No. 619,147. Patented Feb. 7, 1899.

W. A. DOBLE.

ROCK DRILLING MACHINE.

(Application filed Dec. 29, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. I.

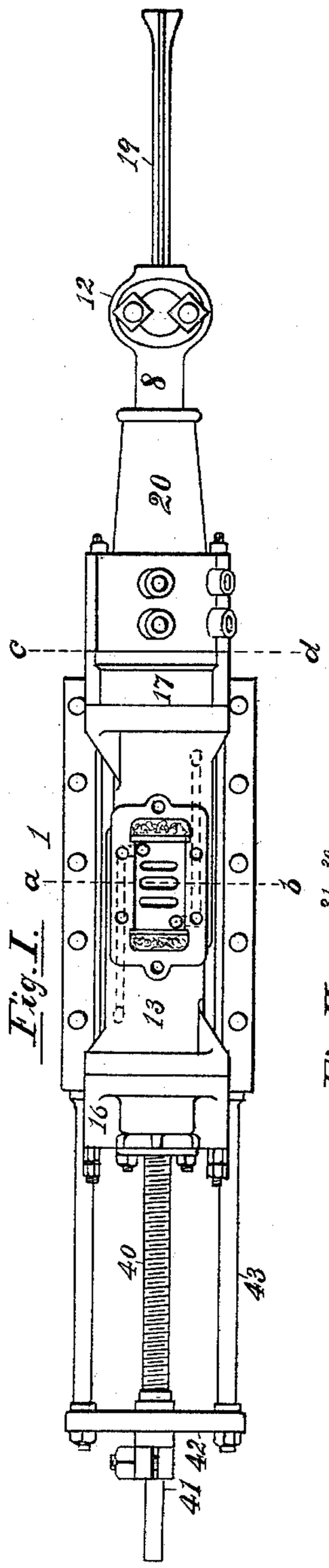

Fig. II.

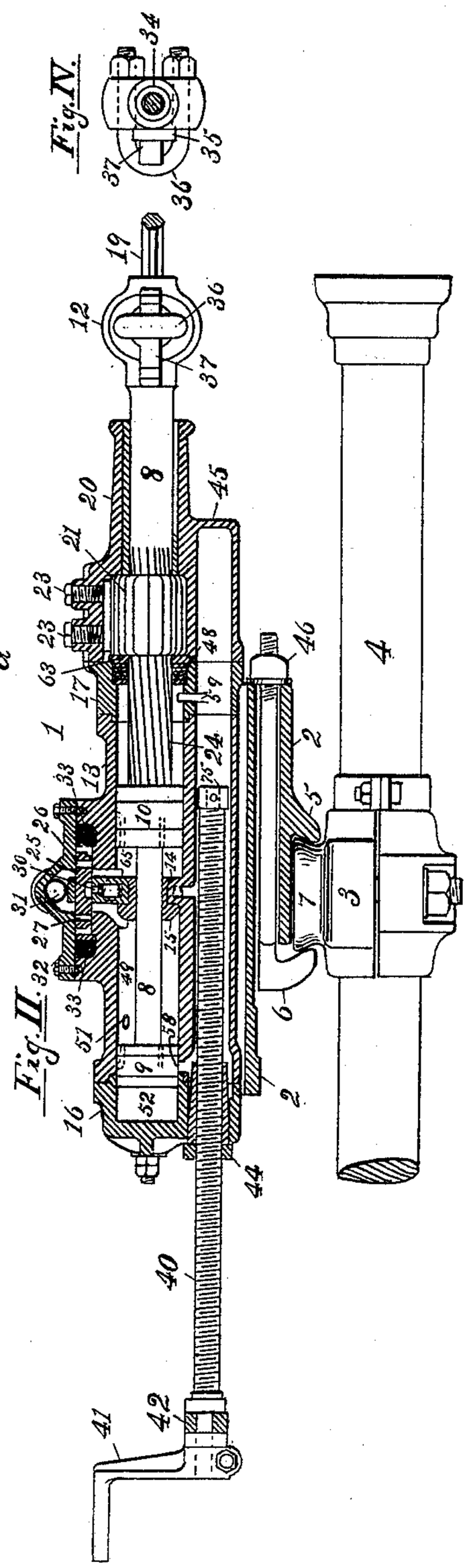

Fig. III.

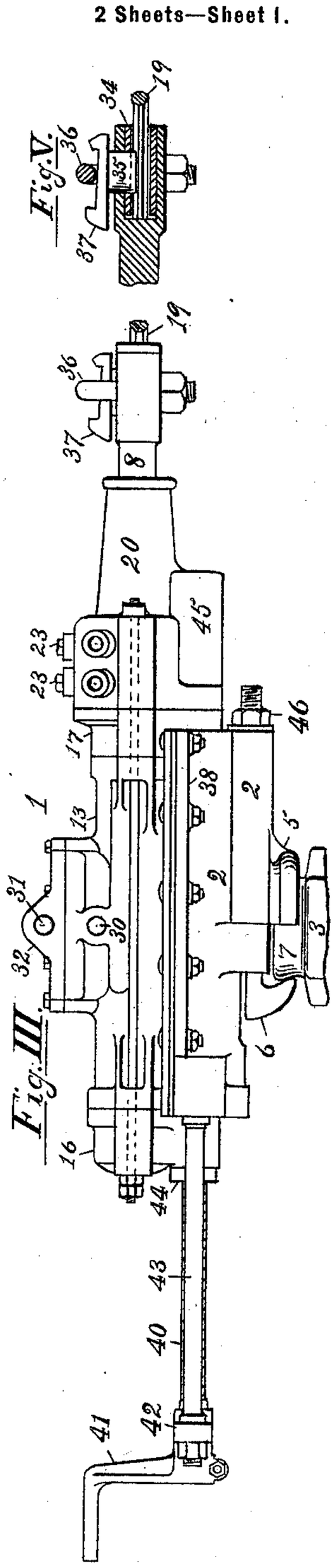

Fig. IV.

Fig. V.

Witnesses
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Fig. VI.

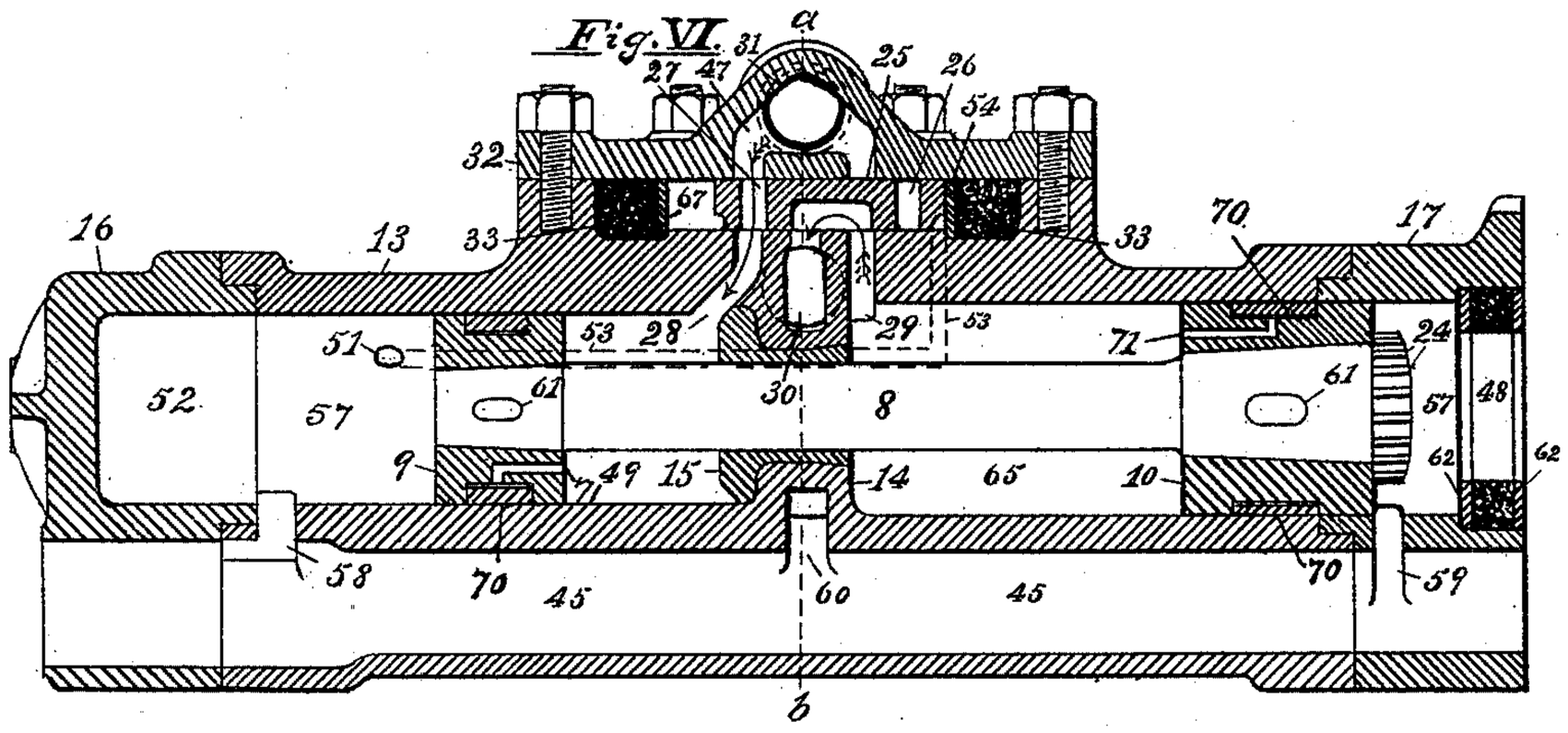


Fig. VII.

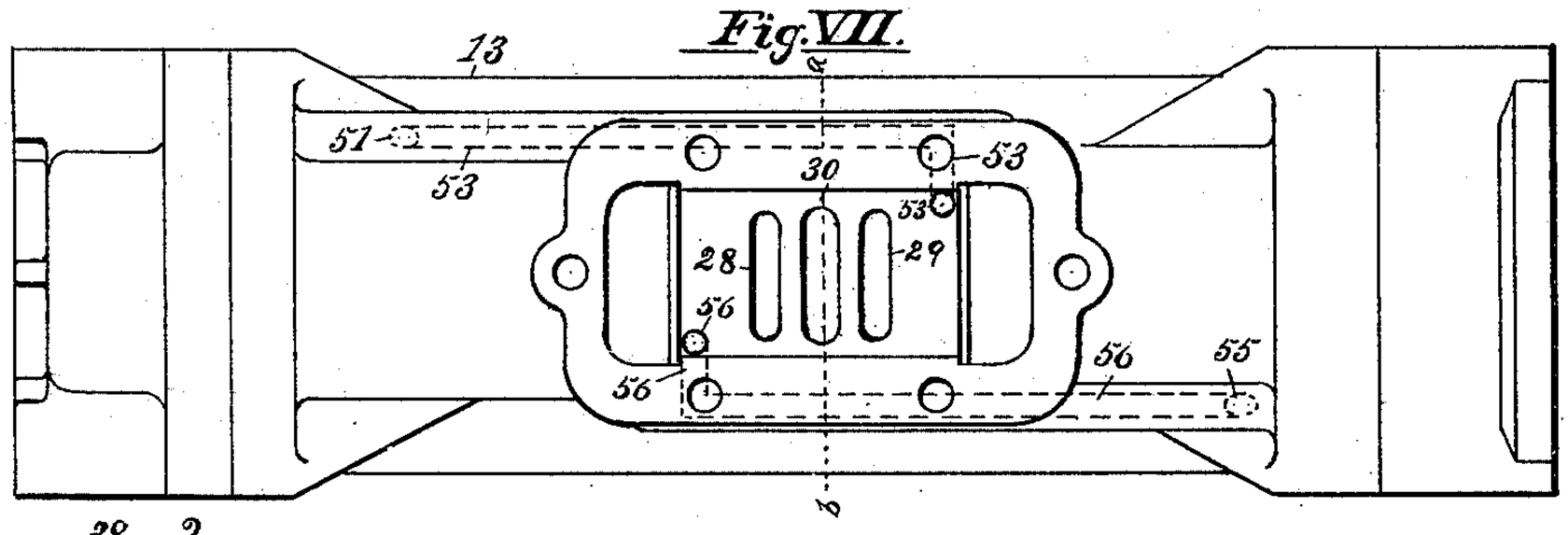


Fig. VIII.

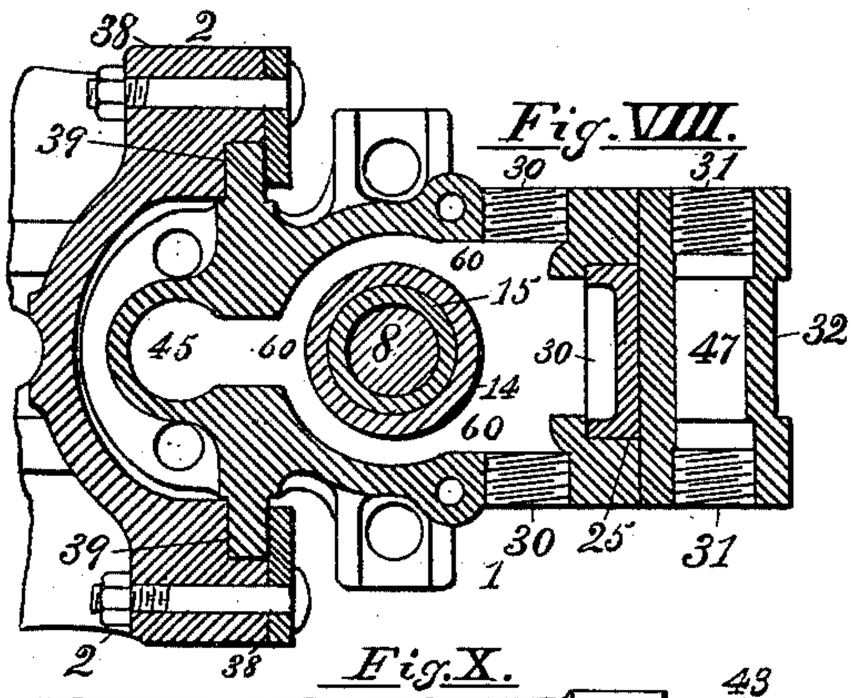


Fig. IX.

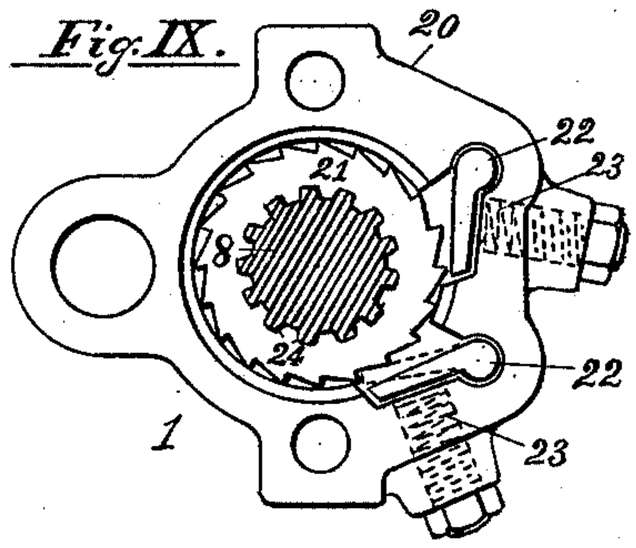


Fig. X.

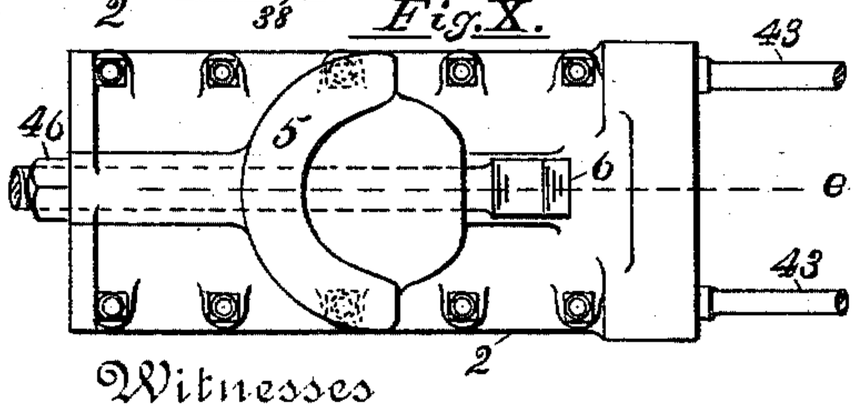
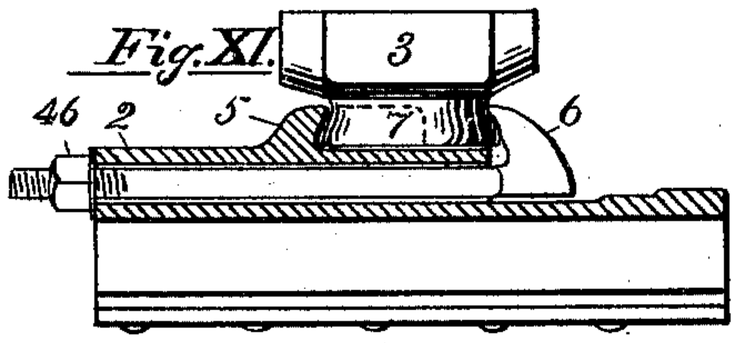


Fig. XI.



Witnesses

K. Lockwood-Nevins.

H. Sanderson

Inventor

Wm A Doble.

By his Attorneys

J Richards & Co

UNITED STATES PATENT OFFICE.

WILLIAM A. DOBLE, OF SAN FRANCISCO, CALIFORNIA.

ROCK-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 619,147, dated February 7, 1899.

Application filed December 29, 1897. Serial No. 664,342. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. DOBLE, a citizen of the United States, residing at San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Rock-Drilling Machines; and I hereby 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.

My invention relates to improvements in rock-drilling machines having a reciprocating motion impelled by air or steam.

My improvements consist in so constructing such machines that the induction-ports are radial from the cylinder and direct, supporting the main stem at several points to avoid leverage and flexure, distributing the air by a balanced and cushioned slide-valve operated by initial pressure from the main cylinder, providing a bumper or cushioning-chamber for the main stem separate from the main cylinder, fastening all parts mounted on the main stem by means of tapering seats, so such parts will become more firmly fixed by concussion, completely housing and protecting the feeding-screw by means of which the drills are advanced, placing the rifle or turning device near the front instead of at the rear end of the drill-stem, and in various other features of a constructive and operative kind that will be more fully pointed out in the description to follow.

The objects of my invention are to attain a greater endurance of these implements, increase their speed and efficiency, and render them more convenient for an operator. To these ends I construct rock-drilling machines, as illustrated in the accompanying drawings, in which—

Figure I is a plan or top view of a rock-drilling machine constructed according to my invention. Fig. II is a longitudinal section through the axis of Fig. I. Fig. III is a side elevation of the same. Fig. IV is a front end view of the drill-stem. Fig. V is a section through the end of the main stem, showing the manner of attaching the drills. Fig. VI is an enlarged longitudinal section through the cylinder of the machine and of the pistons therein. Fig. VII is a top or plan view of Fig. VI. Fig. VIII is a section on the lines *a b* in Figs. I and VI at an angle ninety degrees therefrom. Fig. IX is an enlarged view on the line *c d* in Fig. I, looking forward or to the right. Fig. X is a bottom view of the carriage on which the operating parts are supported. Fig. XI is a section on the line *e* in Fig. X and inverted in respect to Figs. II and III, as when the machine is suspended below its support.

The same numerals of reference are applied to corresponding parts throughout the several figures of the drawings.

A rock-drilling machine of the reciprocating type consists, essentially, of three elements or parts—the stem and its actuating parts or the machine proper, a guiding-carriage on which the main machine is mounted and moves, and an adjustable supporting structure for sustaining and presenting the drilling-machine to its work.

My present invention relates to improvements in the actuating parts of the machine in direct coöperation with the drill proper.

Referring to the drawings, especially to Figs. I, II, and III, 1 is the main operating part, and 2 the carriage or support on which it moves, this latter being mounted by means of the clamp 3 either on a cylindrical bar 4, which is set in various positions like a post, beam, or girder on a tripod, or other suitable structure, as the position of the work may demand. On the bottom of the carriage 2 I provide a fixed jaw 5, formed integral with the carriage 2, and a strong clamping-bolt 6, both of which engage the conical extension 7, formed on the clamp 3, as seen in Figs. II and XI, or on a tripod when that is used. The main spindle 8 is provided with two pistons 9 and 10, fitted on tapering seats on the stem 8, as seen in Fig. VI, and, if required for safety, can be provided with through-keys 61 and a rotating rifle-shell 21 to revolve the stem; also, a drill-clamping head 12, to be hereinafter described. The main cylinder 13 is divided in the middle by a diaphragm or wall 14, containing a bushing or gland 15, through which latter the stem 8 fits loosely, but forming a close joint against the passage of air or steam, and is secure from wear, because the

stem is supported laterally by the pistons 9 and 10 and is completely protected from dust by its inclosure.

The employment of two pistons enables several advantages. The area of the retractile piston can be arranged at pleasure and not, as common in single-piston machines, too small to secure good action. The main stem is not reduced to secure an annulus for the back stroke, but can be of any desired diameter, and the ports can by the use of two pistons be direct, short, and avoid lost space or clearance.

At the rear end of the main cylinder and preferably detachable therefrom I provide a cushioning-chamber 16 to arrest the backward strokes of the piston 9 and the drill-stem 8 by cushioning on the entrapped air in the chamber 52. This cushioning-chamber 16 has two objects. It provides for resilient action in a greater degree than is attainable with metallic or india-rubber springs, such reactive force being utilized on the forward stroke and saving motive power accordingly. Another object attained is that by removing this chamber 16 the piston 9 becomes accessible for inspection or repairs. In a separate or detachable section 17, forming a forward extension of the cylinder 13, I place an elastic collar 48 to cushion the forward stroke of the piston 10 and the stem 8 in case these parts are not arrested by the drill 19 or by the air entrapped beyond the port 59 before the piston 10 reaches this collar 48. This elastic collar 48 is protected on each side by metallic washers 62, held in place by a collar 63, that fits against and forms an abutment at the end of the rifle or turning shell 21, as seen in Fig. II. This chamber 17, like the one 16, permits, when removed, access to the piston 10 for inspection, removal, and repairing. This means of access to the pistons afforded by the removable sections 16 and 17 is a matter of much convenience, because of the pistons in drilling-machines being especially subject to derangement by the severe concussion.

The front extension or member of the machine 20 contains the rifle or turning shell 21, having a toothed periphery engaged by the pawls 22, as seen in Fig. IX, these pawls being pressed inward by coil-springs 23 in the usual manner. The drill-stem 8 is formed with spiral grooves 24 in its forward and strongest part to fit through the shell 21, corresponding to and performing the office of what is called the "rifle-bar" in common rock-drilling machines. In this manner the rear and weaker portions of the stem 8 are relieved of torsional strain, and, as will be observed, the section or diameter of the stem 8 increases successively from the rear to the forward end, corresponding to and compensating the lateral and other strains to which the stem is subjected.

Air or steam distribution is performed by means of a slide-valve 25, having ports 26 27 arranged with reference to the cylinder-ports 28 29 and the exhaust-chamber 30. These cylinder-ports 28 29, as seen, are direct, short, and contain but little air or steam, thus saving in volume what is called "clearance-space" or "waste-room." The valve 25 fits closely against the cover 32, so as to exclude the air or steam from the top surface where in contact, and thus balances the valve. At the ends of the valve-chamber are elastic buffer-plates and springs 33 to cushion and arrest the valve as it is impelled either way by air or steam pressure, as will be hereinafter described.

The drills 19 are held in a shell 34, Fig. V, and may be round, polygonal, or of any desired section. The sleeve or shell 34 is circular on the outside and fits into a parallel socket in the drill-stem 8, as seen in Fig. V, one side being cut away to receive a chock-piece 35, that is clamped by the U-bolt 36, a key 37 being interposed between the bolt and chock, as seen in Figs. III and V. This key 37 has a double purpose. When the machine is operating, momentum tends to drive the key forward, and thus more firmly grip the drill 19 in proportion to the shock and severity of the work, and when a drill is to be removed this can be done instantly by driving back this key 37 instead of loosening the U-bolt 36.

Referring next to the carriage or support 2, this is made of a trough form, as seen in the section Fig. VIII, having grooved ways to receive the ledges 39 at the sides of the main cylinder 1. The operating-machine 1 and its connected parts are moved on the carriage or support 2 by means of the screw 40, advanced as the drill 19 penetrates and withdrawn when the drills are changed for adjustment or when a hole is completed. This screw 40 is operated by means of a handle 41 and has its outer bearing in the cross-bar 42, held by the struts 43, and passes through the nut 44 into the chamber 45, which is entirely closed, so as to exclude dust and grit. On the end of this screw 40 I place a collar or guide-piece 75, that fits but slides freely in the chamber 45, preventing lateral vibration of the screw 40, which would otherwise soon be destroyed by such lateral motion and abrasion resulting therefrom.

The carriage or support 2 is pivoted on a strong conical projection 7, formed integrally with the clamp 3 or a tripod, and abuts against the solid ledge or jaw 5 at the forward or working side, so as to resist the thrust of the stem 8 and the reactive effect of the blows delivered by the drill 19. Opposing the jaw 5 is a strong clamp-bolt 6, operated by the nut 46. The whole being a portion of the carriage or support 2 retains continually the same position in respect to the main or movable portion 1 of the machine and is more convenient and accessible than if these parts were inverted and the extension 7 were

cast on the carriage 2 and swiveling clamp 5 were made integral with the main clamp 3, as is common in rock-drilling machines.

Referring now to the manner of the machine's operation, and especially to Figs. VI and VII, air or steam under sufficient pressure is supplied to the chamber 47 through the inlet 31, commonly through a flexible hose, so as to permit adjustment of the machine and to accommodate its advancement as the drill penetrates the material.

Referring to Fig. VI and supposing the valve 25 to be moved to the right, so the port or passage 27 will communicate with the port 28, as shown, then the chamber 49 will be filled with air or steam, and the drill-stem 8 will be driven back by means of the piston 9 until this piston passes the small port 51 in the side of the cylinder 13 and cushions on air entrapped in the chamber 52. As soon as the piston 9 passes the small port 51 air or steam from the chamber 49 rushes through the port and a small passage 53 (indicated by dotted lines in Figs. VI and VII) and enters between the end of the valve and the plate 54 at the right hand and instantly forces the valve back to the left against the plate 67 and the elastic buffer 33, closing the port 28, and bringing the passage 26 over the port 29, filling the other end of the cylinder or the chamber 65 and forcing the drill-stem 8 forward by means of the piston 10, thus performing the forward or working stroke. When the piston 10 on its forward stroke passes the small port 55 in the chamber 65 diagonally opposite to the one 51 in the chamber 49, (indicated by dotted lines at 55 in Fig. VII,) air or steam from behind the piston 10 rushes through the passage 56 and enters between the valve 25 and the plate 67, forcing the valve to the right, again filling the chamber 49 for the back or return stroke, as before described. When the valve 25 is moved to the right or left, admitting air or steam to either of the ports 28 or 29, the other port is open to the exhaust-passage 30 by means of the chamber beneath the valve 25 spanning the two ports 28 and 30 or 29 and 30, thus performing the functions of a common slide-valve, so well understood as to not require further description. The packing-rings 70 are of the usual type and are expanded during the working stroke by air or steam admitted through the passages 71, of which there are two or more, connecting with the chambers 49 65 of the main cylinder 13. On the return stroke, these chambers being exhausted, the rings 70 are relieved from pressure and make the back stroke without friction, thus avoiding metallic springs.

To prevent a vacuum in the chambers 57 when the pistons 9 and 10 move toward the center, there are provided ports 58 59, that communicate with the chamber 45, and this chamber communicates at the center with the exhaust-way 30 by means of a passage 60, as seen in Figs. VI and VIII. In this manner the chamber 45 and the screw 40 therein are sealed from the external air and secure from grit and dust.

Rotation of the stem 8 and the drill 19 is performed by the shell 21 by reason of the spiral threads 24, which tend to turn this shell right and left as the drill-stem moves backward and forward. As, however, this shell 21 can turn in but one direction because of the pawls 22, the result is that the shell 21 is turned during one stroke and the stem 8 is turned on the other stroke, causing a regular intermittent rotation of the drills 19, which is necessary in drilling holes in stone.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a rock-drilling machine, an actuating-cylinder divided into two parts, two single-acting pistons therein, a division in the center of the cylinder, means to distribute air or steam on each side of this division and against the inner ends of the two pistons, and to exhaust the same, the longitudinal chamber 45 beneath the main cylinder in communication with the outer ends of the pistons and with the exhaust-way 60, substantially as described.

2. In a rock-drilling machine, a main actuating-cylinder divided into two parts, two pistons therein impelled by air or steam applied on their inner ends, a separable cushioning-chamber 16 attached to the rear end of the main cylinder, and forming a removable extension thereof, into which the rear piston passes, substantially as described.

3. In a rock-drilling machine, a main cylinder divided into two parts, two pistons therein receiving air or steam on their inner ends, passages to admit and release air or steam, and a separable extension 17 attached to the front of the main cylinder, forming an extension thereof, and into which the forward piston passes, substantially as described.

4. In a rock-drilling-machine, a main actuating-cylinder, two pistons therein, a center division through which the drill-stem fits and moves, the separable chambers 16 and 17 at the ends of the cylinder that when removed permit access to the pistons 9 and 10 without removing them from the main stem, substantially as described.

5. In a rock-drilling machine, a main actuating-cylinder divided into two chambers, two pistons and a drill-stem therein, the pistons receiving air or steam at one end, these pistons provided with elastic packing-rings 70 and passages 71, to admit steam or air beneath the packing during the working strokes, and release it therefrom during idle strokes each way, substantially as described.

6. In a rock-drilling machine, a main actuating-cylinder provided with a central division and two single-acting pistons 9 and 10, direct or radial ports 28 29 to admit air or steam to the inner ends of these pistons, an exhaust-way communicating with external air, and by an annular chamber around the

cylinder to the parallel chamber 45 and to the outer ends of the pistons by the ports 58 59, substantially as shown.

7. In a rock-drilling machine, a main actuating-cylinder divided into two chambers by a midway partition, a piston in each chamber, said pistons being connected by a common piston-rod passing through said midway partition, means for admitting steam or like expansive fluid to the inner ends of said pistons, elastic packing-rings surrounding said pistons, and means for admitting said elastic fluid from said chambers to the inner side of said packing-rings, whereby they are expanded outward during the working stroke, substantially as specified.

8. In a rock-drilling machine, a main actuating-cylinder, divided into two chambers by a midway partition, a piston in each chamber, said pistons being connected by a common piston-rod passing through said midway partition, direct ports 28, 29 admitting steam or like expansive fluid to the inner ends of said pistons, a balanced valve controlling admission of said expansive fluid to said ports, an exhaust-way 30, a parallel chamber 45 communicating with said exhaust-way, and ports 58, 59, between said parallel chamber and chambers 57, substantially as specified.

9. In a rock-drilling machine, a main actuating-cylinder, drill-stem 8 and pistons 9 and 10, the slide distributing-valve 25 with ports and passages to supply and exhaust air or steam from the inner ends of the pistons, ports 51 and 55 in the sides of the main cylinder and passages 53 and 56 leading to and supplying air or steam under direct pressure at the ends of the slide-valve at predetermined points of and reversing the piston's stroke, substantially as specified.

10. In a rock-drilling machine, a main actuating-cylinder with two opposed single-acting pistons therein, the latter mounted on the drill-stem 8 by tapering seats, expanding forward so the pistons will be fastened and retained by concussion of the forward strokes, substantially as described.

11. In a rock-drilling machine, a main actuating-cylinder and reciprocating drill-stem therein, the latter having tapering seats to receive the pistons 9 and 10, and the rifle-shell 21, and increasing successively in diameter from the rear to the forward end, substantially as described.

12. In a rock-drilling machine, a main actuating-cylinder, two single-acting pistons therein, a drill-stem 8 on which these pistons are mounted passing through a gland 15 in the middle of the cylinder, and enlarged in front of the forward-acting piston, and provided with helical grooves in its forward and strongest part, substantially as specified.

13. In a rock-drilling machine, a main cylinder, two single-acting pistons and a drill-stem therein, helical grooves formed in the drill-stem in front of the forward-acting piston, a turning or rifle shell 21, the collar 63 and elastic buffer-rings 48, combined and operating substantially as described.

14. In a rock-drilling machine, a main actuating-cylinder, two single-acting pistons therein, receiving air or steam on their inner ends, a turning shell 21 placed forward of the pistons within the removable extension 20, and inside of the main front bearing 20, furnishing the front support of the main stem, substantially as shown and described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

WILLIAM A. DOBLE.

Witnesses:
K. LOCKWOOD-NEVINS,
H. SANDERSON.