(No Model.) 3 Sheets—Sheet 1.

R. L. AMBROSE.

VALVE MECHANISM FOR ROCK DRILLS.

No. 518,212. Patented Apr. 17, 1894.

Fig. 1.

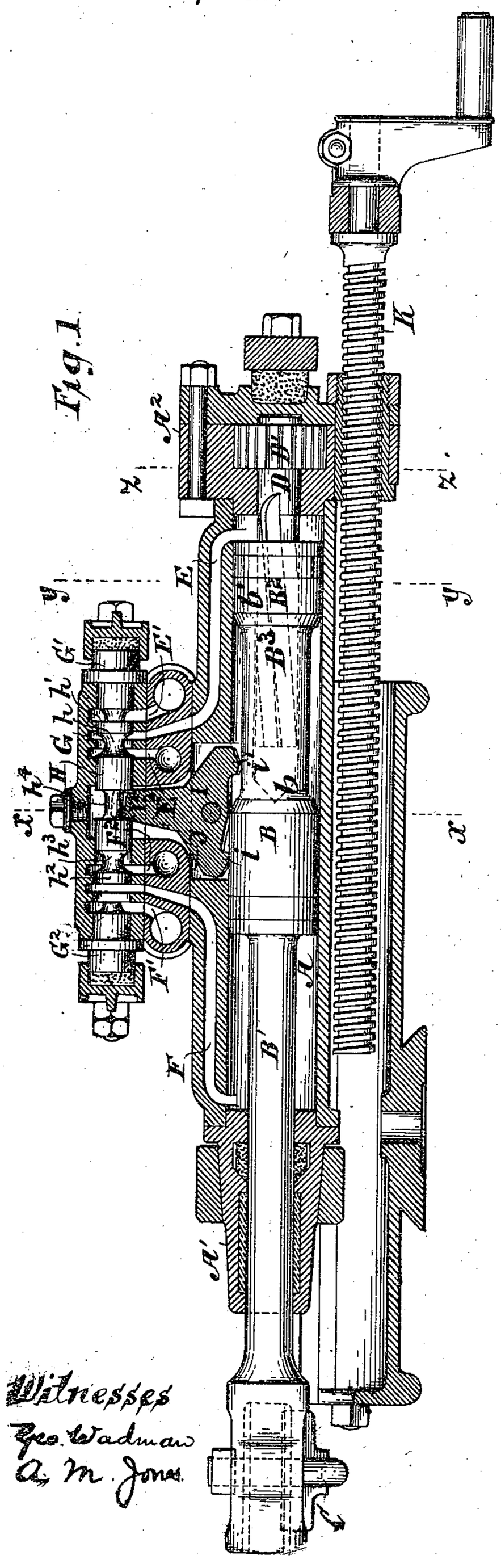
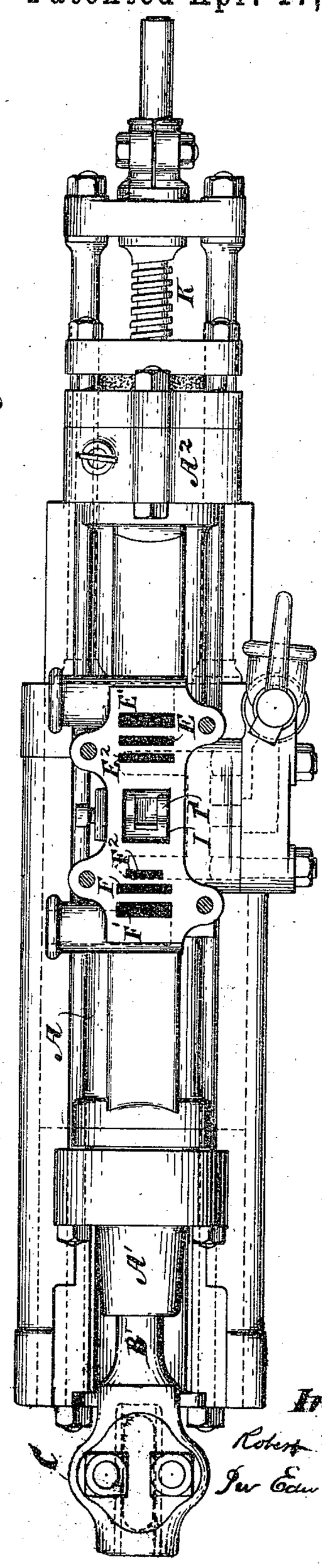


Fig. 2.



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(No Model.)

3 Sheets—Sheet 2.

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VALVE MECHANISM FOR ROCK DRILLS.

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Fig. 4

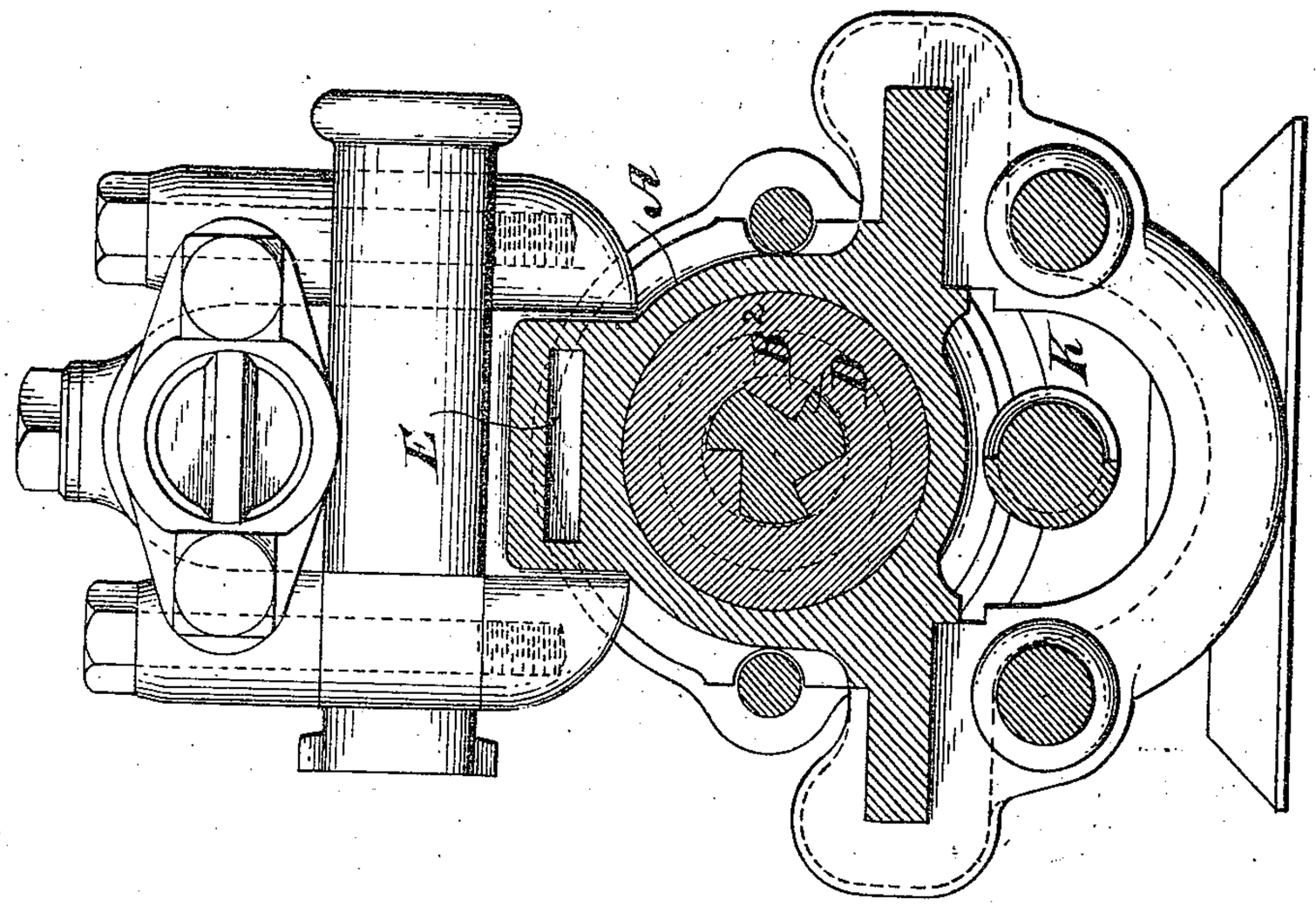
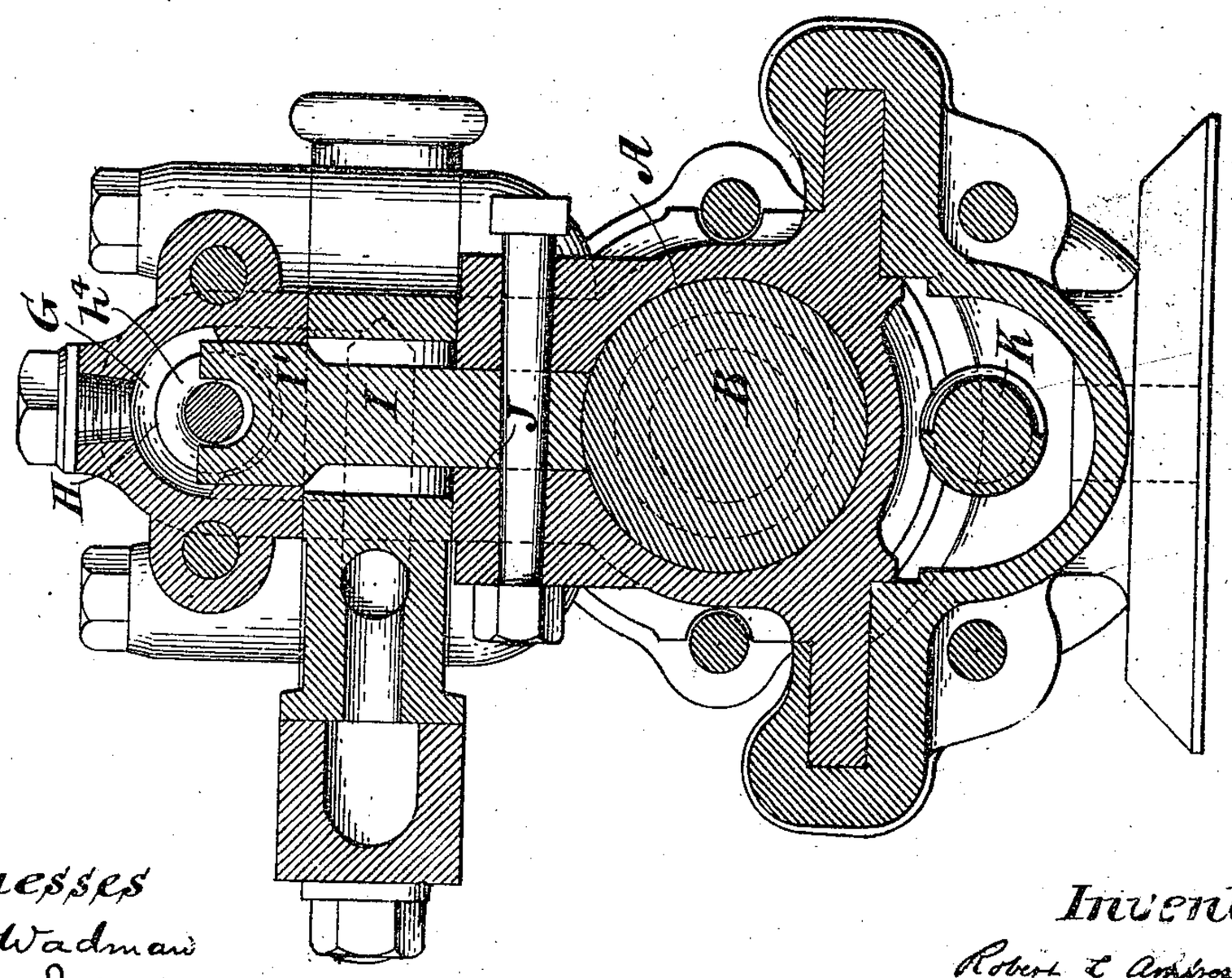


Fig. 3



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VALVE MECHANISM FOR ROCK DRILLS.

No. 518,212. Patented Apr. 17, 1894.

Fig. 5

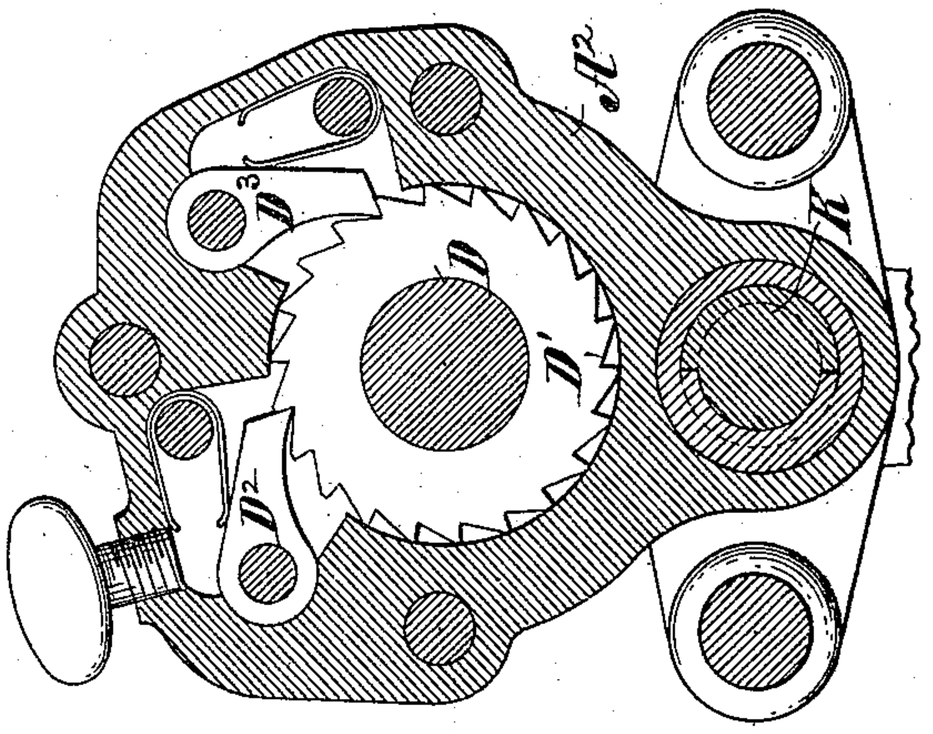


Fig. 6

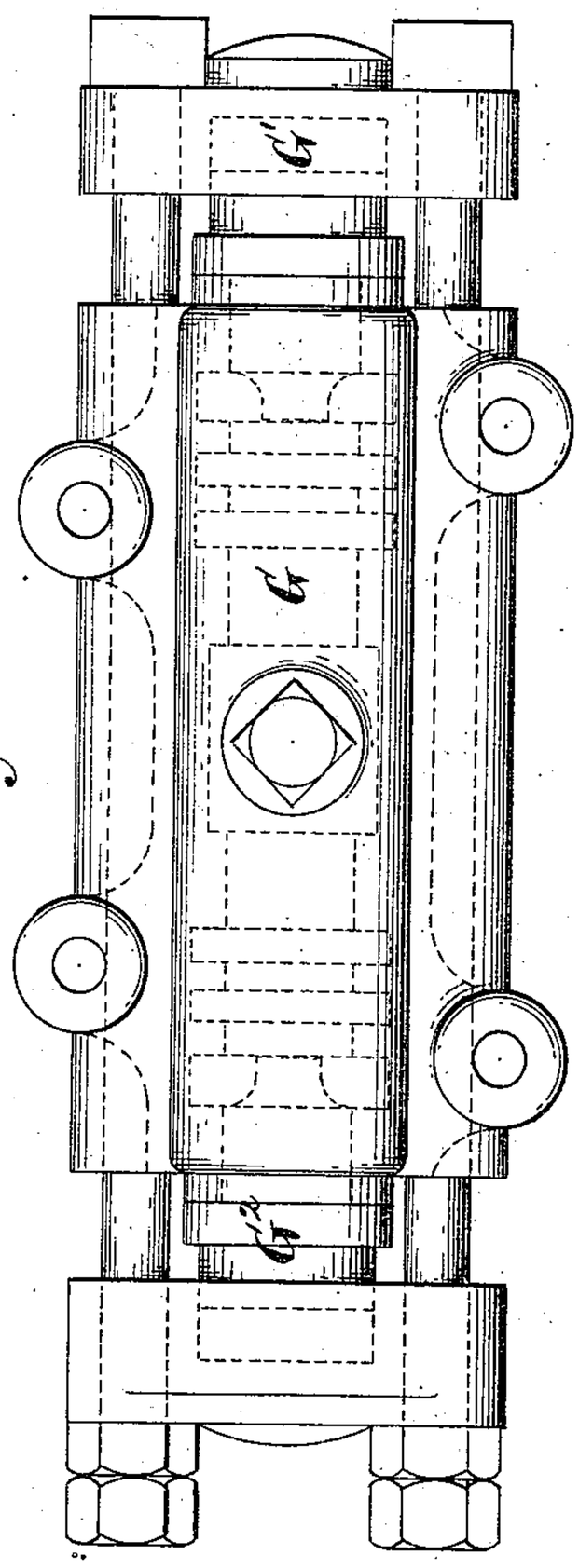
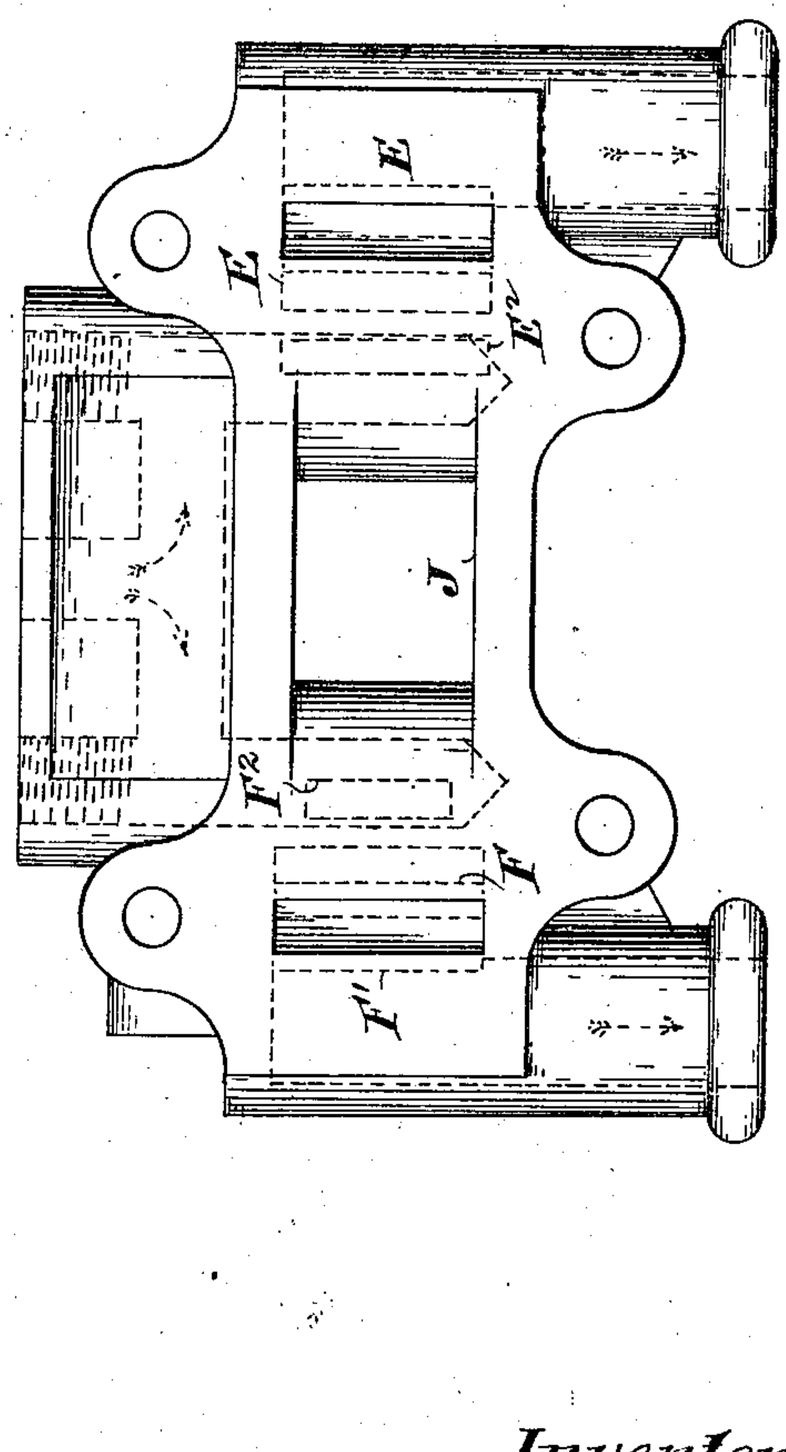


Fig. 7



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UNITED STATES PATENT OFFICE.

ROBERT L. AMBROSE, OF BURDEN, NEW YORK.

VALVE MECHANISM FOR ROCK-DRILLS.

SPECIFICATION forming part of Letters Patent No. 518,212, dated April 17, 1894.

Application filed September 21, 1893. Serial No. 486,076. (No model.)

To all whom it may concern:

Be it known that I, ROBERT L. AMBROSE, of Burden, New York, have invented certain Improvements in Valve Mechanisms for Rock-Drills, of which the following is a specification.

These improvements relate to the organization of a balanced valve with the passages and ports of a rock drill cylinder employing an elongated circumferentially grooved piston, and a tappet actuated by the said grooved piston for appropriately reciprocating the said balanced valve at the proper stage in each stroke of the piston and thus admitting alternately into the opposite ends of the cylinder the steam, compressed air, or other fluid under pressure, by which the rock drill is operated. The valve is an elongated piston reciprocating endwise in a valve-chamber having solid yielding heads, respectively, backed up with compressible and resilient cushions, for receiving, storing up, and returning the force of the impacts of the ends of the valv › piston against the heads of the valve-chamber. The valve piston is provided with three circumferential grooves, the middle one of which is engaged by the bifurcated end of the valve-operating tappet. The other two grooves by the successive excursions of the valve-piston are made to alternately connect the live steam or compressed air ports with the passages communicating respectively with the opposite ends of the drill cylinder. Each end of the valve-chamber is provided with an exhaust port. The end portions of the valve piston operate alternately to shut off the appropriate exhaust port from communication with one end of the drill cylinder and at the same time to open communication between the other exhaust port and the other end of the drill cylinder, whereby the exhaust steam or air is always conducted into and through the space in the valve chamber adjoining the head from which the valve piston has just departed and by its pressure therein exerted assists the tappet in completing the stroke of the valve piston and compressing the cushion of the opposite head of the valve-chamber. During the ensuing stroke of the drill piston, when the pressure of the exhaust weakens, the resilient force of the previously compressed cushion initiates the return stroke of the valve piston which is made to thereby partially close the live steam or compressed air port and to thus cause the live steam or compressed air previously introduced into the drill cylinder to act expansively. Moreover, by thus employing the pressure of the exhaust to assist in completing the last portions of the strokes of the valve piston and to store up in the cushioned heads at each stroke the force which initiates the return stroke of the valve piston, the work of the tappet is rendered very easy.

The accompanying drawings of a rock-drill employing the invention are as follows, viz:

Figure 1 is a central longitudinal section. Fig. 2 is an elevation with the valve chamber removed. Fig. 3 is a transverse section taken through the plane indicated by the dotted line *x*—*x* on Fig. 1. Fig. 4 is a transverse section taken through the plane indicated by the dotted line *y*—*y* on Fig. 1. Fig. 5 is a transverse section taken through the plane indicated by the dotted line *z*—*z* on Fig. 1.

The drawings represent a rock-drill which, for convenience of description, may be assumed to be occupying an upright position, adapting it to drill a hole in a downward direction. The cylinder, A, contains the elongated piston, B, affixed to the piston rod, B′, projecting through the suitably packed lower head, A′, of the cylinder, and carrying the drill stock C. The upper portion, B^2, of the piston is hollowed out and rifled to receive the spirally feathered rotating rod D. The upper head, A^2, of the cylinder is chambered in the usual way to contain the ratchet wheel, D′, affixed to the upper end of the feed rod, D, and also the check-pawls, D^2 D^3, which prevent the ratchet, D′, from turning backward. The steam or compressed air is admitted into the upper end of the cylinder to effect the downward or working stroke of the piston, B, and the exhaust steam or compressed air is discharged from the upper end of the cylinder during the upward or return stroke of the piston, B, through the passage, E, the corresponding offices being performed for the lower end of the cylinder by the passage F. The mouth, E′, of the passage, E, opens into the valve chamber, G, between the exhaust port, E′, near the upper end of the valve chamber, G, and the live steam or com-

pressed air port E^2. The mouth of the passage, F, opens into the valve chamber, G, between the exhaust port, F′, near the lower end of the valve chamber, G, and the live steam or compressed air port, F^2. By the upward excursion of the valve piston, H, communication is established between the passage, E, and the live steam or compressed air port, E^2, through the circumferential groove, h, near the upper end of the valve piston, H, while the cylindrical uppermost portion, h', of the valve piston shuts off communication with the exhaust port, E′. At the same time the cylindrical lowermost portion, h^2, of the valve piston shuts off communication with the live steam or compressed air port, F^2, and being carried above the level of the mouth of the passage, F, thereby opens communication between the passage, F, and the exhaust port, F′, through the lower end of the valve chamber. At a prescribed stage in the ensuing downward or working stroke of the drill operating piston, the valve-piston is driven downward to the lower end of the valve chamber, G. By the downward excursion of the valve piston its cylindrical portion, h', is carried below the level of the mouth of the passage, E, and thus opens communication between the passage, E, and the exhaust port, E′, while at the same time communication is established between the passage, F, and the live steam or compressed air port, F^2, through the circumferential groove h^3. The impact of the upper end of the valve-piston, H, is received by the cushioned upper head, G′, and impact of the lower end of the valve-piston, H, is received by the lower cushioned head, G^2, of the valve chamber G. The reciprocation of the valve-piston H is effected in part by the pressure of the exhaust, as has been stated, and in part by the rocking of the tappet, I, which is transversely pivoted in the slot, J, formed through the shell of the cylinder A. The bifurcated extremity, I′, of the tappet embraces the middle grooved portion, h^4, of the valve piston H. The extremities of the cross arms of the tappet, I, are respectively provided with the cams, i and i', which project slightly into the path of the piston B. The middle portion of the piston, B, is turned down to form the wide circumferential groove, B^3, the end walls, b and b', of which are inclined. During the upward stroke of the piston, B, the collision of the inclined wall, b, with the cam, i, rocks the bifurcated extremity, I′, of the tappet, upward, thus communicating downward motion to the valve piston H. The width of the circumferential groove, B^3, is greater than the distance between the cams, i and i', but during that part of either stroke of the piston, B, which occurs immediately after one of the cams has been disengaged from the periphery of the piston, B, and from one of the inclined walls of the groove, B^3, and before the other cam has been engaged by the other inclined wall of the groove, B^3, the valve-piston is for an instant held stationary by the pressure upon one end of it of the exhaust steam or air, as has been explained, and then as the pressure of the exhaust falls the resilient force of the previously compressed cushions acting upon the adjacent head of the valve piston starts the valve piston upon its return stroke a sufficient distance to cause it to partially cut off the live steam or compressed air port in advance of the rocking of the tappet by which the valve piston is further moved so as to completely close the live steam or compressed air port and open the exhaust port, after which the concluding portion of the stroke of the valve piston is given to it by the tappet assisted by the pressure of the exhaust.

The usual manually operative adjusting screw K is employed for effecting, when required, the endwise movement of the drill cylinder A. It will therefore be seen that the organization is such as not only to facilitate and assist the work of the tappet, but to employ the expansive action of the steam or compressed air during the period in each stroke while the live steam or compressed air port is partially closed and before the final part of the stroke of the valve piston occurs.

What is claimed as the invention is—

1. The combination as and for the purposes herein set forth of the steam or compressed air cylinder of a rock drill; passages for connecting the opposite extremities of said cylinder with the end portions respectively of the valve chamber; a valve chamber provided with two exhaust ports near its ends respectively, also provided with two live steam or compressed air ports, respectively, adjacent to the mouths of the said passages and an endwise reciprocating circumferentially grooved balanced piston valve for alternately connecting one of the said live steam or compressed air ports with the passage communicating with one end of the said cylinder, while uncovering the mouth of the passage communicating with the other end of the said cylinder and at the same time uncovering the adjacent exhaust port and thereby at each successive stroke effecting the discharge of the exhaust steam or air through the end portion of the valve chamber unoccupied by the piston valve.

2. The combination as herein described of a rock drill cylinder, an elongated piston reciprocating in said cylinder and having its middle portion circumferentially grooved, a valve actuating tappet adapted to be rocked by said grooved piston in one direction during the latter portion of the working stroke, and in the opposite direction during the latter portion of the return stroke, and free from the control of said piston during an intermediate portion of each stroke; a valve-chamber provided with resilient cushioned heads and provided near each end with an exhaust port and with an adjacent live steam or compressed air port, passages respectively connecting the ends of said drill cylinder

with the adjacent ends of said valve chamber, an endwise reciprocating piston valve adapted to, at each stroke, connect one of said live steam or compressed air ports with one of said passages at one end of said valve chamber and to simultaneously open a path for the exhaust through the space between the valve piston and the other end of said valve chamber, whereby the tappet is assisted by the pressure of the exhaust to effect the latter portion of each stroke of the valve piston and to compress and store up in the cushioned head of the valve chamber against which the valve is driven, the resilient force by which, during the intermediate portion of the stroke of the drill piston, the return stroke of the valve piston is initiated and the live steam or compressed air port partially closed.

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