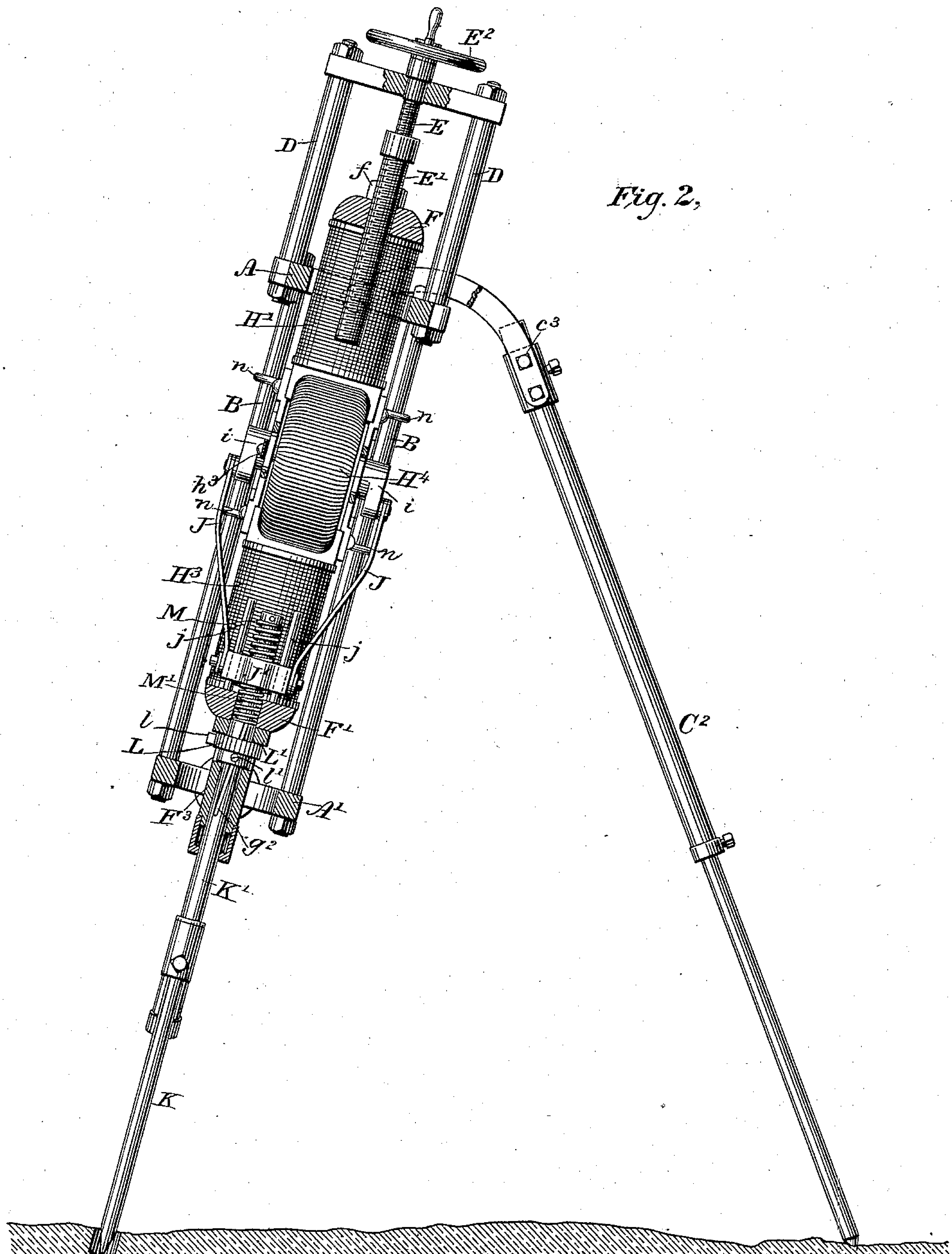

Fig. 2,

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Fig. 3.

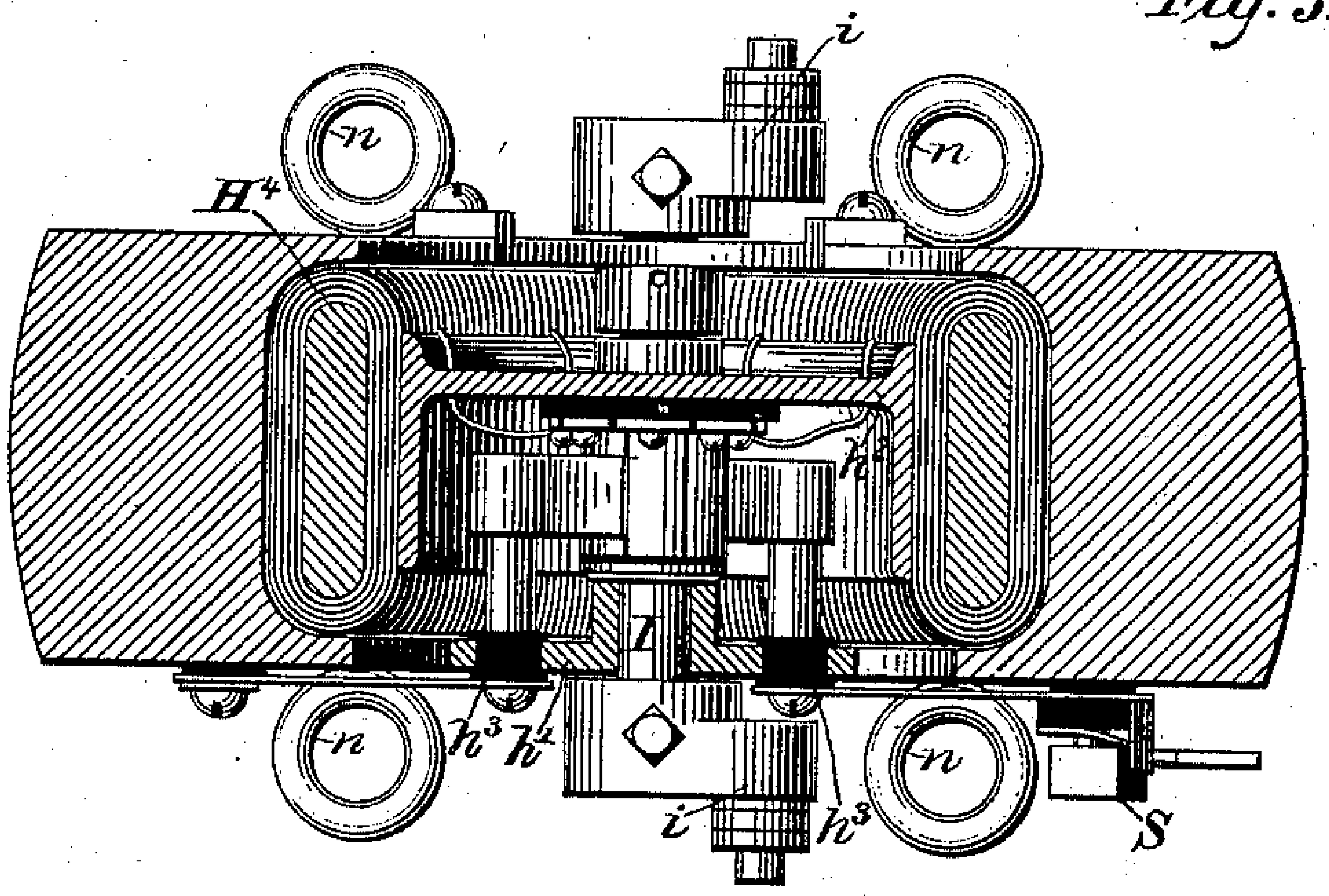
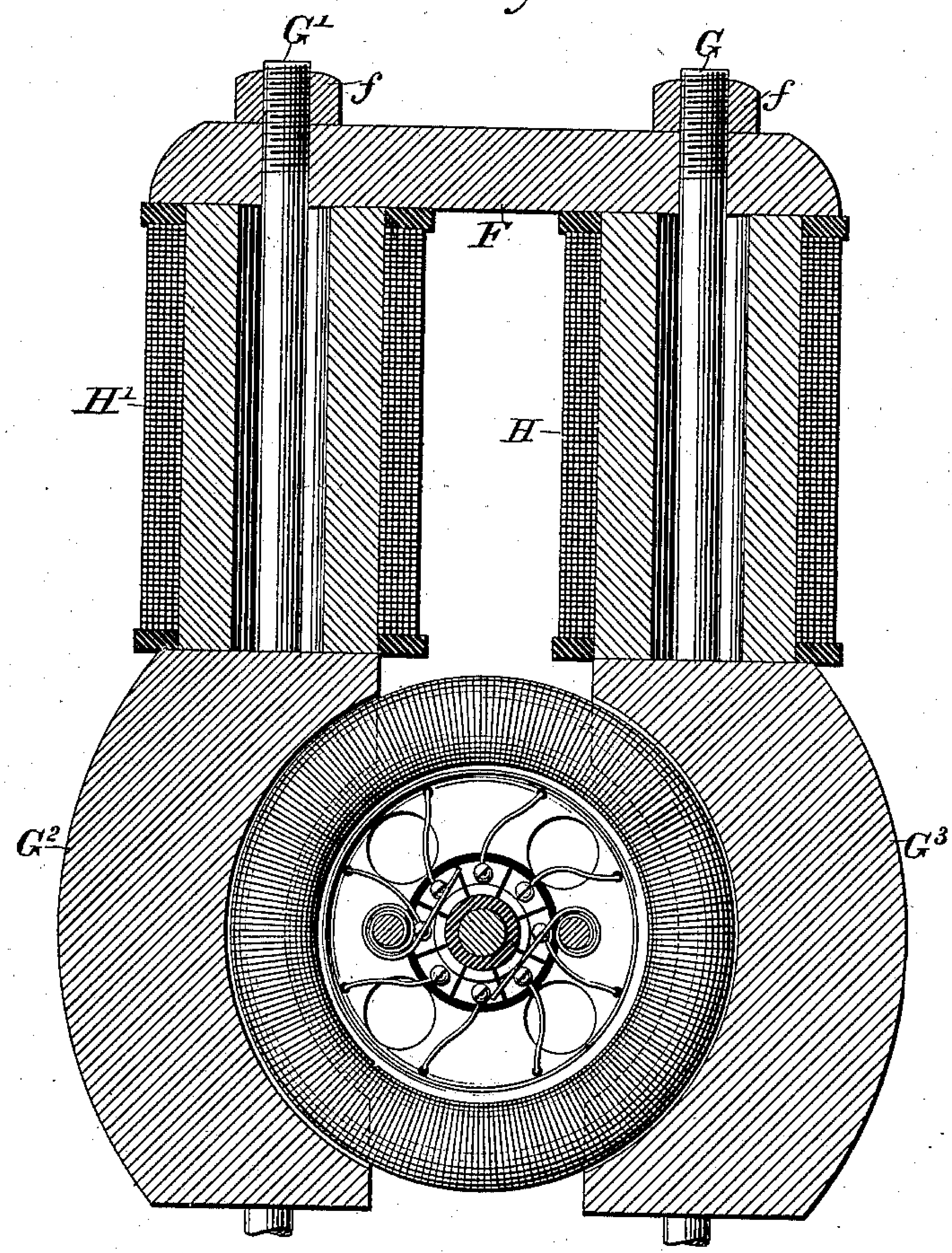


Fig. 4.



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UNITED STATES PATENT OFFICE.

LUCIUS J. PHELPS, OF NEW YORK, N. Y., ASSIGNOR TO CHARLES A. CHEEVER, TRUSTEE, OF SAME PLACE.

ELECTRIC ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 366,184, dated July 5, 1887.

Application filed December 31, 1885. Serial No. 187,275. (No model.)

To all whom it may concern:

Be it known that I, LUCIUS J. PHELPS, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Electric Rock-Drills, of which the following is a specification.

The objects of the invention are to secure simplicity in construction and efficiency in action.

The subject-matter claimed is specifically designated at the end of the specification.

My improved drill, while capable of a great variety of uses, is especially adapted for drilling rock or other hard substances.

So far as my knowledge extends, electric drills may, for the purposes of this specification, be divided into three classes: first, those in which a core or armature actuating the drill-stock reciprocates endwise through a solenoid; second, those in which an armature vibrating on a pivot actuates the drill, and, third, those in which a rotating armature actuates the drill through the intervention of belting, of a cam, or of gearing. Investigation and experience convince me that all these plans consume too much power in proportion to the results attained to be practically successful. I have, however, discovered and demonstrated that the requisite effectiveness may be obtained by the organization hereinafter described, which, generally stated, consists in actuating the drill through the intervention of cranks and connecting-rods directly from the revolving armature of an electric motor. This discovery and demonstration have led to the invention of numerous improvements, all of which are represented in the accompanying drawings as embodied in one organized apparatus. Some of these improvements, however, may be used without the others, and in apparatus differing in construction from that herein shown.

In the accompanying drawings, which represent all my improvements as embodied in the best way now known to me, Figure 1 is a front elevation; Fig. 2, a side elevation, partly in section; Fig. 3, a central horizontal transverse section therethrough; Fig. 4, a central vertical section of the upper portion of the motor.

As my improved drill is one of that class in which the motor is mounted on the same frame as the drill, and as that frame has to be supported at various inclinations to rest upon irregular surfaces in order to apply the drill advantageously to its work, it is important that the frame should be readily adjustable on its supports, that it should be strong and rigid to bear the shocks to which it is exposed, that the mechanism should be protected from injury by accidental blows, and be so balanced and centered in the frame as to minimize the working strain to the greatest practical extent. These ends I attain in this instance by constructing the frame of two oval-shaped yokes, A A′, provided with flanges or ears a' a', to serve as points of attachment for the legs or supports of the frame, as well as to strengthen it. These yokes are connected by four rods, B, provided with nuts and screws, so that the parts can be readily removed or replaced when desired. The front tubular legs, C, provided with bracing-ears c, are securely clamped to the ends of the lower yoke, A′, by nuts and screws in such manner as to permit the legs to be adjusted around their pivots to vary the angle of the legs relatively to the drill. Feet C′ slide endwise in these tubular legs, and are held at any desired point by means of set-screws c', thus enabling the lengths of the legs to be adjusted. The back leg, C^2, is similarly constructed and adjusted. Its upper end, however, forms a fork or yoke, C^3, which is pivoted to the opposite ends of the upper yoke or frame-piece, A, by bolts or clamp-screws c^3, which permit its angle relatively to the frame to be varied as required. A gallows-frame, D, formed with or detachably connected with the upper yoke, A, is provided with a telescoping screw, E, operated by a hand-wheel, E^2. The male screw E works in a female screw in the section E′, which in turn carries a male screw, passing through a cross-piece, F, supporting the motor and drilling mechanism. This arrangement is a compact one, giving a large range of adjustment to the drill, while the screw works in a small space. The upper cross-piece, F, slips over the core-pieces G G′ of the motor-magnets, and is secured by nuts f, which permit of the removal of the cross-piece and the ready removal or replacement of the bobbins H H' of the field-magnets. The lower bobbins, H^2 H^3, are similarly secured upon the pole-pieces by the cross-piece F'. Any portions of the frame which would tend to interfere by their induction with the lines of force of the motor may be made of brass or other non-magnetic metal.

The revolving armature H^4, which is preferably of the Gramme-ring type, is mounted on a crank-shaft, I, revolving freely in bearings in spiders h' h^2, bolted to the front and back of the pole-pieces G^2 G^3. These spiders thus serve not only as cross-braces for the pole-pieces, but afford a firm bearing for each end of the crank or armature shaft. This shaft projects both back and front beyond the face of the spiders, and is provided with cranks *i i* at each end. The pole-pieces of the field-magnets, as well as the armature, it will be observed, are flattened, so as to bring the cranks as close together as practicable, as this construction promotes stability of movement.

The commutator-brushes are mounted upon insulated posts h^3, carried by one of the spider-frames and projecting inwardly, as clearly shown in Fig. 3, into the face of the armature-ring, the commutator being located in this instance on the armature-shaft within the face of the armature-ring. It will be observed that the spokes or frame H' of the armature are arranged to one side of the vertical center of the wheel, as clearly shown in Fig. 3, so as to afford a chamber or recess for the commutator ring and brushes. This structure is compact and enables me to use a very short crank or armature shaft, and to locate the commutator wheel and brushes between the cranks. While I prefer such an organization, I do not, however, limit the invention to it. Connecting-rods J, pivoted at one end to the cranks on the armature shaft, are connected at the other with a cross-head, J', which carries the drill-stock and slides vertically in or on guides *j* on the lower cross-piece, F'.

The drill K is mounted in well-known ways in the drill-stock K', which reciprocates in a guide, F^3, bolted to the under side of the cross-piece F'. It is essential to efficient work that the drill should not only be capable of reciprocating freely, but of rotating axially in its support. This latter movement may be obtained in well-known ways. The preferred mode is the following well-known form: The drill-stock revolves and reciprocates in a socket, L, turning loosely in its support in the cross-piece F'. This socket carries a collar, L', provided with a ratchet, with which a pawl, *l*, pivoted on the cross-piece F' engages. A screw, *l'*, on the collar projects into an inclined groove, g^2, on the drill-stock. On the upward stroke of the stock the pawl holds the ratchet, and the stock is thus partly turned in the socket. On the downward stroke the pawl slips on the ratchet and the stock is not turned. The organization above described would give the ordinary reciprocating crank movement to the drill; but as it is advantageous to prevent shocks and jars to the mechanism and to impart a darting or thrusting stroke to the drill, I mount a spring, M M', on each side of the cross-head and connect the drill-stock with these springs. Spiral springs surrounding the stock above and below the cross-head are shown in this instance; the construction will be plain. Owing to this organization, on the upstroke of the crank the drill is cushioned by the compression of the upper spring, M, while it is lifted to some extent by the expansion of the lower spring, M'. On the downstroke these conditions are reversed, the lower spring being compressed and the upper spring being expanded, thus giving a thrusting stroke. The end-play of the drill-stock in its bearings thus obtained acts as a cushion to prevent communication of shocks and jars to the frame or motor.

The drill and motor can readily be adjusted on the frame by the telescoping screw, guides, or eyes *n*, attached to the pole-pieces for that purpose, traversing on the connecting-bars which unite the yokes of the frame.

The electrical connections are preferably arranged in the following manner: The bobbins of the field-magnets are connected in series, the circuit-wire *w* from the generator passing from the upper bobbin, H, to the corresponding one, H', then to the lower bobbin, H^3, through the commutator and armature-coils to the lower bobbin, H^2, and then back to the generator, the direction of the current being indicated by the arrows in Fig. 1. A switch, S, of well-known construction, serves to cut off the current when desired.

It will be observed that the frame within which the motor and drill-stock are mounted and fed surrounds and projects beyond the planes of the outer faces of the motor, so that all the parts of the motor, the cranks, and the connecting-rods are in a measure protected against accidental injury by the overturning of the drill, or otherwise.

When the machine is folded for shipment or storage, the legs are telescoped and the upper legs turned up alongside of the motor. When thus folded, the legs serve as a further protection to the motor.

As before remarked, I prefer to construct my motor with a flat compact armature, which may be of the Gramme type or a bobbin armature. This structure is preferred for the reason that a short armature-shaft may be used, so that the cranks thereon can be close together and the cross-head with which they are connected be short. This gives a greater efficiency and stability of action. So far, however, as the broader aspect of my invention is concerned, any of the other well-known types of armatures may be employed.

It will be observed that the motor is carried and adjusted in the longitudinal central axis of the supporting-frame, that the drill-stock is arranged in the same line, and that the power, being taken from both ends of the armature-shaft, is also symmetrically applied around the same center. This organization prevents any lateral jarring or wabbling of the machine and gives a well-balanced and steady action of the drill, which is one of the chief results I have sought to effect.

I am aware that, broadly, it is not new to operate a crank-shaft directly from the spindle of a rotating armature. I am also aware that, broadly, a commutator-ring inclosed within an armature-ring is old.

I claim as my invention—

1. In a drill, the combination of a frame, a rotary electric motor mounted in the frame, mechanism for adjusting or feeding the motor relatively to the frame, a drill-stock, and a crank-and-pitman connection by which the drill-stock is connected with the spindle of the motor.

2. The combination of the drill-frame, a rotary electric motor mounted and moving longitudinally therein, mechanism for adjusting or feeding the motor relatively to the frame, a drill-stock, a cross-head connected with the drill-stock, and a pitman-and-crank connection between each end of the cross-head and each end of the spindle of the electric motor, substantially as and for the purpose set forth.

3. The combination of the drill-frame consisting of upper and lower yokes and connecting-bars, a rotary electric motor mounted on the drill-frame and adapted to move longitudinally through the yokes of the frame, mechanism for adjusting or feeding the motor relatively to the frame, a drill-stock, and a crank-and-pitman connection between the drill-stock and spindle of the rotary electric motor, substantially as set forth.

4. The combination of a drill-frame having upper and lower yokes and connecting-bars, adjustable legs by which the frame is supported, an electric motor carried by the frame and adapted to move longitudinally through the upper and lower yokes, the longitudinal center of the motor and drill-frame coinciding, a drill-stock arranged in the same longitudinal central line, and a crank-and-pitman connection between the drill-stock and each end of the spindle of the rotary motor, substantially as set forth.

5. The combination of a drill-frame, a rotary electric motor mounted therein, mechanism for adjusting or moving the motor longitudinally relatively to the frame, a drill-stock, the driving-connection between the drill-stock and the spindle of the rotary motor, and impelling and cushioning springs interposed between the driving-connection and the drill-stock, substantially as and for the purpose set forth.

6. The combination of the drill-frame, a rotary electric motor mounted therein, adjusting mechanism mounted on the frame and connected with the motor, consisting of the gallows-frame and the double-screw feeding device, whereby the motor is moved longitudinally relatively to the frame, a drill-stock, and a crank-and-pitman connection between the drill-stock and the spindle of the rotary motor, substantially as set forth.

7. The combination of a drill-frame, the rotary electric motor mounted thereon and adjustable longitudinally relatively thereto, the motor consisting of field-magnets, an armature-ring, and commutator devices arranged within the face of the armature-ring and within the planes of the sides of the field-magnets, a drill-stock, and crank-and-pitman connections between the drill-stock and each end of the spindle of the armature-ring, the crank connections with the spindle being located outside of the commutator, substantially as set forth.

8. The combination of a drill-frame having upper and lower yokes and connecting-bars, the rotary electric motor mounted in the frame and adapted to move longitudinally through the upper and lower yokes, the spider-frames connecting the poles of the field-magnets of the motor, in which spiders the spindle of the rotary armature has its bearings, the commutator devices located between the spiders, a drill-stock, and a crank-and-pitman connection between each end of the motor-spindle and the drill-stock, substantially as set forth.

9. The combination of the drill-frame having upper and lower yokes and connecting-bars, adjustable legs by which the frame is supported, an electric motor carried by the frame and adapted to move longitudinally through the upper and lower yokes, the longitudinal center of the motor being arranged substantially in the longitudinal center of the drill-frame, a drill-stock arranged in the same longitudinal central line, and a driving-connection between the drill-stock and motor, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

LUCIUS J. PHELPS.

Witnesses:

HENRY D. HALL,

R. J. MONTGOMERY.