(No Model.) 2 Sheets—Sheet 1.

A. W. & Z. W. DAW.

ROCK DRILL.

No. 389,740. Patented Sept. 18, 1888.

FIG. 4.

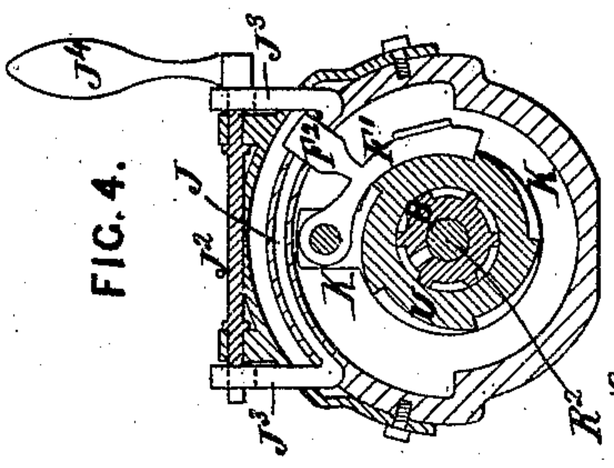

FIG. 3.

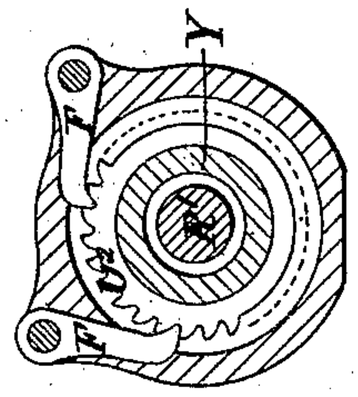

FIG. 2.

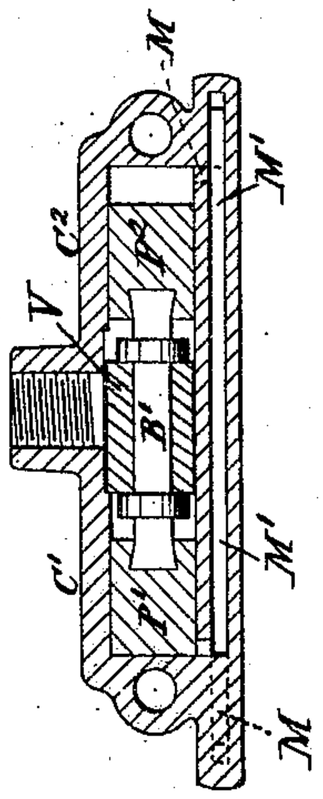

FIG. 1.

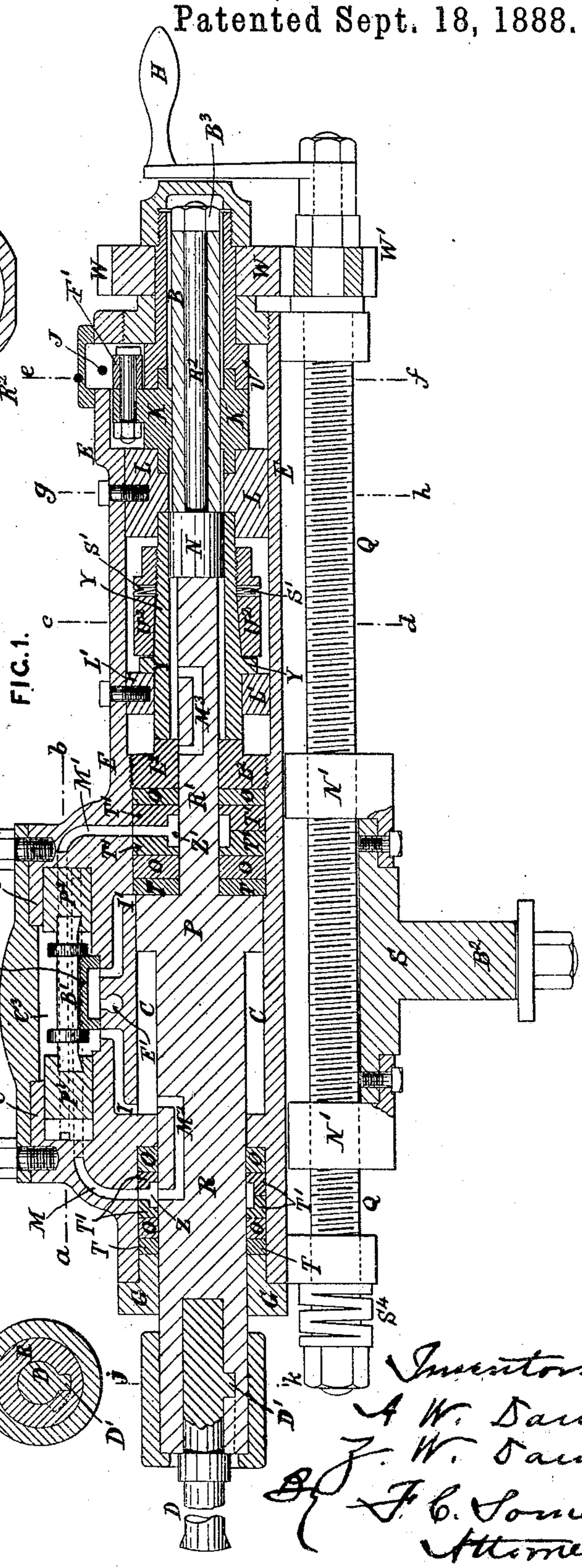

FIG. 7.

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(No Model.) 2 Sheets—Sheet 2.

A. W. & Z. W. DAW.

ROCK DRILL.

No. 389,740. Patented Sept. 18, 1888.

FIG.6.

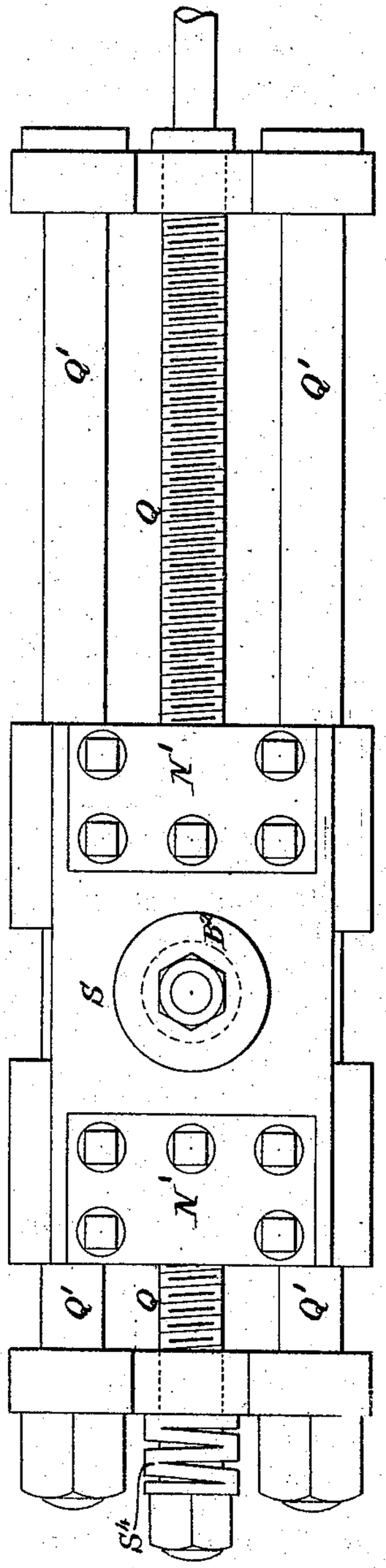
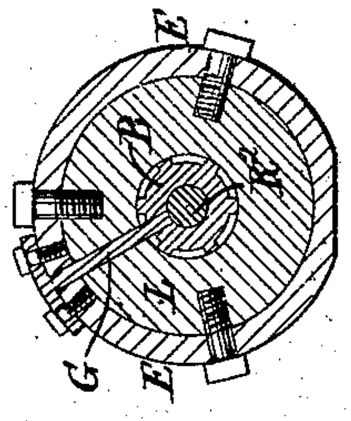


FIG.5.



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UNITED STATES PATENT OFFICE.

ALBERT WILLIAMS DAW AND ZACHARIAS WILLIAMS DAW, OF AAMDALS KOBBERVOERK, SKAFSE, OVRE THELEMARKEN, NORWAY.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 389,740, dated September 18, 1888.

Application filed August 13, 1887. Serial No. 246,894. (No model.) Patented in England August 4, 1887, No. 10,738.

To all whom it may concern:

Be it known that we, ALBERT WILLIAMS DAW and ZACHARIAS WILLIAMS DAW, both subjects of the Queen of Great Britain, residing at Aamdals Kobbervoerk, Skafse, Ovre Thelemarken, in the Kingdom of Norway, have invented new and useful Improvements in Rock-Drills, (for which we have obtained a patent in England, dated August 4, 1887, No. 10,738,) of which the following is a specification.

Our invention relates to an improved rock-drill or rock-boring machine to be actuated by steam or air, and is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section; Fig. 2, a section on line *a b;* Fig. 3, a section on line *c d;* Fig. 4, a section on line *e f;* Fig. 5, a section on line *g h;* Fig. 6, a plan view of the under side of Fig. 1, and Fig. 7 a section on line *j k.*

Like letters represent similar parts in all the figures.

The drill is provided with a cylinder, C, of ordinary construction, having the usual supply-passages, I I′, and an exhaust-passage, E′, in addition to which passages M M′ are provided in the cylinder and act in conjunction with passages Z Z′, formed in the stuffing-boxes at each end, and the passages M^2 M^3 in the piston-rod, for the purpose of actuating the valve V, as hereinafter described. The piston P is also of ordinary construction, and may be fitted with one or more packing-rings to move air-tight in the cylinder C. The piston-rod runs the whole length of the body of the machine, and is, for convenience of description, referred to by the letters R R′ R^2, each representing a different part in the length of such rod. The part R moves in cylinder C, and in it is formed the passage M^2, above referred to, such part R working through the stuffing-box at the lower or forward end of the cylinder, in which the hollow space Z is formed, and with which communicates the passage M, leading to the upper or rear end of small cylinder C^2, in which the valve-piston P^2 works. The part R′ works through the stuffing-box at the other end of cylinder C, and in it the passage M^3 is formed, while in the stuffing-box, through which it works, is the hollow space Z′, communicating with passage M′, which leads to the lower or forward end of small cylinder C′, in which the valve-piston P′ works. The part R′ carries a rifled nut, N, for the purpose of rotating the drill, as hereinafter described. On the part R^2 of the piston-rod is fitted a slotted cylindrical rifled bar, B, actuating the feeding device, as hereinafter described.

The valve V is of ordinary construction, and is connected by a removable bar, B′, to the two small pistons P′ and P^2, respectively, working in the small cylinders C′ and C^2, formed in the opposite ends of the valve-chest C^3, and which pistons are actuated by air or steam alternately admitted to and exhausted from such small cylinders from the main cylinder C by the passages M^2 and M^3 in the parts R and R′ of the piston-rod, and the passages M and M′, at each end of the valve-chest, through the hollow spaces Z and Z′ in the stuffing-boxes, these passages being brought into communication at certain portions of the stroke of the piston.

The action is as follows: The piston P having arrived at its full backward stroke, as shown in Fig. 1, air or steam is admitted from cylinder C through passages M^2, Z, and M to the rear side of the valve-piston P^2, the passage M^2 in the piston-rod R being so arranged as to establish the necessary communication when the piston has nearly completed its backward stroke. The steam or air, acting on the rear of valve-piston P^2, moves it to the position shown in Fig. 2, when the valve V (having been moved with the pistons P′ P^2) will put the space below the drill-piston P open to the exhaust, through passages I and E′, and the passage M^2, being still in communication with such space below the drill-piston P, will also be open to the exhaust, and the steam will thus be exhausted from behind valve-piston P^2 through passages M, Z, M^2, I, and E′. At the same time, as the movement of the valve V will have opened the passage I′ to the steam or air in the valve-chest, the steam or air will pass to and act upon the rear of drill-piston P and effect the down or working stroke of the

drill, such movement cutting off both cylinders C′ and C² both from steam and exhaust until the downward stroke of the drill is nearly completed, when passage M³ in piston-rod R′ will establish communication (through passages Z′ M′) between the space which there will then be above the piston P and the rear of valve-piston P′, and the steam or air passing from such space in cylinder C will act on piston P′, and so reverse valve V, returning it again to the position shown in Fig. 1, thus putting the space above piston P and at the rear of piston P′ open to the exhaust and admitting steam through passage I to act upon the under side of piston P, and so effect the return-stroke, thus bringing the whole of the parts back to the position shown in Fig. 1, when the action above described will be repeated.

The rotation of the drill is effected by means of the nut N, which is externally rifled or provided with helical projections engaging corresponding grooves formed in the inside of bush Y, so that as nut N, which is mounted on the piston-rod R′, reciprocates with the latter it will cause the bush to make a partial rotation during the forward stroke of the drill. As the bush Y is prevented from rotating in the opposite direction during the backward stroke of the drill by means of an arrangement of pawls F engaging the ratchet-wheel U², mounted on bush Y, as shown in Fig. 3, so as only to permit the latter to revolve in one direction, it follows that during the backward stroke of the drill the rifled nut N will be caused to make a partial rotation, carrying with it the piston-rod and drill, whereas during the forward stroke, the pawls F being free to slip over the teeth of the ratchet-wheel U², (the inertia of which and the bush Y is more than counterbalanced by that of the piston and its rod and the drill,) the bush Y will be caused to turn instead of the piston-rod. The pawls F are acted upon by springs to insure their proper engagement with the teeth of ratchet-wheel U².

In order to avoid all chance of the breaking of the pawls F, or of the teeth of ratchet-wheel U², should the drill encounter any obstruction to its rotation, the ratchet-wheel U² is mounted on a conical seat formed on bush Y, and is held fast thereon by the friction of the contact-surfaces caused by the action of a powerful spring, S′. If only a slight or no obstruction presents itself to the rotation of the drill, the action of the spring will cause the ratchet-wheel U² to act as though it were keyed to the bush and prevent its rotation during the backward stroke; but should any considerable opposition present itself, the strain will cause the bush to slip within the ratchet-wheel U², and thus prevent all chance of the pawls F or the teeth of ratchet-wheel U² being broken.

The part R² of the piston-rod is surrounded by a hollow cylindrical rod, B, in which the part R² can revolve, but to which latter the rod B is secured by a nut, B³, so that it is caused to reciprocate with the piston-rod. This rod B is rifled or provided with external helical projections engaging corresponding grooves in the inner surface of the boss of a crank, K, mounted loosely on the rod. To the arm of crank K a pawl, F′, (acted upon by a spring,) is pivoted, and engages the teeth of a ratchet-wheel, U, to the hub of which a wheel, W, is secured. The wheel W gears with a pinion, W′, secured to the feed screw Q, working through nuts N′, fixed to the slide or saddle S, on which the machine is mounted.

The rod B is prevented from rotating by means of a longitudinal slot running the greater portion of its length, with which a bar, G, engages, such bar passing through the bearing L and casing E, to which latter it is secured, as shown in Fig. 5.

On the completion of the forward stroke of the piston P the pawl F′ is forced into engagement with one of the notches or teeth of ratchet-wheel U, and locks same, so that on the return-stroke the rifling of rod B, imparting a partial rotation to crank K, will cause the pawl F′ to impart a similar movement to wheel U, and through wheel W, gearing with pinion W′, such movement will be transmitted to feed screw Q, and by causing it to work through the nuts N′ on saddle S thus advance or feed the machine forward. In consequence of this advance the next forward stroke of the piston will not be a full-stroke, and will not be a full-stroke again until the length of the forward movement has been bored by the drill, and until this takes place the pawl F cannot enter a fresh notch or tooth of wheel U, but will move freely backward and forward over such wheel without actuating same. Immediately that the piston regains its full-stroke the pawl will engage a fresh notch or tooth, and a further advance will be given to the machine.

The pawl F′, as shown in Fig. 4, has a head, F², capable of sliding freely on the curved bar or yoke J as the crank K reciprocates. From bar J two arms, J³, extend, and are mounted on eccentrics on spindle J², mounted on the casing, so that by turning said spindle by means of the crank or handle J′ at one end the pawl F′ will be raised clear of ratchet-wheel U and permit of the drill being screwed back on saddle S, after having been advanced to the full extent of the feed. The end of feed-screw Q is fitted with crank-handle H, to enable same to be turned by hand for the purpose of moving the machine backward or forward on the saddle S, as required, the pawl F′ being first raised clear of ratchet-wheel U, as above described.

Two circular bars, Q′, running parallel with the feed-screw Q, work through the saddle S, and are keyed firmly to the body of the machine, and further held by nuts, as shown in Fig. 6.

To prevent excessive wear on the feed-screw Q and nuts N′, the former is fitted with a

strong spring, S', at its lower end, as shown in Figs. 1 and 6.

In action the machine is attached to a carriage or column by the saddle-arm B^2.

The drill or borer D has a projection, D', (see Figs. 1 and 7,) for fixing it in its socket in the lower end of the piston-rod R, the socket having a longitudinal slot, from the end of which a transverse slot leads, the latter being in the form of part of a screw-thread. The projection D' on drill D is first inserted in the longitudinal slot in the socket and forced to the end of same, when by a twist being imparted to the drill the projection is caused to enter the transverse groove, and, moving over the inclined plane thereof forces, the end of the drill or borer tightly against the bottom of the socket. The direction of the transverse groove is opposed to that in which the drill is caused to rotate, so that the latter may have no tendency to loosen in its socket.

The upper part of cylinder C is turned to receive the bearings L and L', the latter being turned to fit same, and being fixed by screws to the casing E of the machine. The stuffing-boxes are each closed by annular plates T, (see Fig. 1,) the packing O and the plates T' fitting compactly on each other with the spaces Z and Z' in the centers, from each of which a channel proceeds for placing the passages M and M', respectively, in communication therewith. The upper box is finally closed and the packing compressed by the screw-nut L^2, and the lower box by the gland G.

The rifling of nut N and bush Y, and also that of rod B and crank K, can be arranged with the projections on either part to enter the grooves in the other part.

Having fully described our invention, what we desire to claim and secure by Letters Patent is—

1. The means for actuating the valve of rock-drills, consisting in arranging the valve between two pistons capable of reciprocating in suitable cylinders provided in the valve-chest, and from the outer end of each of which a passage leads through the stuffing-boxes or glands of the main cylinder into the latter, the passage from each valve-piston cylinder passing through the stuffing-box at the opposite end of the main cylinder to that at which it is itself situated, the usual passages for the admission and exhaust of steam or air to and from the main cylinder being arranged between the ports or passages leading to the valve-piston cylinders, and two separate passages formed in the rod of the main or drill piston, and each serving to control the supply and exhaust of one of the valve-piston cylinders, all substantially as specified.

2. Constructing the stuffing-boxes or glands of the cylinder of rock-drills with passages through them communicating with such cylinder, and also with one end of one of two cylinders in which are arranged pistons carrying between them the valve for actuating the main piston of the drill, substantially as specified.

3. The combination of parts for effecting the rotation of the drill-piston and its rod at each backward stroke, consisting in an externally-rifled nut, N, rigidly fixed to the part R' of the piston-rod and engaging an internally-rifled bush or sleeve, Y, capable of a circular movement, but prevented from moving longitudinally in the casing E, and having an external conical surface forming the seat for a ratchet-wheel, U^2, which is forced to such seat by a spring, S', permitting the bush Y to turn therein in the case of any unusual obstruction during the backward stroke, suitable pawls, F, being arranged to engage such wheel and prevent its rotation during the backward stroke, substantially as specified.

4. The arrangement of mechanism for feeding the drill forward as the work progresses, consisting in mounting on the piston-rod of the drill a hollow rifled rod provided with a longitudinal groove, with which a bolt projecting through the drill-casing engages, so as to prevent its rotation on the piston-rod while allowing it to reciprocate therewith, such rifled rod engaging the boss of a crank mounted so as to be capable of a circular rocking movement thereon, and upon the arm of which is pivoted a pawl which engages a ratchet-wheel, to the boss of which a toothed wheel is connected and gears with a pinion fixed to the feed-screw, working through a nut or nuts carried by the slide or saddle on which the whole machine is mounted, all arranged and operating substantially as specified.

5. The means for disengaging the pawl F' from ratchet-wheel U when required to move the drill in relation to the slide or saddle by hand, such means consisting in the shaft J^2, mounted so that it can be rocked in suitable bearings, and provided with eccentrics engaging the arms J^3 of a curved bar or yoke, J, on which an arm or head, F^2, of the pawl F' is free to slide, all arranged and operating substantially as specified.

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