R. Nulty,

Rock Drill.

No. 87,061. Patented Feb. 16, 1869.

Fig: 1.

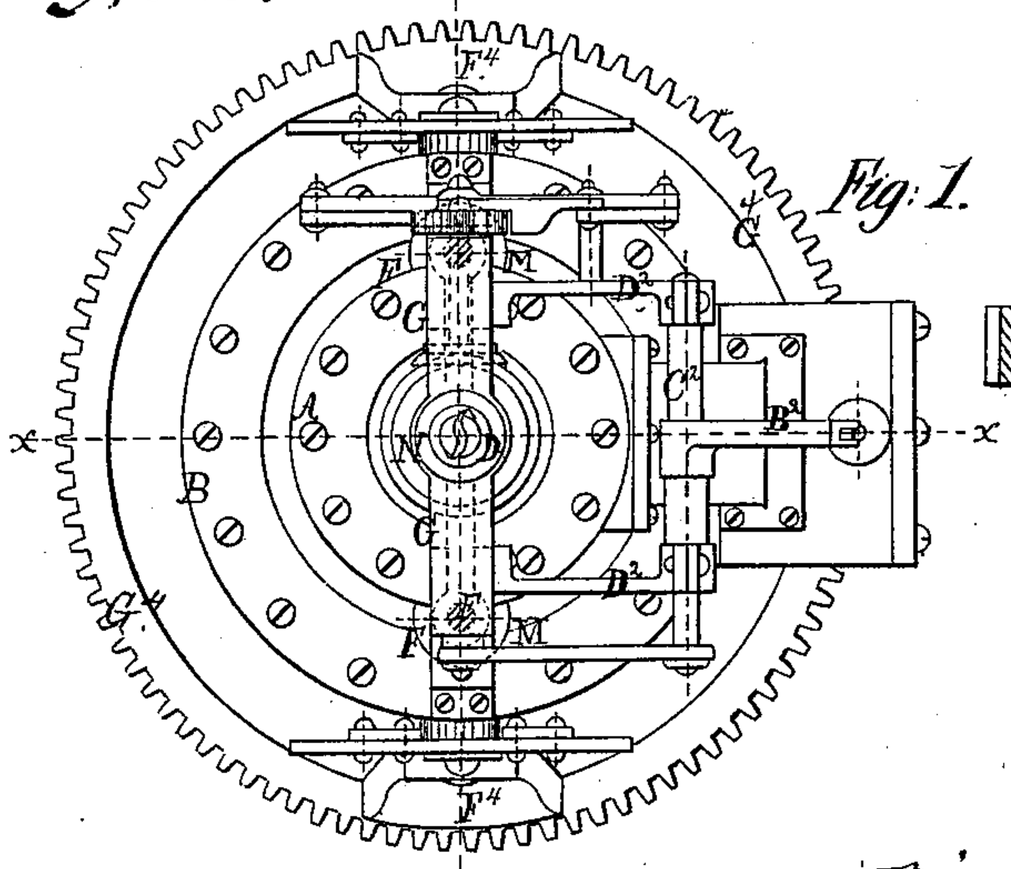

Fig: 2.

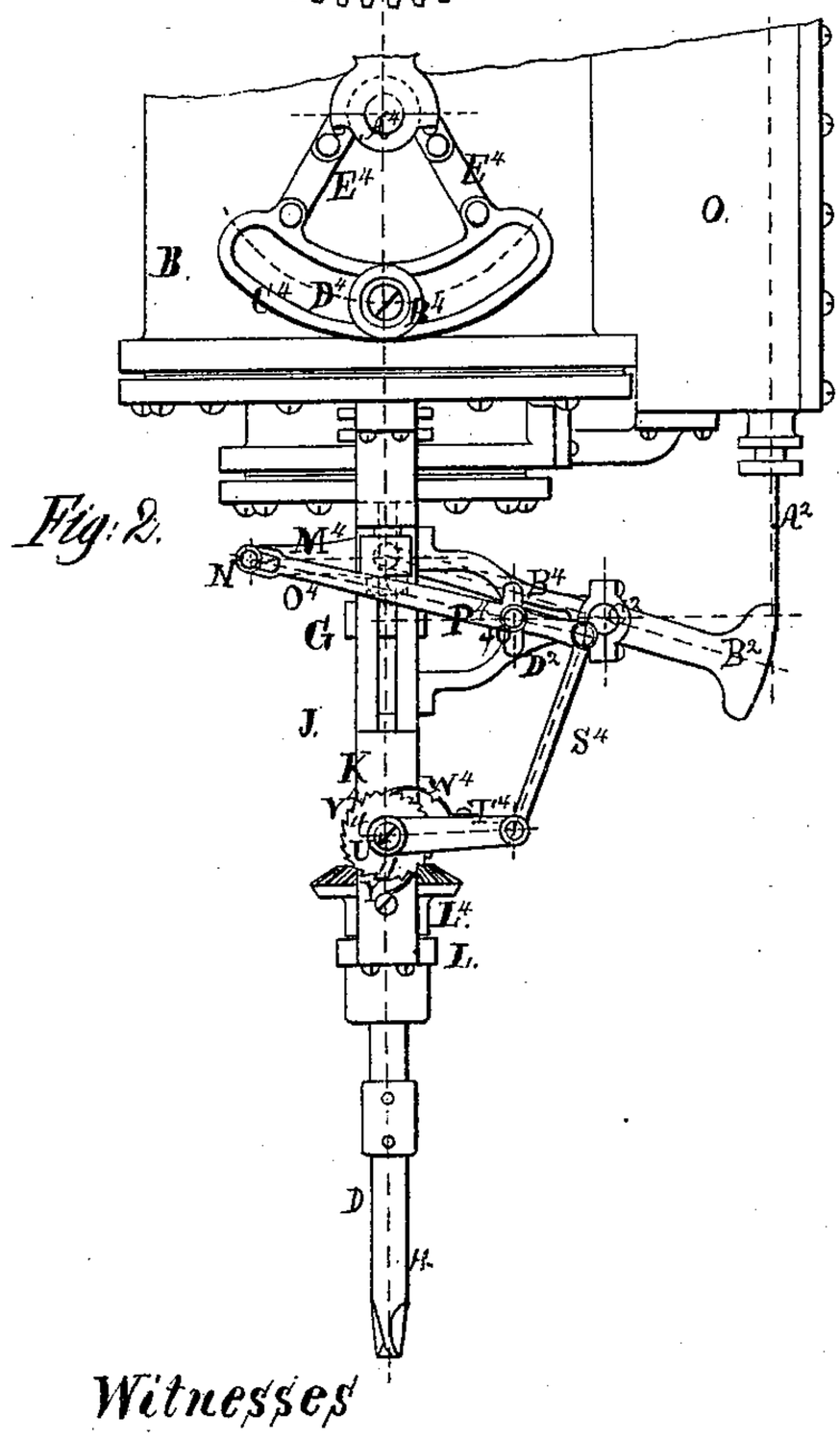

Fig: 3.

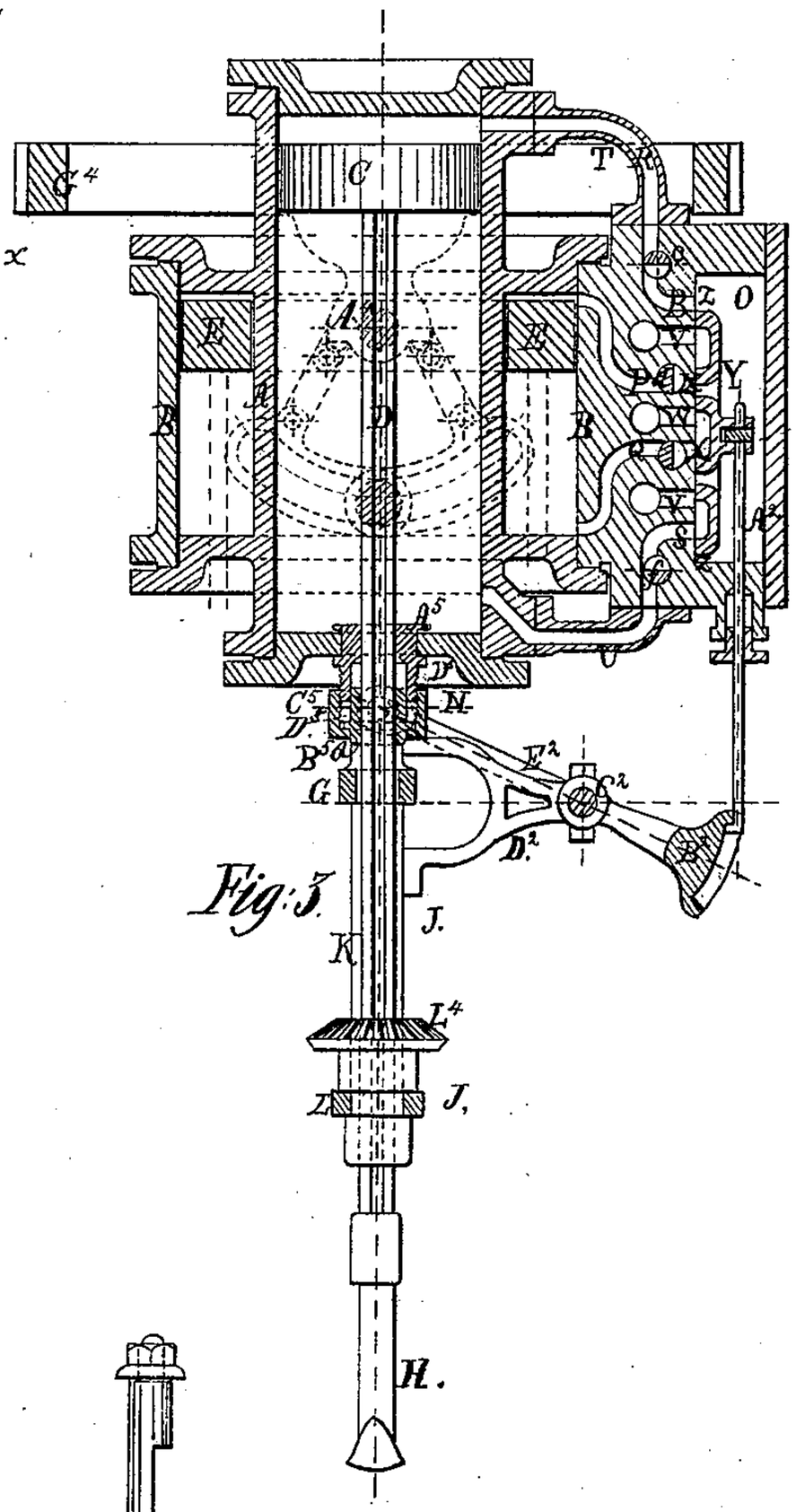

Fig: 4.

Witnesses

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ROBERT NUTTY, OF NEW YORK, N. Y.

Letters Patent No. 87,061, *dated February* 16, 1869.

IMPROVED ROCK-DRILLING MACHINE.

The Schedule referred to in these Letters Patent and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, ROBERT NUTTY, of the city of New York, in the county and State of New York, have invented certain new and useful "Improvements in Machines for Drilling Rocks, and for other purposes;" and that the following is a full and complete description of the same, reference being had to the accompanying plates of drawings, hereinafter referred to.

The improvements embraced in this invention will be in their description explained more particularly in connection with machines for the drilling of rocks, &c., although they are susceptible of adaptation to other machines used for other purposes, such as forge and steam-hammers, and in which the drill or hammer-head, or other part, through and by which the blow is transmitted, must necessarily have an irregular movement, or, in other words, a stroke of a greater or lesser length at times, according to the nature of the material on which it acts, and for other obvious reasons; and the main object and purpose of the present invention is to obviate the constant breakage of those portions of the machine by which the drill or hammer-head, &c., is lifted, and force imparted to it for striking a blow, and, in case a drill is used, those portions by which the drill is fed, as fast as the hole is cut.

For overcoming this breakage of parts to the machines, many inventions have been devised, but with only partial success, as they could not be relied upon for continuous working, from the fact that the jarring of the parts, by the striking of the drill on the rock, is so great as to render it almost, if not impossible, to keep the machine in repair, as, for instance, when the drill was worked through a piston, or through a spring which is compressed by the drill, as it is forced against it, so as to deliver a blow by its sudden expansion.

In this latter mode, the friction is so great as to require almost constant repair, and to cause much difficulty in the handling of the machine, so that such machines have been virtually abandoned, especially for open-quarry work; and furthermore, machines have been devised, in which the drill has been lifted by friction-clutches, but allowed to fall of its own weight. These machines, however, were not found satisfactory in practical operation.

In addition to the above difficulties experienced in the lifting and striking of the drill by machines now and heretofore in use, much difficulty has also been experienced in the matter of feeding the drill forward to its work, the many complicated devices heretofore in use failing to relieve the strain on the gearing, &c., and, in fact, no mechanism has heretofore been arranged that would indicate with sufficient accuracy the great and continued change in the hardness of the rock.

By the present invention, however, a machine is produced by which the difficulties heretofore encountered are overcome, the drill being lifted and driven by the direct action of the steam, or other motive-power, so that, whatever may be the amount of power applied, no part of the machine can be damaged by the shock, and the machine can be run at any required speed without any difficulty being experienced in the easy and continuous working of the whole; and in my improved machine, two steam or piston-cylinders are employed, the one for operating the drill, and the other for regulating the length of stroke, and for working the valves and other necessary appendages, the cylinder in which the drill is operated being longer than that of the governing-cylinder, so that the drill can be fed forward as fast as the hole is cut, whereby the necessity of using delicate and complicated motions, as has heretofore been the case, is obviated.

In the accompanying plates of drawings, my improvements in machines for drilling rocks, and for other purposes, are illustrated—

Figure 1, plate 1, being a plan or top view of the upper ends, or heads, to the two piston-cylinders.

Figure 2, a side view or elevation of the lower ends to the piston-cylinders.

Figure 3, plate 2, a central vertical section, taken in the plane of the line *x x*, fig. 1.

A and B, in the drawings, represent the two steam-cylinders, the one within the other, with the inner one longer than the outer one.

C, a piston-head, arranged to move within the inner steam-cylinder A, to which piston-head D is the rod.

E, a piston-head, arranged to move within the outer cylinder B, which piston-head is of an annular, or ring-shape, and is provided with two piston-rods F, at points diametrically opposite to each other, that upon the outside of the cylinder B, at its lower end, are connected together by a common cross-head, G.

The rod D to the inner piston-head C is extended through the cross-head G, hereinbefore referred to, and at its extreme outer end has fastened to it, in any proper manner, a drill-head, H.

J, a frame, bolted to the lower head of the outer cylinder, from which it is extended below, and has its side-pieces, K, connected at their lower ends by a cross-piece, L, through which the piston-rod, carrying the drill-head, extends and plays or moves.

This frame J is provided for the purpose of holding the parts (to be hereinafter described) arranged for rotating the drill, and those for working the valve.

M, the stuffing-boxes, for the rods to the annular piston-head, and

N, a stuffing-box, through which the piston-rod carrying the drill-head moves, this stuffing-box N being arranged to revolve with the piston-rod, as such rod is carried around for rotating the drill-head, and constructed for such purpose, as will be hereinafter described.

O, the steam-chest, to which P Q and R S are steam-ports, the first two belonging to and connecting with the cylinder B, and the other two with the inner cylinder A, with the latter connected through passages T and U, leading from the steam-chest O to the ends of the inner cylinder.

The passage U leading to the lower end, opens into

the cylinder at some distance from its head, for the purpose of protecting the cylinder-head from the blow of the piston, when it has worked forward to its full extent, as such port will be thereby closed by the piston, before it reaches the cylinder-head, and thus, by preventing the entrance of steam between the piston and such head of the cylinder, stop the working of the drill, as it can and will not be again raised.

V and W, exhaust-ports for outer cylinder B, and X, exhaust-port for inner cylinder A.

Y, valve-plate, arranged to move over valve-surface Z to steam-chest, and thus, by making it of suitable form, and with proper openings, to alternately open and close the steam and exhaust-ports to the cylinders A and B, for the admission and exhaustion of steam from the same, as it is moved over the valve-face from end to end. To move this valve-plate Y, it is connected through its stem, or rod, A^2, with the outer end of an arm, B^2, to a horizontal rocker-shaft, C^2, turning in suitable bearings at each end of the bracket-arms D^2, fixed to the extension-frame J; this shaft C^2, by a pitman-rod, E^2, being connected with the cross-head, hereinbefore referred to, of the piston-rods to the outer cylinder.

From the foregoing description of the double engine, composed of the cylinders A and B, (both being connected with the steam-chest,) it is obvious that if steam be admitted into the chest, it will pass therefrom, as the steam-ports are opened and closed, either at one or the other ends of such chest, into corresponding chambers or portions of the cylinders, and thus, by permitting the steam to act on both pistons at the same time, move them with equal speed.

The piston of the inner cylinder delivers, through its drill-head, the blow upon the rock intended to be drilled, while at the same time the piston of the outer cylinder, through its cross-head, works the valve.

As the piston of the inner cylinder, which carries the drill-rod, has no connection with the working-parts of the piston to the other, or outer cylinder, it is apparent that there is no possibility of a shock from the blow being received by any part of the machinery which would be liable to injury by the constant jarring.

This would be the case if the drill-head had any connection with the parts worked by the motion of the cross-head.

By making the drill-carrying cylinder longer than the other, it is obvious that the piston E to the former cylinder, as it has no valve motions of its own, can have any desirable length of feed, or a longer or shorten stroke, to accommodate it to any irregularity which may occur in the rock, without danger of deranging the engine, and, by giving increased pressure to the outer face of the piston, for driving it forward with a greater speed than that by which it was drawn back, the drill can be fed forward as fast as the hole is drilled, thus securing a forward feed to the drill, which in all other machines has been done through a complicated and intricate arrangement of machinery.

For regulating the speed of both of the pistons, throttle-valves, *c d e f*, are placed and arranged under the steam-ports, for the purpose of opening and closing them to any desired extent, thus placing them completely under control while the engine is in motion. As, for instance, if it be found that the piston of the governing-cylinder is running with greater speed than is desirable, thus cutting off steam from the drill-carrying piston C too soon, by opening the valves *c f*, and closing the valves *d e*, either more or less, the said piston may be brought to the precise rate of speed.

These throttle-valves are very necessary, as the drill is constantly changing in weight, and thus requires an increase of pressure to lift it with a common arrangement of the valve; for upon the admission of a greater amount of steam to the steam-chest, to compensate for such increase of weight in the drill, the governing-piston will receive more steam than is necessary, if not regulated by the said valves, and thus, running faster than the piston, render it impossible for the drill-carrying piston to run a sufficient length of stroke to strike the rock with force enough to cut it.

A^4, trunnions on outer cylinder, and at points diametrically opposite to each other, which trunnions are provided for the purpose of hanging the engines in bearings of a boom.

B^4, additional trunnions, applied to the outer cylinder below the trunnions A^4, hereinbefore referred to. These trunnions B^4 have screw-bolts tapped in them.

C^4, segment-yokes, arranged by the slots D^4, to act on the screw-bolts to trunnions B^4, and at their ends attached, by link-pieces E^4, to the uprights F^4 of a gear or toothed wheel, G^4, which is arranged to encircle the outer piston-cylinder, in which uprights F^4 the trunnions A^4, hereinbefore referred to, are hung and turn.

By these yokes, with their link-connection to the geared wheel or frame G^4, when it is desired to shift the engine, for work by its drill, in any new position, it is only necessary to first loosen the screw-bolts, which leave the engines free to be swung through the yokes, either more or less, until brought into the proper position, when, screwing up such bolts against the yokes, all is made tight and firm.

With the gear-wheel G^4 suspended upon a frame, so as to move around thereon, with a pinion-wheel arranged on such frame, to work into the gear-wheel G^4, the position of the engine may be changed for angles which could not otherwise be obtained by the movement of the yokes, and without leaving a weak point, which would be the case were a universal-joint employed instead.

Between the cross-head of pistons to governing-cylinder and bevel-gear wheel L^4, arranged by a spline-joint on the drill-rod, the following arrangement of parts is provided for rotating the drill-rod.

M^4, an arm bolted or keyed to one end of cross-head, above referred to, which arm, at its outer end, is provided with a fixed pin, N^4.

Over this pin N^4 the slotted end, O^4, of a rocking-lever, P^4, is placed, this lever turning upon a fulcrum, at Q^4, of the bracket-arm R^4 to the extension-frame, and at its other end connected, through a pitman-rod, S^4, with the outer end to an arm, T^4, arranged to swing loosely upon the centre shaft U^4 of a ratchet-wheel, V^4.

This arm T^4 carries a spring-pawl, W^4, for revolving said ratchet V^4, and thus, through its shaft, having bevel-gear wheel, which engages with the bevel-gear L^4, or drill-rod revolving such rod, the said pawl W^4 being moved alternately forward, carrying the wheel, and then back over the same, as, by the upward and downward motion of the cross-head, the lever is rocked.

Y^4, a spring-pawl, applied to extension-frame J, in position to hold the ratchet-wheel from turning back.

As the drill-rod, which is in fact the piston-rod to the inner cylinder, is revolved by the action of the parts hereinabove described, and, for that reason, must be provided with a groove along its length, the stuffing-box for the cylinder-head, through which it passes, must necessarily be so constructed as to turn within the cylinder-head, in connection with the drill or piston-rod thereof.

In fig. 3, a stuffing-box so constructed, is shown, and is made of three parts, A^5 B^5 C^5, with packing-ring D^5, which is confined between the part A^5, fixed in the head to the piston-cylinder, and the sleeve-part C^5, which is held to its place by the screw-collar, or part B^5, which is screwed over the projecting-portion of part A^5.

The screw-collar and sleeve are of such form as to interlock by a flange-joint, *a*, so that if the collar be screwed down, the sleeve will be made to tightly confine the packing around the drill-rod, while at the same

time it is allowed to freely turn within the box, as the rod turns, between which and the sleeve there is a spline-joint.

Having thus described my improvements in rock-drilling machines, &c., I will state my claims as follows:

What I claim as my invention, and desire to have secured to me by Letters Patent, is—

1. The combination of the inner and outer cylinders, with their pistons and connections, substantially as and for the purpose set forth.

2. In combination with the above, a steam and valve-chest, when so constructed, and provided with steam and exhaust-ports, and with suitable conducting-passages as to admit and exhaust-steam from the two steam-cylinders, when used for the purpose specified.

3. A stuffing-box to a cylinder-head, when constructed so as to turn around with the drill or piston-rod, substantially as described, for the purpose specified.

4. The arrangement of the rocking-lever P^4, pitman-rod S^4, ratchet-wheel V^4, arm-carrying pawl W^4, gear-wheels G^4, one upon the drill-rod, in combination with the cross-head, to which the said rocking-lever is connected, substantially as described. for the purpose specified.

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