(No Model.) 2 Sheets—Sheet 1.

W. X. STEVENS.

ROCK DRILLING MACHINE.

No. 481,598. Patented Aug. 30, 1892.

Fig I.

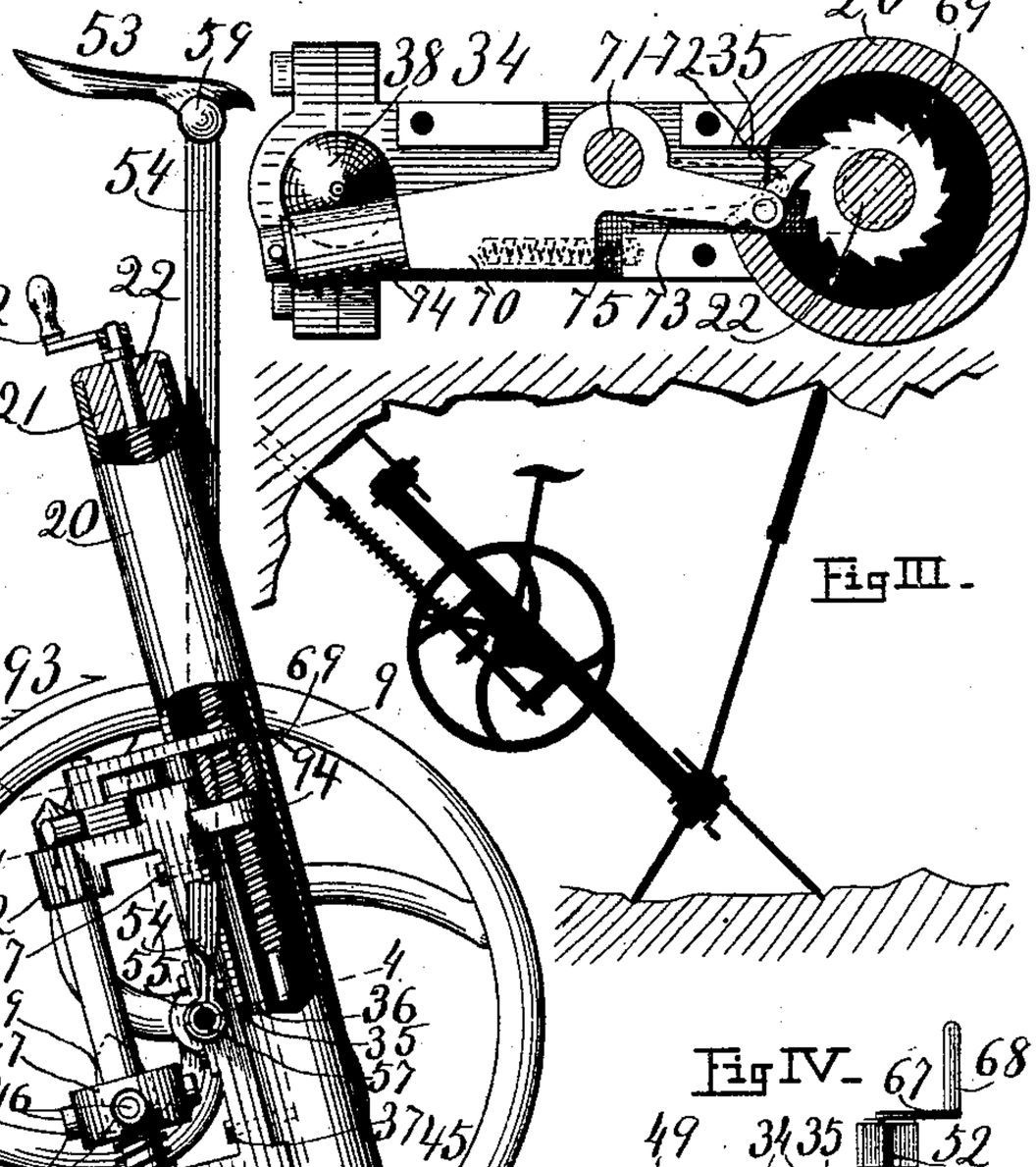


Fig IX.

Fig VI.

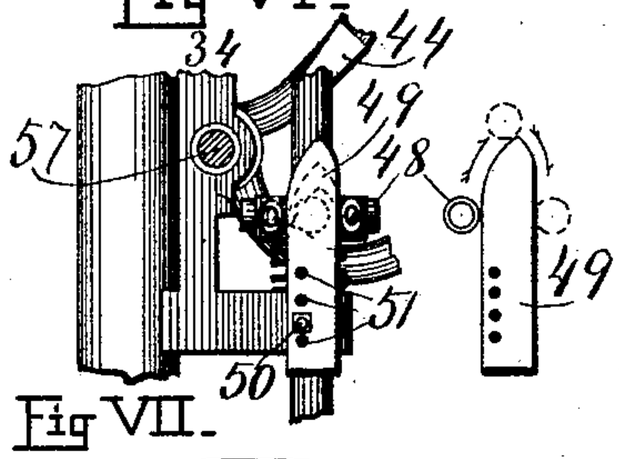


Fig VII.

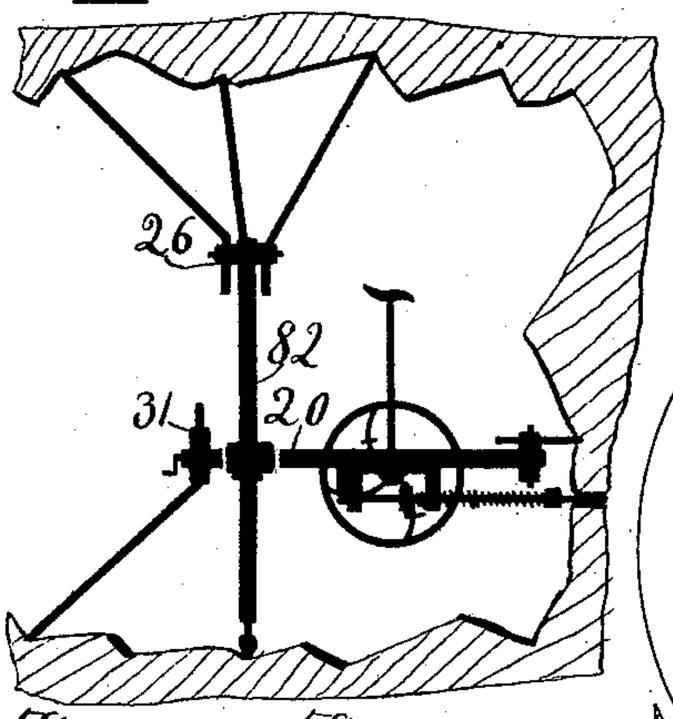


Fig III.

Fig IV.

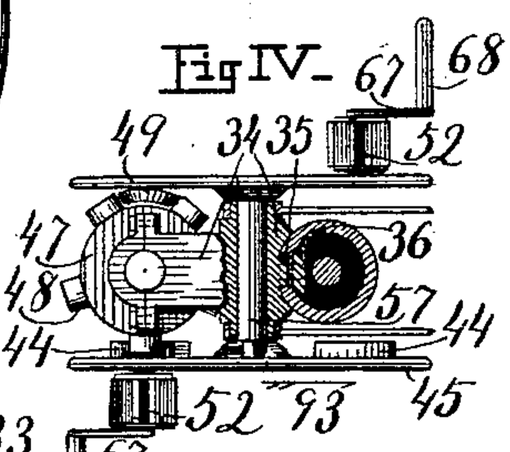


Fig V.

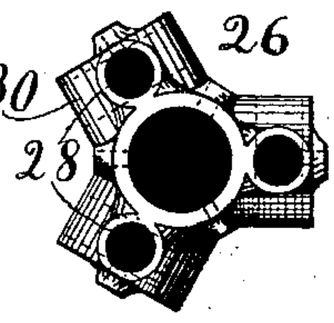


Fig VIII.

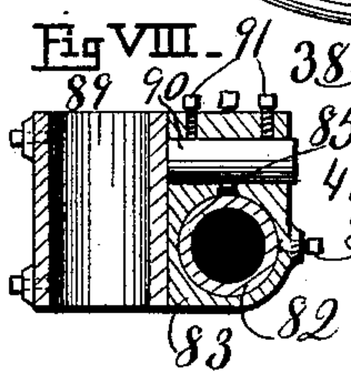


Fig II.

WITNESSES,

P. E. Stevens

M. C. Hillyard

INVENTOR.

William X. Stevens.

(No Model.) 2 Sheets—Sheet 2.

W. X. STEVENS.

ROCK DRILLING MACHINE.

No. 481,598. Patented Aug. 30, 1892.

Fig X.

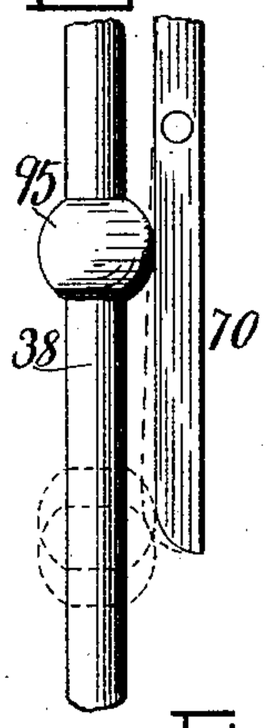


Fig XI.

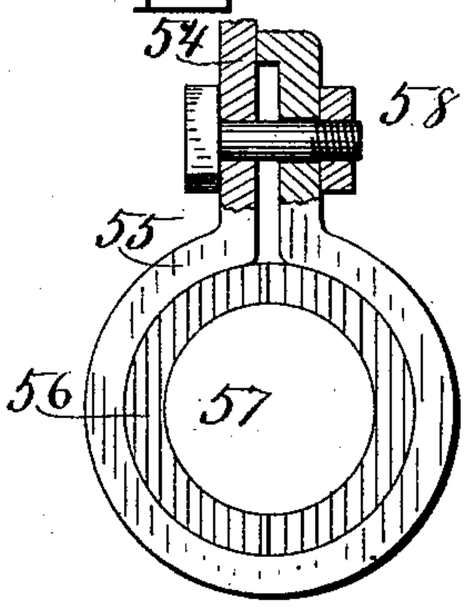


Fig XII.

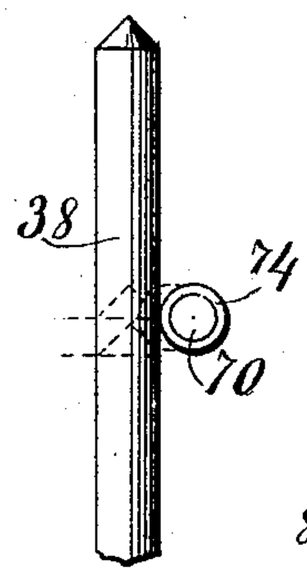


Fig XIII.

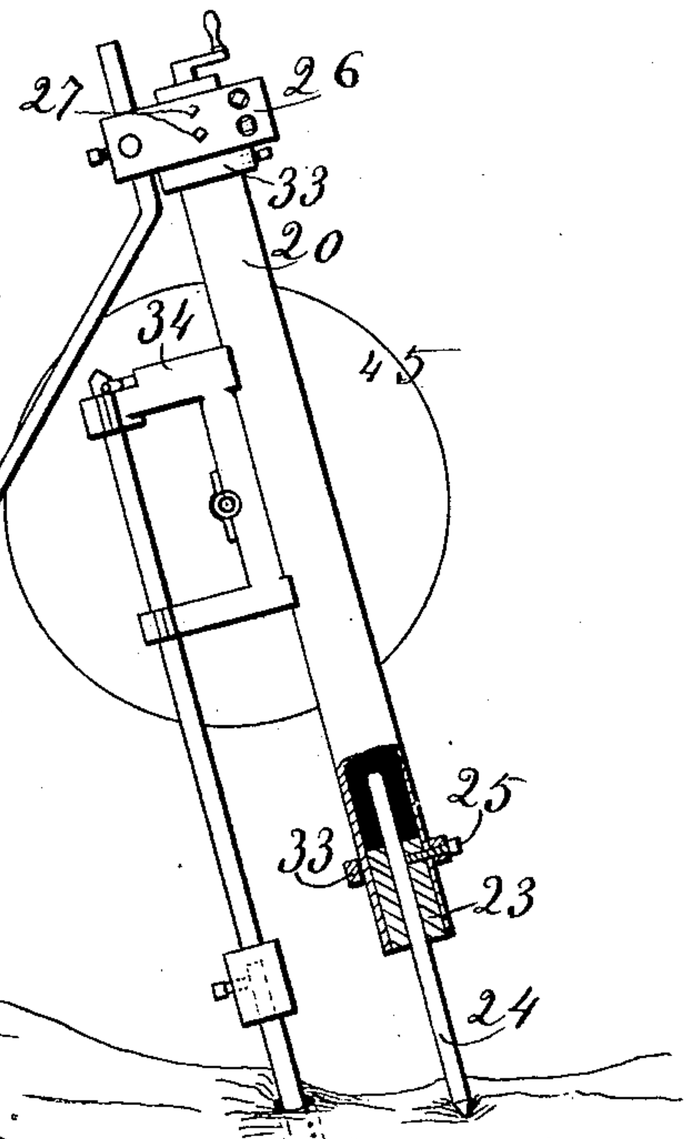


Fig XIV.

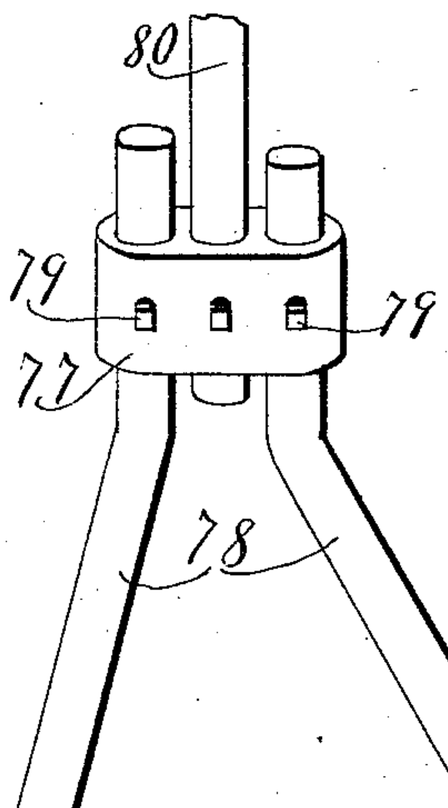
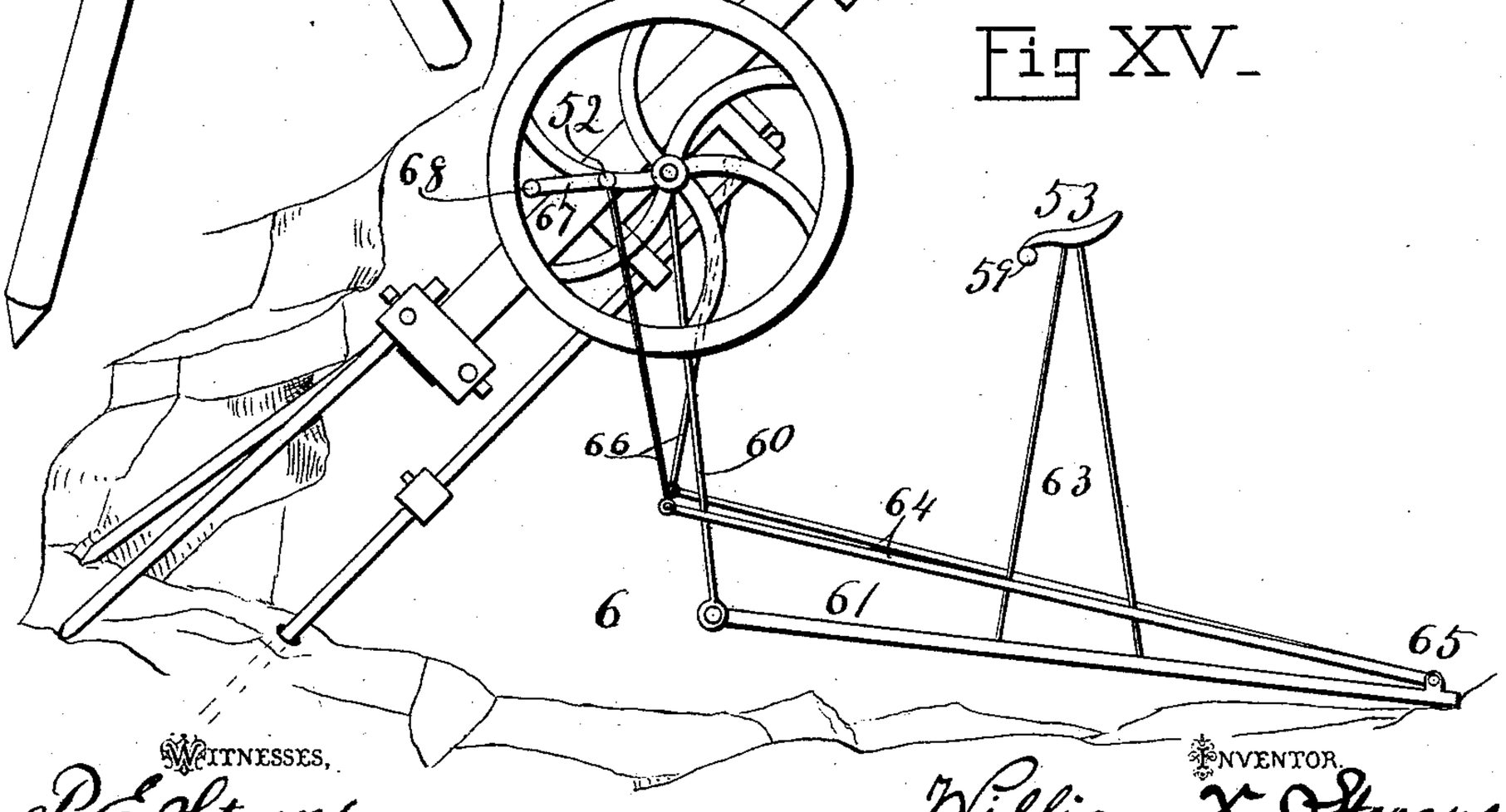


Fig XV.



WITNESSES,

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In. C. Hillyard

INVENTOR.

William X. Stevens.

UNITED STATES PATENT OFFICE.

WILLIAM X. STEVENS, OF WASHINGTON, DISTRICT OF COLUMBIA.

ROCK-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 481,598, dated August 30, 1892.

Application filed October 8, 1891. Serial No. 408,094. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM X. STEVENS, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Rock-Drilling Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates in general to machines for drilling holes in rock, and more particularly to that class of rock-drilling machines which act upon the rock by the drill being reciprocated endwise against it, propelled by manual labor, and fed automatically toward the rock.

Its object is, first, to adapt a feeding device to be automatically operated, so as to feed the drill forward as fast as it cuts the rock out of its way and no faster, and this without any concussion or shock between the operative parts; second, to provide propelling mechanism whereby power may be applied to operate the drill either by hand or foot, or both; third, to provide supports for adjusting and holding the drill to penetrate the rock downward, upward, horizontally, or at any required angle; fourth, to provide means for retracting the drill against the pressure of the propelling-spring and for rotating the drill a little by the same act and for resisting the twist of the drill in the hole at each stroke.

To this end my invention consists in the construction and combination of parts forming a rock-drilling machine, hereinafter described and claimed, reference being had to the accompanying drawings, in which—

Figure I is a side elevation of a rock-drilling machine according to my invention, represented as working upon a ledge of rock, the near wheel being left off and certain parts broken away, exposing the interior to view, also showing a top view of one form of tripod head or receiver. Fig. II shows the same machine in front elevation mounted upon a parallel slideway for the purpose of drilling a series of holes in a single plane. Fig. III represents a shadow view of the same machine in side elevation with supporting appliances adapted for working overhead in a tunnel. Fig. IV represents a plan view of the same machine, partly in horizontal section, on the irregular line 4 of Fig. I. Fig. V represents a top or end view of another form of a tripod head or receiver. Fig. VI represents details in side view at the opposite side of the machine to that shown in Fig. I. Fig. VII represents a shadow view of the machine in a horizontal position with various appliances for supporting it in any position in a tunnel. Fig. VIII represents a universal joint whereby the drilling-machine body may be held upon the slideway at any required angle. Fig. IX represents a plan view of the feeding device, showing certain parts in horizontal section at line 9 of Fig. I. Fig. X shows a modification of a portion of the feeding device in side elevation. Fig. XI represents in side elevation, partly in vertical section, the end of the main shaft-bearing and the saddle-supports secured thereon. Fig. XII is a side elevation of the plunger, showing the feeding-lever with a friction-roller on it in end view. Fig. XIII is a side elevation of a portion of the drilling-machine, partly in vertical section, showing a bifurcated rear support in perspective. Fig. XIV represents in the preferred form a head to the bifurcated support and the parts connected therewith. Fig. XV represents the drilling-machine located in a tunnel in the act of drilling at a downward angle and showing a modification of the saddle-support and connections for propelling the drill by foot-power.

20 represents the body or column of the drill, and it consists of a piece of iron pipe having a plug 21 secured in one end to form a bearing for the feed-screw 22 to revolve in and with a bushing 23 at the other end, bored through to receive a leg 24 and provided with a binding-screw 25, whereby the leg may be secured in place.

26 represents the receiver, centrally perforated to fit upon the column 20 to be bound thereon by means of one or more set-screws 27 and provided with three perforations 28, parallel with the central perforation to receive the three legs 29, which form therewith the tripod to support the drill, and further provided with a series of perforations 30 of the same size as the leg perforations and im-

tersecting the same at right angles to receive the same legs when the drill is to be used in a different position, as shown at 31 in Figs. II and VII.

32 represents a series of binding-screws located in the receiver at the juncture of the crossing leg perforations, so that the same screw may bind a leg in the receiver, whether the leg be placed in a longitudinal or a transverse hole.

33 represents a collar located upon the column 20 a distance from the end thereof equal to the length of the receiver. This collar is secured in position by means of the screw 25, which passes directly through it. (See Fig. XIII.)

34 represents the drill-carriage, provided with a rib 35, fitted to slide in a slot in one side of the column 20, in which slot it is kept by means of a shoe 36, which is fitted to slide on the interior face of the column and is bound to the carriage by means of screw-bolts 37.

38 represents the plunger, consisting of a steel shaft provided with a socket 39, fitted to carry a drill 40 and having some means—such as a set-screw 41—for holding the drill in the socket. The body of the plunger is fitted to slide in bearings 42 of the carriage, through which it is to be driven forward by a strong spring 43, which acts between the socket 39 as the shoulder of the plunger and one of the bearings 42 of the carriage in the act of drilling, and to be retracted by a series of cams 44, located at intervals upon one of the drive-wheels 45, the said cams acting consecutively upon arms 46, which project radially from a head 47, that is rigidly secured upon the plunger 38.

48 represents antifriction-rollers journaled upon the arm 46, of which arms I prefer to make an odd number, as shown in Fig. IV.

49 represents a sentinel secured to the carriage 34 by means of a binding-screw 50, and it is provided with a series of holes 51, any one of which may engage the said screw. This sentinel stands in the path of rotation of the arms 46 until they are raised to pass one at a time over its head.

52 represents pedals mounted upon cranks of the drive-wheels 45, whereby the operator may propel the machine with his feet.

53 represents a saddle adjustably secured to the drill-carriage by means of standards 54, having each a socket portion 55, fitted upon the stationary hub 56 of the bearing in which the shaft 57 of the drive-wheels 45 revolves. The sockets 55 are each provided with a binding-screw 58, whereby they and the saddle may be secured to the carriage rigidly and in a vertical position in whatever position the carriage may be.

59 represents handles secured to the saddle 53, whereby the operator may not only steady himself in his seat, but he may also pull downward in order to exert more force upon the pedals on the same principle that a bicycle is operated.

In Fig. XV the standards 54 are supplemented by hangers 60, secured in the same manner to the bearing-hubs 56, and the saddle 53 is connected with these hangers by means of a base-piece 61, one end of which is pivoted to the hangers at 62, and the other end may be left to rest upon the ground or upon any removable support, and standards 63 connect the saddle with the base-piece.

64 represents treadles pivoted at one end 65 of each to the base-piece and connected at their other ends with the pedal-cranks by means of a connecting-rod 66. The novelty of the cranks 52 67 68 consists in their adaptation for direct application of one operator's feet and one or more operator's hands at the same time. (See Figs. II and IV.)

67 represents a pair of crank-arms rigidly secured to the outer ends of the shaft of the pedals 52 and provided with crank-handles 68, whereby the drive-wheels may be revolved by hand, so that the machine may be operated either by foot or hand by one person, or by two persons working by hand, or by three persons working two by hand and and one by foot.

69 represents a ratchet-wheel provided with an internal screw-thread fitted to engage the screw 22.

70 represents the feeding-lever, pivoted to the carriage at 71 and provided at one end with a pawl 72 to engage the ratchet-wheel 69 to revolve it in the direction to feed the carriage downward or forward upon the screw while the screw is held stationary by the friction of its bearing.

73 is a spring acting upon the pawl to spring it lightly into engagement with the ratchet-wheel.

74 is an antifriction-roller journaled upon the feeding-lever 70 to roll when not feeding against the side of the plunger-shaft 38, as seen in full lines in Fig. XII, and against the upper end of the said shaft, as shown in dotted lines in the same figure and in full lines in Fig. IX, at the time when the drill has worked deep enough to require to be fed forward.

75 represents a spring acting between the carriage and the feed-lever to press the roller 74 constantly into contact with the shaft 38 and to retract the pawl end of the lever whenever the roller end may pass over the shoulder onto the tapering end of the shaft.

76 is a common buffer-spring located upon the plunger between the head 47 and a bearing to prevent the head damaging the carriage if the plunger were operated when there is no rock in the way to resist the action of the drill.

77 represents a receiver provided with two legs 78, which may be rigidly secured thereto, as shown in Fig. XIII, or they may be secured therein by means of binding-screws 79, so

that the legs are removable from and adjustable in the receiver. The receiver, Fig. XIV, is provided with a central aperture of the same size as the two side apertures to receive a single leg 80, and with a binding-screw 81 to fasten it at any point thereon. The leg 80 may be secured to the machine by means of the before-described receiver 26, and the bifurcated receiver 77 provides two legs, to form with the third leg 24 a tripod without interfering with the drive-wheels 45, as two straight legs would do if they extended from the points on the ground where the legs 78 rest to the receiver 26.

82 represents a slideway made of pipe, corresponding exactly in size with the column 20, so that the receiver 26 is interchangeable from the column to the slideway.

The universal joint shown in Fig. VIII comprises the block 83, which is perforated to receive either the column 20 or the slideway 82, and is provided with a binding-screw 84, whereby it may be fastened thereon, and with an internal slot 85 to receive a spline 86.

87 represents two collars fitted to slide upon the way 82, each provided with a slot similar to slot 85 to receive the spline 86 and with a binding-screw 88, whereby both the spline and collar may be bound at once and be rigidly secured in any position along or around the slideway.

89 is a receiver provided with a trunnion 90, which is journaled in a bearing in the block 83 and may be secured therein by binding-screws 91.

The operation is as follows: If the machine is to be used for drilling a hole downward into a rock, the receiver 26 may be adjusted to receive three legs and form a tripod, as shown in Fig. I, or to receive a single leg with the bifurcated attachment 77 78, as shown in Fig. XIII, and the bushing 23 enables the single central leg 24 to be used as the third leg of the tripod. An indentation should be either found or made in the rock to receive the point of each leg, so that the machine will not move from its position on the rock after it has once been started into operation.

92 is a hand-crank, by means of which the screw 22 may be revolved either to feed the carriage forward or to retract it, and after the tripod is in position the carriage should by this means be forced forward or downward until the drill resting upon the rock has pushed the plunger-head 47 off from the buffer-spring 76 for about one-half of an inch, so that the roller 74 rests against the side of the plunger, as shown in Fig. I. Now let the driving-wheel be revolved in the direction of the arrows 93 and one of the cams 44 will be brought upward underneath one of the arms 46, and the head 47, with the plunger and drill attached thereto, will be raised. The form of the cam tends to cause the head to revolve, so that when the arm which bears its roller 48 against the sentinel 49 reaches the top of the sentinel that arm which was in engagement with the cam is suddenly set free therefrom by the roller 48 passing over the top of the sentinel, and the plunger and drill are thrown forward toward the rock with great force by the spring 43. As the action of the drill in the rock is to repeatedly slice off radial chips every blow has a glancing effect to twist the drill in the hole, and this effect is resisted by the sentinel 49, which, acting upon the rollers 48, prevents the head from being revolved when the drill is at the lower end of its throw.

The various holes 51 and the binding-screw 50 enable the sentinel to be set at different heights within a certain range, as may be required, to raise the drill more or less to give a heavier or lighter blow, because the spring is strained in proportion as the plunger is raised before an arm 46 escapes over the sentinel. This is a point of great importance in enabling the drill itself to be run lightly at first in starting a hole where the drill would glance and be broken by a heavy blow, instead of having to start a hole by a hand-drill and afterward adjust the machine-drill over it in the usual manner.

To enable the sentinel to be quickly adjusted in height, it may be slotted in place of the perforations 51 to receive the binding-screw or it may be fitted to be bound to any usual slideway. The drill being rotated at every stroke an arc of a circle equal to the space between arms 46 chips off pieces of rock and gradually pulverizes them into an impalpable powder, which is forced to the surface around the body of the drill, water sometimes being used to aid the outflow, and as the drill in penetrating the rock moves lower and lower relative to the carriage the upper end of the plunger is brought low enough to permit the roller 74 on the feed-lever to be sprung over its top shoulder enough to draw back the pawl 70 to engage a new tooth of the screw ratchet-wheel 69. Then the next rise of the plunger wedges the roller and lever to operate the ratchet and advance the nut and carriage, between arms 94 of which latter the nut works.

If the rock be very hard, the drill may take a great many blows and be rotated a number of times in its hole before it advances enough to operate the feed-lever, while, on the contrary, if the rock be very soft, the drill may penetrate it so easily as to cause the lever to feed one or more teeth of the ratchet-nut at every stroke. By this means the machine is made perfectly automatic in its feed, and both the drill-bit and the machine endure better than where irregular hand-feed is trusted to, and persons may operate it successfully without previous experience. This feed mechanism is particularly to be contrasted with the automatic feed mechanism of that class of machines in which the feed-lever is operated either to go back for a tooth or to push a tooth

forward by the direct blow of the plunger as it strikes toward the rock. Such machines strike blows upon their feed-works with the greatest force of the drill-spring and tend to break themselves to pieces; but my feed is operated upon without any blow or shock. The drill may strike repeated blows, while the roller 70 plays smoothly all the time against the side of the plunger, as in Fig. XII, and when the drill penetrates the rock far enough to require more feeding the lever 70 is pushed by the light spring 75 over the shoulder of the plunger, as shown in dotted lines. Then the roller 74 and lever 70 are pushed out of its path by the ascending plunger not by a blow, but by an easy motion at the beginning of the action of the lifting-cam 44. Thus one fruitful source of self-destruction of automatic feed-drilling machines is obviated.

For the purposes of the claim the contact of the feed-lever and the drill-plunger will be called a "parallel slideway," with an offset at its end over which the coacting part may pass.

In Fig. XII the side of the plunger is the parallel slideway, its shoulder at the upper end is the offset, and the lever-roller 74 is the coacting part.

In the modification shown in Fig. X the parallel slideway is an arm of the feed-lever 70, the offset is the curved lower end thereof, and the ball or knob 95 on the plunger 38 is the coacting part, and the characteristic of this feed mechanism is that while the feed-lever is brought into position to be actuated by the advancing plunger at the instant of impact of the drill, yet the force of the advancing plunger is not received by the feed mechanism.

The saddle 53, being supported directly upon trunnions concentric with the wheel-shaft, may be turned to any position around that shaft to accommodate the operator to the varied positions of the drill and yet bear the same relation at all times to the cranks, so that the same may in all positions be propelled by the operator sitting on the saddle.

In the modification shown in Fig. XV the saddle 53, the base-piece 61, and the treadles 64 rise and fall with the carriage by means of the connections before described, thus maintaining the operator all the time in operative relation to the drive-wheel. Both ends of the column 20 are fitted to the receiver 26, so that the column may be reversed and either end of it be placed in the receiver, according as it is desired to drill downward, as in Fig. I, or upward, as in Fig. III. The slideway 82 and the column 20 are of the same form and size, so that the receivers for each will fit upon the other to meet the great variety of conditions to be met with in mining. Thus in Fig. II the slideway 82 serves to guide the column in a plane so that a series of holes may be drilled in a perfect line for quarrying building-stones, while in Fig. VII the same slideway 82 serves as a vertical column, up and down and around which the drill-column 20 may be set at every angle for tunneling.

The receivers 26 are perforated to receive legs of rough unturned bar-iron, which may be readily procured of any length required, and one series of holes in the receiver. The longitudinal ones are made parallel with the central or column hole to enable the legs to be set up or down without interfering with each other or the column, and the legs may each be bent to any required angle, so that by swinging the lower ends about the upper portion as an axis suitable bearing-points on the rock may be reached, and the transverse leg-holes in the receiver enable the same legs to be used in a greater variety of ways. When a drill-bit has been run into the rock to its full length, the carriage is to be retracted by means of the hand-crank 92 and screw 22. Then the screw 41 should be turned to loosen the bit 40, and the screw 27, Fig. I, should be turned to loosen the column 20 in the receiver 26. Then the column may be turned a little in the receiver to take the plunger out of line of the bit, and the bit may be withdrawn and a longer one placed in its hole in the rock. Then the column may be returned to bring the plunger into line and the new bit be made fast therein without moving the legs on the rock. In this connection the collar 33 serves as a shoulder to prevent the descent of the column through the receiver when loosened to be turned. In Fig. XIII the same may be accomplished; but the central leg 24 serves in this case as a pivot on which the column 20 rests and turns, and the collar 33 is below the receiver 26, but acting similarly thereon to retain the bifurcated member of the tripod in a fixed relation longitudinally with the column. In using the drill, as in Fig. II, to repeat holes in a line, the collar 87 may be bound to the slideway 82, while the column is slid along upon the slideway, kept in line by the spline 86, and then the column may be bound fast to the slideway while the collars are loosened and the spline slid along the slideway through it and again made fast. Thus a short stiff spline answers for the whole length of the slideway, while leaving the main portion of it free for the leg-receivers 26 to be secured at any desired points thereon.

In some situations the receiver 26, as shown in Fig. V, is preferable—as, for example, at the top of the slideway in Fig. VII—but for use on the column 20 the form shown in Fig. I permits the wheels 45 to pass beside it, giving greater range to the carriage with a short column.

The foot-cranks 52 upon the drive-wheels 45 are termed "pedals" or "pedal-cranks," and the extensions 67 68 thereof to be operated by hand are called "manual cranks."

Having thus fully described my invention, what I believe to be new, and desire to secure by Letters Patent, is the following:

1. The combination, in a rock-drilling machine, of a column and a receiver perforated to fit thereon, the receiver having other perforations parallel therewith to receive legs and having yet other perforations transverse thereto to receive similar legs, substantially as described.

2. The combination, in a rock-drilling machine, of a column, a receiver therefor having perforations both parallel therewith and transverse thereto to receive legs, the said leg perforations intersecting each other in pairs, and a set-screw fitted in the receiver at each intersection, adapted to engage a leg in either of the intersecting perforations, substantially as described.

3. The combination of a rock-drilling-machine column, a slideway of the same form and diameter as the column, and a receiver interchangeably fitted to both column and slideway, substantially as described.

4. The combination, in a rock-drilling machine, of a column, a slideway of the same form and diameter as the column, and a receiver perforated to fit upon either the column or slideway and further perforated to receive legs, substantially as described.

5. The combination, in a rock-drilling machine, of a drill-carriage, a slideway therefor, a drill-plunger fitted to reciprocate in the carriage and provided with a series of radial arms, a sentinel located in the path of rotation of the said arms, and a drive-wheel provided with cams adapted to engage the said arms and lift them over the sentinel, substantially as described.

6. The combination of a drill-plunger fitted to reciprocate and to rotate in a carriage and having radial arms, means for lifting and rotating the said arms, and a sentinel located in their path of rotation and made adjustable longitudinally of the carriage, substantially as described.

7. The combination, in a rock-drilling machine, of a sliding carriage, a plunger fitted to reciprocate therein, a wheel journaled in the carriage and adapted to retract the plunger, pedal-cranks upon the wheel, and a saddle supported on the carriage, whereby the driver's relation to the cranks will be maintained throughout the movement of the carriage, substantially as described.

8. The combination of a rock-drilling-machine drive-wheel journaled in bearings and provided with pedal-cranks and a saddle having supports journaled upon the said bearings, substantially as described.

9. The combination of a rock-drilling-machine carriage, a drive-wheel journaled therein and provided with pedal-cranks adapted for direct application of the driver's feet and having arms extending from their outer ends, and manual cranks formed on the extended arms, substantially as described.

10. The combination, in a rock-drilling machine, of a carriage, a feed-screw journaled in a frame parallel therewith, a ratchet-wheel threaded upon the screw between end bearings of the carriage, a lever pivoted to the carriage and having a pawl to engage the ratchet-wheel, and a drill-plunger fitted to reciprocate in the carriage, the said plunger communicating motion to the said lever by means of a parallel slideway with an offset at its end over which the coacting part may pass, substantially as described.

11. The combination, in a rock-drilling machine, of a reciprocating drill-plunger and a feeding-lever, one of them having a parallel slideway with an offset at its end and the other having a coacting part to slide upon the said way and offset, substantially as described, whereby, first, the said lever is held out of action during the descent of the plunger until the advance of the drill into the rock requires more feed, and, secondly, the lever is actuated to give a positive feed motion by the receding plunger when thus required.

12. The combination of a reciprocating drill-plunger having a shoulder near its end, and a feed-lever fitted to bear against one side of the plunger and to pass over the said shoulder into the path of the plunger, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM X. STEVENS.

Witnesses:
WM. L. SPEIDEN,
M. C. HILLYARD.