(No Model.) 3 Sheets—Sheet 1.

H. F. PARSONS & H. BORCHARDT.

ROCK DRILLING MACHINE.

No. 281,719. Patented July 24, 1883.

FIG. 1.

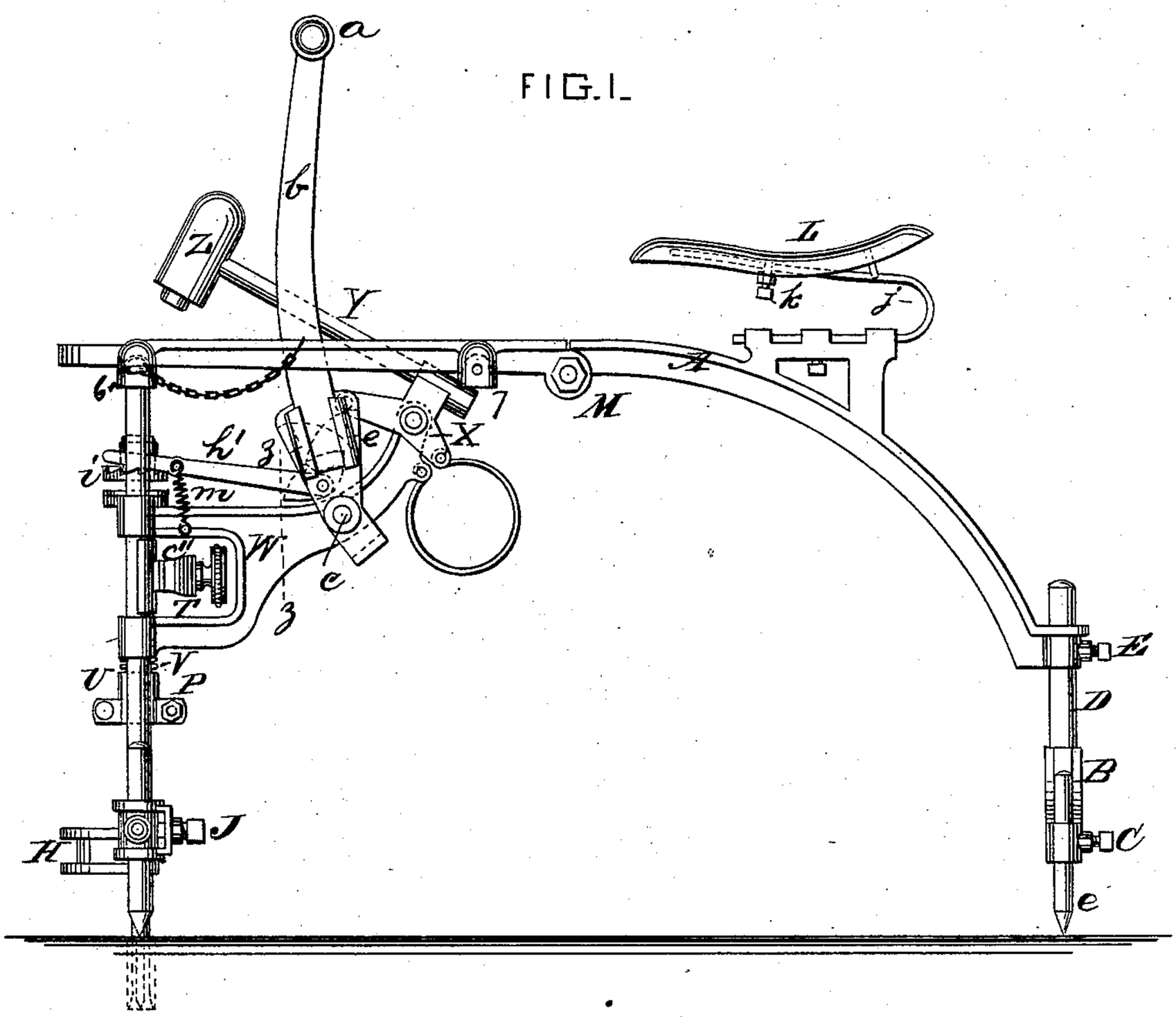

FIG. 2.

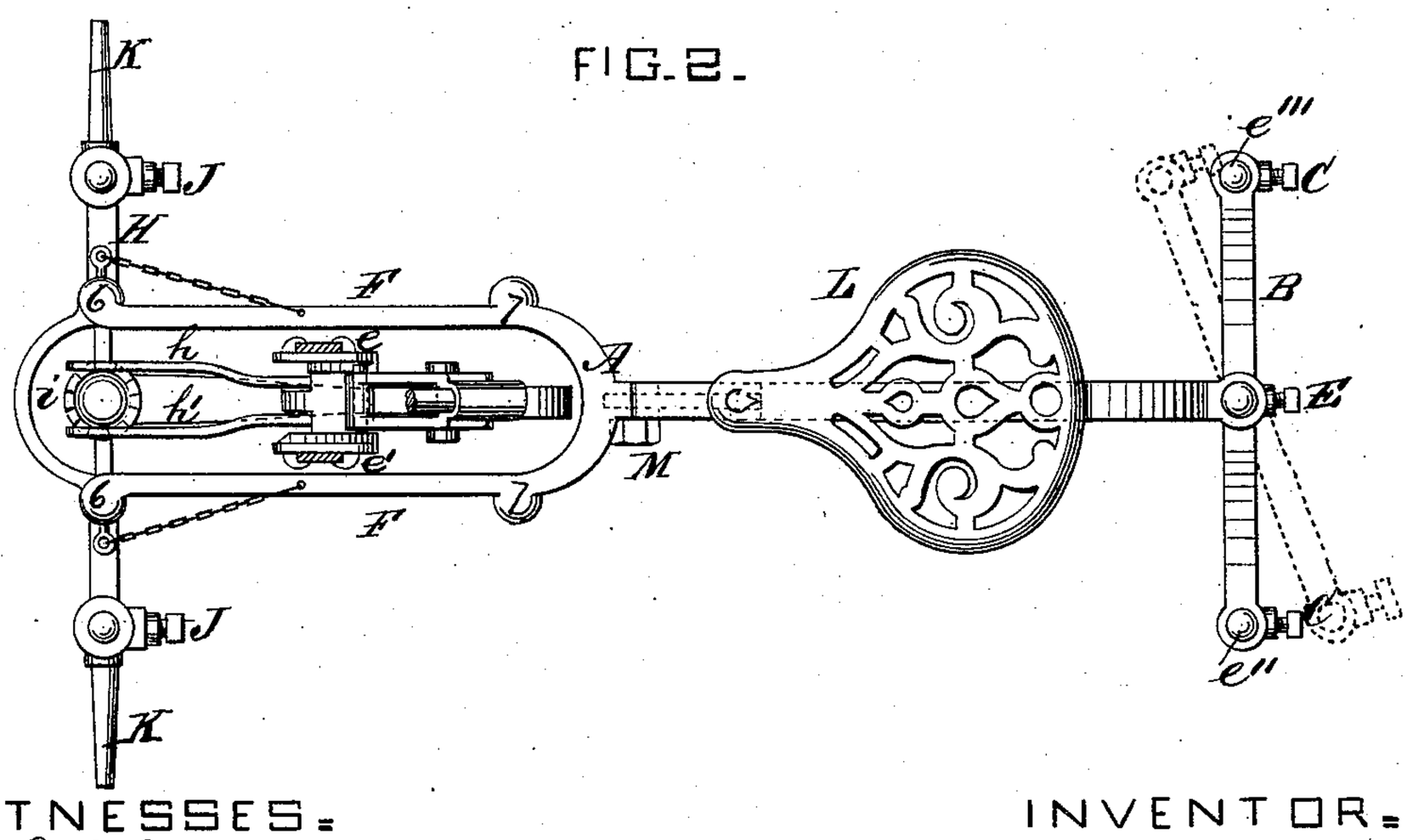

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FIG. 3.

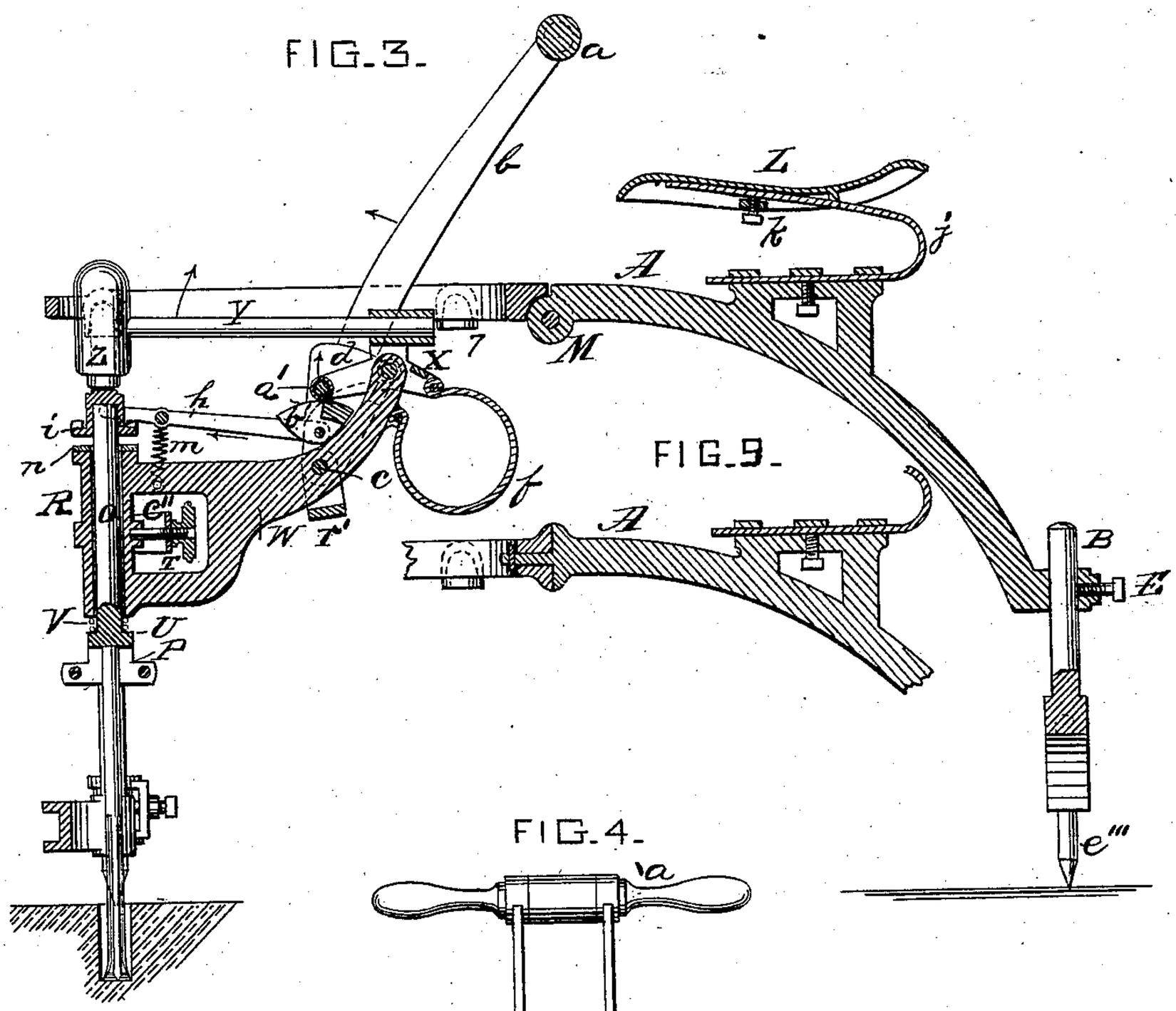

FIG. 9.

FIG. 4.

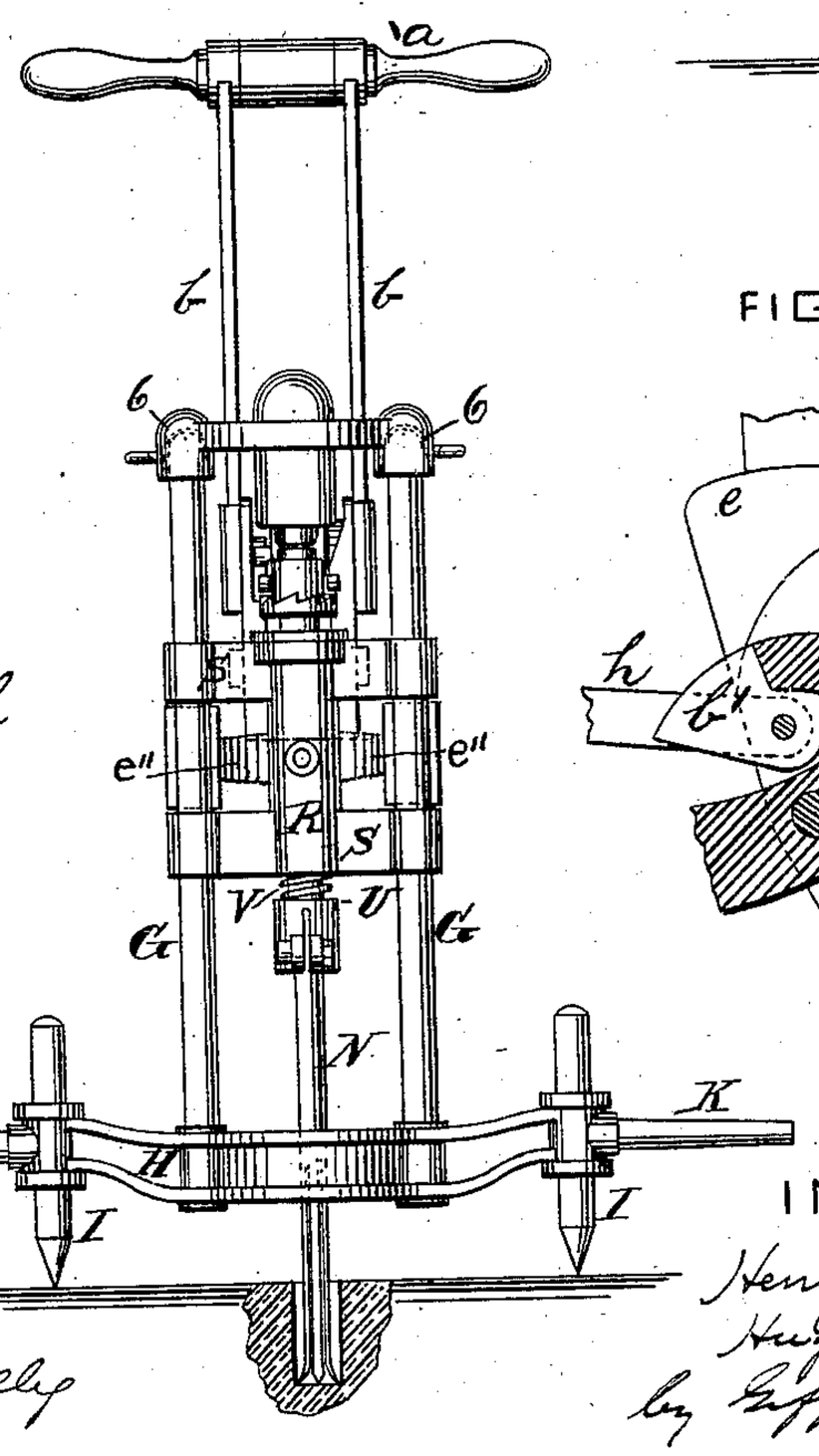

FIG. 5.

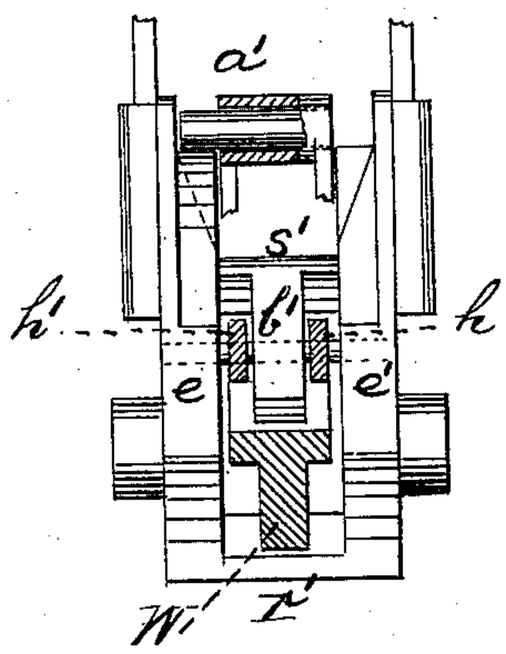

FIG. 6.

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FIG. 8.

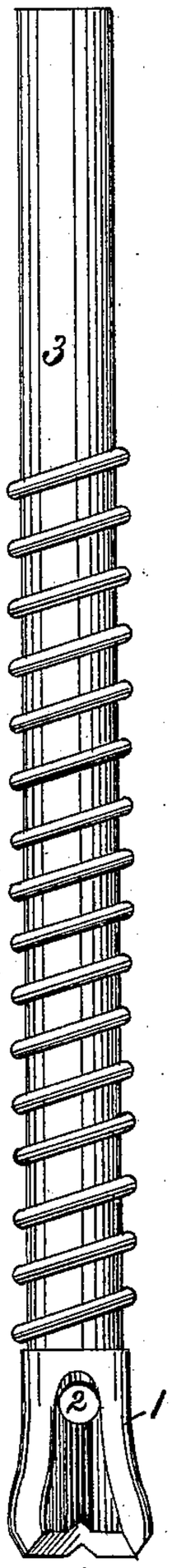


FIG. 7.

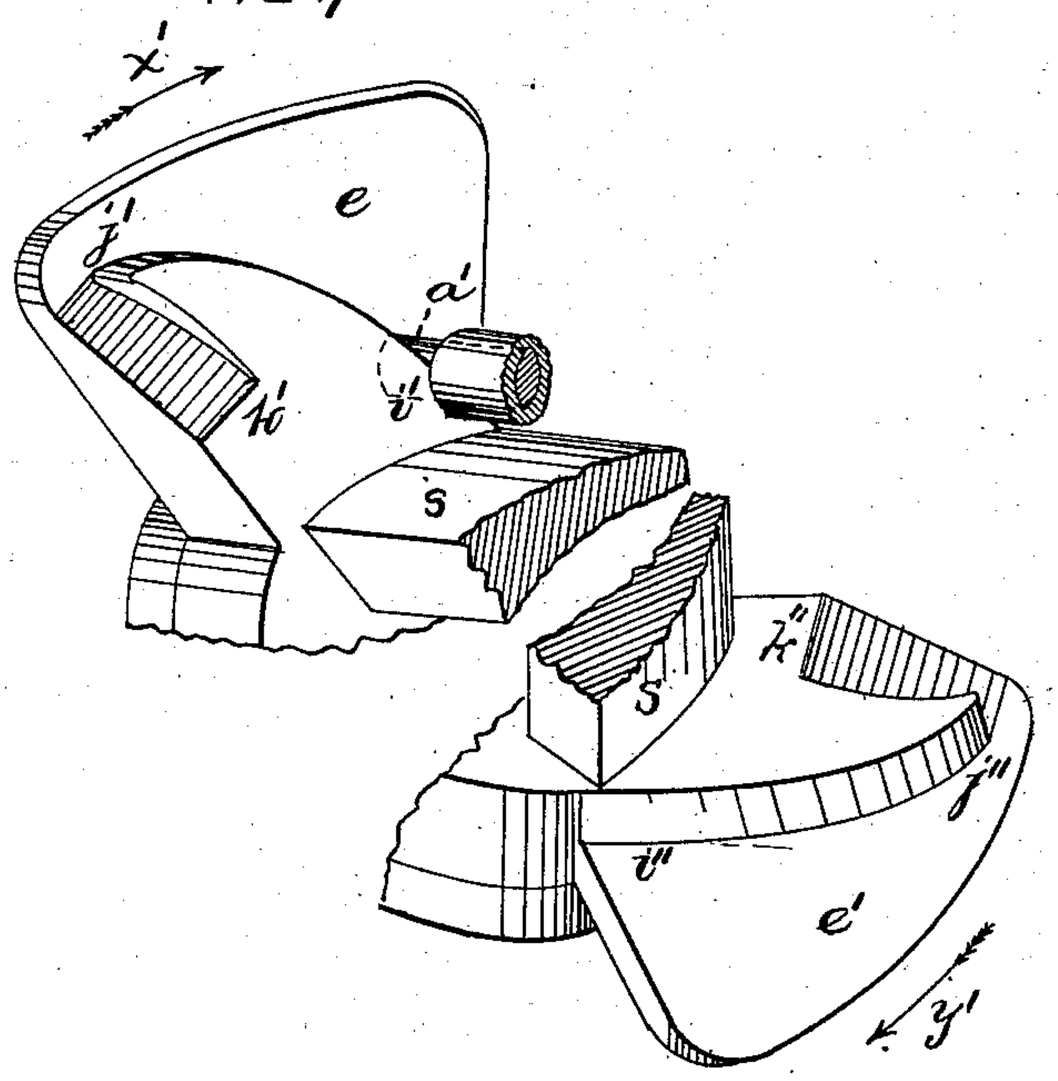
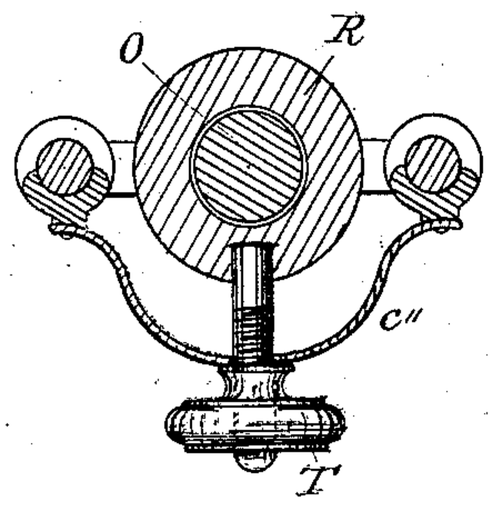


Fig. 10.



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UNITED STATES PATENT OFFICE.

HENRY F. PARSONS, OF SAN FRANCISCO, CALIFORNIA, AND HUGO BORCHARDT, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO DANIEL COOK, OF SAN FRANCISCO, CALIFORNIA.

ROCK-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 281,719, dated July 24, 1883.

Application filed September 12, 1881. (No model.)

To all whom it may concern:

Be it known that we, HENRY F. PARSONS, of the city and county of San Francisco, State of California, and HUGO BORCHARDT, of Bridgeport, Connecticut, have invented a certain new and useful Improvement in Rock-Drilling Machines; and we declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

Figure 1 represents a side elevation of the machine, showing the hammer in a raised position. Fig. 2 is a plan view of the machine with the hammer and a portion of the hammer-arm removed. Fig. 3 represents a sectional side view, showing the hammer in the act of delivering a blow. Fig. 4 is a front view. Figs. 5 and 6 represent certain details of construction, Fig. 5 being a front view of a section through the line *z z*, Fig. 1. Fig. 7 shows the general arrangement of the cams by which the hammer is operated. Fig. 8 shows a form of drill which may be used, if desired. Fig. 9 shows a modification of the joint in the frame. Fig. 10 shows a sectional detail of the friction-brake.

The subject of the present application is an improvement on a former application by said Henry F. Parsons, filed on the 30th day of June, 1881, and on the 5th day of August, 1880, also on an application filed by the present applicants on the same day herewith.

The structure in which we prefer to embody the inventions which are the subject of the present application may be described as follows.

A is the frame of the machine, which is preferably of the form shown in the drawings. In the rear of this frame is formed a hole, through which passes the upper portion of the standard B. This standard consists of a horizontal portion, provided at each end with adjustable supporting pointed rods, which are adjustable vertically in the standard B, and are held in place by means of the set-screws C. From the center of this standard B projects upwardly a rod, D, through the hole above mentioned, in the rear of the frame A. This bar D may be adjusted vertically with relation to the frame A, and is secured in place by means of the set-screws E. This construction not only allows of the vertical adjustment of the standard, but also admits of its being turned on the rod D as a center, as shown in dotted lines, to avoid obstructions, or for convenience in finding a level bearing. The forward end of the frame A is forked, so as to form two branches, as at F F, Fig. 2. From the forward end of each of the branches F F extend downward the guiding and supporting bars G G, Fig. 4. These bars G G are connected at their lower ends with a standard, H, which is supported in a horizontal position by the adjustable pointed supporting-bars I I, the latter passing through holes near the extremities of the standard H, and being adjustably secured therein by the set-screws J J.

Projecting out laterally from the extremities of the standard H are two foot-rests, K K, which may serve to support the feet of the operator, as hereinafter described. The standard H has a forward bow between the bars G G to allow for the passage of the drill.

The frame A is hinged at the point M, so as to allow the machine to be folded together, and thus easily and compactly transported; or, instead of the hinge shown in Fig. 1, the frame may be provided with a revolving joint similar to that shown in Fig. 9, which will permit the supports to adjust themselves more readily to varying surfaces, and which can be easily taken apart for the more convenient transportation of the machine.

N is the drill, which is shown in a vertical position, and situated midway between the supporting and guiding bars G G. This drill is connected at its upper end by the coupling P with the drill-rod O. The drill-rod O passes upward through the barrel R, the drill-rod being so fitted to the interior of the barrel R as to be capable of a free motion in the same. The barrel R is secured to and supported by the frame S, which projects out from either side of the barrel R, and is provided at its extremities with holes, through which pass the

supporting-bars G G. The frame S is thus free to slide in a vertical direction from one end of the bars G G to the other. It is supported on the bars G G by a friction brake or clutch which is controlled by a hand-nut, T, so that the ease with which the frame S may move upon the bars G G can be regulated at the pleasure of the operator. This clutch consists of a curved piece of metal, c'', extending from one guide-rod to the other, which is provided at each end with a friction-bearing for the guiding-rods G G. Through the center of this piece c'' projects a pin, which is secured to the barrel, as shown at Fig. 3. The hand-nut T screws on the end of this pin, and by tightening or loosening the nut the pressure of the piece c'' on the guides G G may be increased or decreased. The drill-rod O is provided at its lower end with a shoulder, U, between which and the lower portion of the barrel R is interposed a coiled spring, V.

Attached to the rear of the barrel R, and extending backward and upward, is the bracket-arm W, attached to and supporting the arm Y of the hammer Z. This hammer is operated in the following manner: a is a handle situated above and in front of the saddle L, which handle is adapted for both hands of the operator. The handle a is provided with arms b b, which fit into sockets on the casting e e'. The casting e e' consists of two side portions, e and e', one of which is situated on each side of the bracket W. They are rigidly connected together below and above the bracket W at the points s r. The casting e e' is attached to the bracket-arm W by the shaft c, which extends through both, and on which the casting revolves. On the inside surfaces of the pieces e e' are formed cam-surfaces, whose general form is clearly shown in Fig. 7. These cam-surfaces are for the purpose of communicating the reciprocating motion of the lever a to the lever X, one arm of which is rigidly secured to the handle of the hammer Z. This result is accomplished in the following manner: Through one arm of the lever X extends the pin a', which is free to move endwise in said arm. This pin a' is long enough to extend out on one side of the lever X a short distance, and is free to move lengthwise, so as to project out on either side of the lever. The pieces e e' are so connected as to be apart just the width of the lever X; but the interior surfaces of the pieces e e' are cut away so as to form cams, on which the projecting end of the pin a' may rest. When the motion of the piece e is in the direction of the arrow x' in Fig. 7, the end of the pin projects over the cam-surface on the piece e, so that the motion of the piece e causes the end of the pin a' to advance up the cam-surface from i' to j', and of course a corresponding motion is imparted to the lever X. When the end of the pin a' reaches the point j, the cam-surface is so formed as to suddenly release the end of the pin a' and allow it to fall. In falling the end of the pin a' impinges against the inclined surface from j' to k', which forces the pin back longitudinally through the lever X until the opposite end of the pin projects over the cam-surface of the piece e', which cam-surface will catch the pin at a point about i'' and prevent it from falling farther. At the same time the end of the pin next the piece e is forced in flush with the side of the lever X, so as not to engage with the piece e in any way. When the pin has reached such a position that its end projects over the cam-surface at i'', the casting, of which the pieces e e' are a part, is moved by the operating-levers, so that the piece e' moves in the direction of the arrow y', which motion causes the end of the pin a' to advance up the cam-surface from i'' to j''. When it reaches j'', it is allowed to fall again, and in so doing the pin is forced back by the incline between j'' and k'' until it occupies the position from which it started, so that one end extends over the cam-surface of e at i', as shown in Fig. 7.

From the above explanation it is plain that when the piece e e' is reciprocated around the shaft c by means of the hand-lever a the lever X, and with it the hammer-arm and hammer, will be reciprocated twice for every reciprocation of the hand-lever a, and that the upward movement of the hammer will be gradual, while its downward movement is unimpeded and rapid. The lever X, being pivoted to the end of the arm W, is made with three projecting arms, one of these arms, as above stated, being attached to the rear end of the arm Y of the hammer Z. Another of the arms of the lever X extends backward, and is attached to one end of a circular spring, f, the other end of said circular spring being attached to the rear side of the bracket W. Another arm of the lever X extends forward, and is provided with the pin a', the operation of which has been described.

Attached to each of the pieces e e' at a short distance above the point where they are pivoted to the bracket W are pawls h h', projecting forward, so as to extend on each side of the drill-rod O. At its upper end the drill-rod O is provided with a striking pin or cap, which receives the blows of the hammer, and which is pinned or screwed or otherwise fastened upon the top of the drill-rod. Below this cap, and secured to the drill-rod, is the piece i, which is provided on its upper surface with ratchet-teeth. The pawls h h', at their forward ends, rest upon this circular ratchet i, and are provided upon their lower surfaces with teeth, the tooth on h' being so formed as to engage with and push the circular ratchet i around by the forward movement of the pawl h', and the tooth on the pawl h being so formed as to pull the circular ratchet i around on the backward movement of the pawl h, so that for every forward movement of the pawl h' the circular ratchet i is moved the distance between two teeth by the pawl h', and also for every backward movement of the pawls the circular ratchet i is

moved the distance between two teeth by the pawl *h*. Into the face of the hammer Z is inserted a striking-pin. It is removable, so that it may be replaced when worn without the necessity of renewing the hammer. The saddle L is adjustable backward and forward on the spring *j*, and is secured in position by the set-screw *k*. A stop, *b'*, attached to the casting *e e'*, limits the extent of the motion of *e e'* by coming in contact with the bracket-arm W.

The operation of the machine is as follows: The operator places the machine so that the drill occupies a position above the place where the hole is required. The machine then rests upon the pointed supports I I *e'' e''*, which are adjusted vertically by means of the set-screws C C and J J until the machine occupies the required position, which is as nearly as possible horizontal if the hole is required to be drilled in a vertical direction. The position of the machine will be, however, somewhat varied by the direction in which the hole is required to be made. After having placed the machine in position, as described, the operator takes his seat upon the saddle L and places his feet on the projections K K. He then takes hold of the handle *a* with both hands and moves it backward and forward in a direction away from and toward him. This motion of the handle *a* is communicated by the arms *b* to the pieces *e e'*, provided with the cam-surfaces before described. As the handle *a* moves backward and forward, it is obvious that the pawls *h h'*, being between the handle *a* and the place where the arms *b* are pivoted at *c*, will also be moved backward and forward, though to a less extent, and the distance through which they are moved is so regulated as to be equal to the distance between each two of the teeth on the piece *i*. This motion of the handle *a* will therefore be communicated through the pawls *h h'* to the circular ratchet *i*, and the ratchet will be revolved the distance between two of its teeth for every forward and every backward motion of the handle *a*. This rotary motion of the circular ratchet *i* is communicated by the drill-rod O to the drill N, which thus receives a rotation through the distance between two of the teeth of the ratchet *i* during each motion of the handle *a*, and ceases to rotate at the end of each forward and backward stroke of the handle *a*, and since the hammer Z performs one stroke between each forward and backward movement of the handle *a*, the drill will be revolved the distance between two teeth of the ratchet *i* between each stroke of the hammer, and will be stationary at the time the stroke of the hammer occurs. The spiral springs *m m* will serve to hold the pawls *h h'* down upon the circular ratchet *i*, and these springs *m m*, either alone or in conjunction with the coiled spring V, which may or may not be used, will serve to retain the drill at the bottom of the hole while it is being revolved, and in readiness for the next stroke of the hammer. On the upper end of the barrel R, and below the ratchet-wheel *i*, is placed a washer, *n*, of leather or like material. The blows of the hammer striking upon the top of the drill-rod O, will force the drill into the rock, and if it forces the drill into the rock a greater distance than the distance between the lower side of the circular-ratchet *i* and the top of the washer *n* the momentum of the hammer, acting thus upon the top of the barrel R, will overcome the friction-connection between the frame S and the supporting-bars G G and force the barrel down a distance which will be determined by the depth to which the drill was driven. Now, as the hammer is raised again the drill is revolved the distance between two of the teeth on the ratchet-piece *i*, which moves the edge of the drill from the cut made by the previous stroke, and causes it to be lifted up onto the ridge of rock which is next adjoining the cut which has been made at the bottom of the hole. In this way the lower surface of the ratchet *i* and the upper face of the washer *n* are separated the distance to which the drill is raised by being so revolved. The next stroke of the hammer, however, forces the drill again downward, and in case the drill descends farther than it did on the next preceding stroke the lower portion of the ratchet *i* will again come in contact with the washer *n*, and the inertia of the hammer, being communicated to the barrel R, will again force the barrel forward a distance to correspond with the travel of the drill. In this way each stroke of the hammer feeds the drill-supporting mechanism forward a distance corresponding with the travel of the drill, so that their relative position is always the same, and their downward movement is regulated by the velocity with which the boring proceeds. At the same time the drill is never lifted off of the bottom of the bore-hole; but the only lifting of the drill is produced by the form of the bottom of the bore-hole acting as a cam on the cutting-edge of the drill, which is beveled on its sides. In case the friction-connection between the frame S and bars G G is too weak, so that the travel of the barrel R is too fast, the friction may be increased by turning the thumb-nut T; or the friction may be decreased by turning the thumb-nut in the opposite direction. In case it is desired at any time to remove the drill from the bore-hole, or to detach the drill, the friction-connection between the frame S and bars G G may be loosened, and the frame S, carrying the barrel R and the hammer-supporting mechanism, may be raised up on the supporting-bars G G, so as to lift the drill out of the hole. It will be noticed that in the machine above described there is no mechanism provided for lifting the drill from the bottom of the bore-hole between the strokes of the hammer, as has been the case in machines heretofore produced. We have discovered that by having the edges of the drill beveled the simple revolution of the drill, without mechanism for rais-

ing it, the drill, being free to rise, will raise it and cause the cutting-edges to closely follow the rock at the bottom of the bore-hole, so that the cuttings are never allowed to come between the cutting-edges of the drill and the rock. This continuity of contact between the cutting-edge and the rock is insured by providing a yielding pressure on the drill-holder, as by the spring V. By thus excluding the cuttings from between the cutting-edge of the drill and the rock the power is saved which was formerly required to force the drill through the cuttings when the drill was raised by mechanism provided for the purpose. This feature of dispensing with mechanism for raising the drill is also of especial utility when drills are used with spirals formed on their sides for feeding the cuttings out of the bore-hole, because these spirals heretofore always created much friction by the raising and dropping of the drill, and did not perform the discharging operation as well as though the drill was operated as shown in the present application. The drill attached to the machine in the drawings is provided with a spiral rib on its sides; but in Fig. 8 is shown a drill which we prefer to use with the machine. This drill is more particularly described in an application of said Parsons filed September, 1881. It consists of a cutting-head, 1, which is provided with cutting-edges beveled on each side. The outside of the cutting-head is grooved between the cutting-edges, so as to admit of the upward passage of the cuttings, and for the same purpose a passage is formed in the center of the cutting-head, from its bottom to near its top, where the passage intersects with a cross-passage, 2, having an opening on each side of the cutting-head. This cutting-head is attached to a drill-rod, 3, which is surrounded by a spiral rib extending from the cutting-head to near the top of the drill-rod. This spiral rib is preferably formed by a wire wound around the drill-rod and held in place by a slight groove in the surface of the drill-rod.

As shown in the drawings, the guiding-rods G G are attached to the forward end of the frame A by having their upper ends secured in the sockets 6 6 by pins; but we also provide similar sockets at 7 7 on the frame, and if it is desired to drill a hole under that portion of the frame the guiding-rods may be removed from the sockets 6 6 and attached to the sockets 7 7, all of the parts connected with the guiding-rods being reversed, so that the bracket W extends away from the saddle, instead of toward it, and the head of the hammer will be where the end of the handle is, as shown in Fig. 3, and vice versa.

The form of machine shown in the drawings is especially adapted for quarrying-work; but the general features of the device may be embodied in apparatus of a form suitable for other kinds of work, as tunneling or mining, when the arrangement of supports shown in our application filed on the same day herewith would be adopted.

It is evident that as the operator is seated with his legs in a fixed position the machine is not so liable to rock from side to side as when it is driven by the feet of the operator. Moreover, the operator, being seated with his feet on rests a few inches from the ground, can, if disposed to do so, or if it should be necessary, steady the machine with his feet, which cannot be done in machines driven by foot-power.

Some of the features shown in this application are not claimed, broadly, here, but will be shown and claimed in a separate application we are about to make.

What we claim, and desire to secure by Letters Patent, is—

1. In combination with the frame A, having one end constructed to rest on the ground and a socket at the other end, the standard B, having a central stud, D, constructed to be adjusted at different heights in said socket, and adjustable supports *e* at each end, substantially as described.

2. The combination, in a drilling-machine, of a frame forked in front and suitably supported in the rear, with two rods, each connected to and supporting a separate arm of the fork, and a bracket supported by and moving on said rods, forming a guide for the drill, and having on its extended arm the hammer and hammer-operating mechanism, both on the same side of the drill, substantially as described.

3. The combination, in a rock-drill, of a frame forked in front and suitably supported in the rear, each branch of the fork resting on a separate rod, with a bracket supported by and moving on said rods, one end of which forms a guide for the drill and the other a support for the hammer, and having mechanism for operating the hammer arranged intermediate of the drill and hammer-supports, substantially as described.

4. The rock-drill frame A, having a suitable support at the rear, and its front end forked to allow of the movement through it of the operating mechanism, and provided with two sets of sockets, 6 6 and 7 7, for the guide-rods, in combination with the guide-rods G, whereby the position of the drilling mechanism may be reversed, substantially as described.

5. In a rock-drilling machine, the combination, with the lever and intermediate device for driving the drill longitudinally, of a pawl or pawls for revolving the drill, moving independently of the hammer and pivoted to said lever, whereby the motion of the lever operating the hammer also turns the drill, substantially as described.

6. The combination, in a drilling-machine, of a drill, an oscillating lever, a double-acting lifting device moving with said lever, intermediate connections, substantially as described, between the lifting device and the drill, and

pawls connected to the lever, whereby a blow is given to the drill and it is turned by a pawl as the lever vibrates in one direction, and another blow is given to the drill and it is turned again by another pawl as the lever vibrates in the opposite direction, as set forth.

7. The combination of a drill having a spiral rib for removing the drillings, mechanism, substantially as described, for giving the drill an intermittent rotary motion without lifting it, a spring to keep the drill in contact with the bottom of the drill-hole, and a hammer for driving the drill lengthwise, substantially as described.

8. The combination, with the mechanism for revolving the drill, of a drill-rod free to reciprocate in its bearings, so that it may be lifted by the inequalities at the bottom of the bore-hole as the drill revolves, without being actuated by any lifting mechanism, and a spring for producing a yielding pressure on the drill, so as to retain its cutting-edge in contact with the rock.

9. The combination, in a drilling-machine, of the ratchet-wheel I for moving the drill, the pawls *h* and *h'*, operating said ratchet-wheel, and mechanism, substantially as described, for giving motion to said pawls, whereby the drill is moved twice to each complete movement of the hand-lever, as set forth.

10. The combination, in a rock-drill, of a reciprocating hammer and a bracket constructed and arranged to be fed toward the work by the downward movement of the drill, one end of said bracket forming a guide for the drill and the other a support for the hammer, with a frame suitably supported at the rear, and having its forward end forked to receive the guide-rods, on which the bracket travels, and to admit of the hammer working through it, substantially as described.

11. The combination of the lever *b*, vibrating cam-pieces *e e'*, the pawls *h h'*, connected to the cam-pieces, and the ratchet *i*, substantially as described.

12. The combination of the guiding-bars G, the vertically-adjustable stud D, the frame A, having one end forked, and provided with sockets to receive the guide-bars G, and having at its other end a socket for the stud D, the standard B, connected to stud D, and the standard H, attached to the guide-rods, both standards being provided with adjustable supports, substantially as described.

13. The combination, in a rock-drill, of a bracket, one end of which has two parallel apertures to receive the guiding and supporting bars, and an aperture to receive and guide the drill, a frame having one end forked to receive and rest on the guiding-bars, a hammer working through said forked end to strike the drill, and means for operating the hammer, all substantially as described.

14. The combination, in a rock-drill frame, of the supporting-bars G G and adjustable bars I I with the standard H, provided with the foot-rests K K, and sockets for the guide-bars G G, and adjusting-bars I I, and fastening devices for securing the bars in the desired position, substantially as described.

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