H. Haupt.

Steam Rock-Drill.

No. 47,819. Patented May 23, 1865.

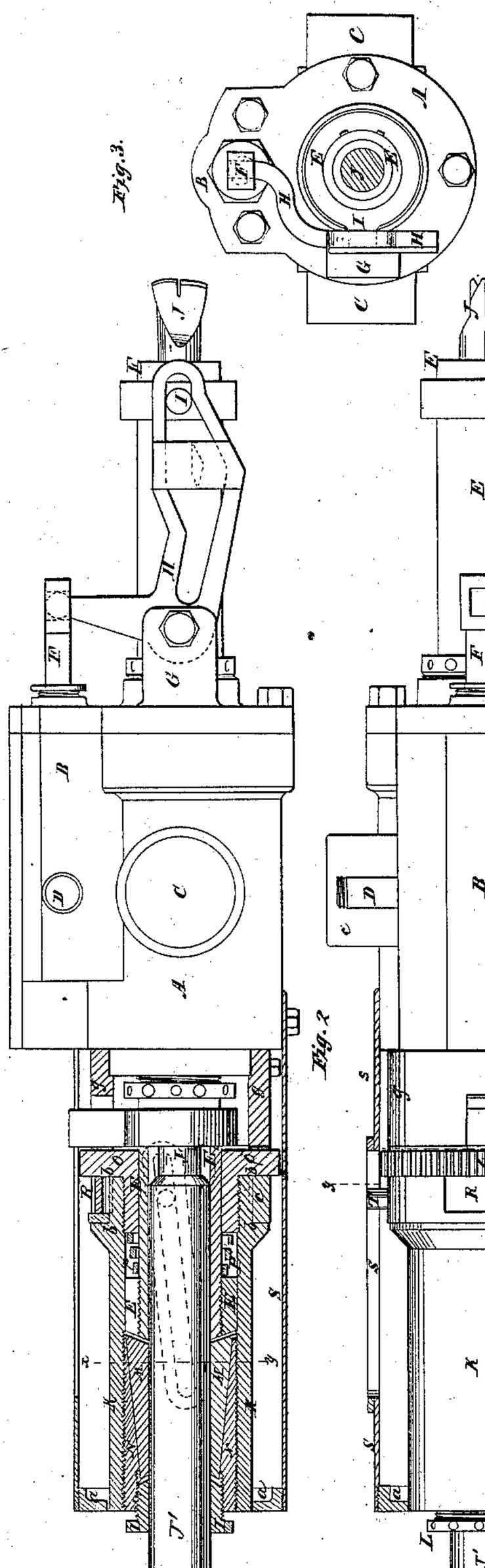

Fig. 1.

Fig. 2.

Fig. 3.

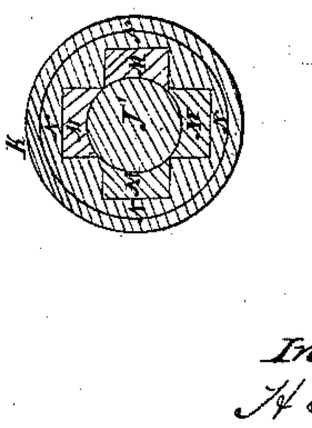

Fig. 4.

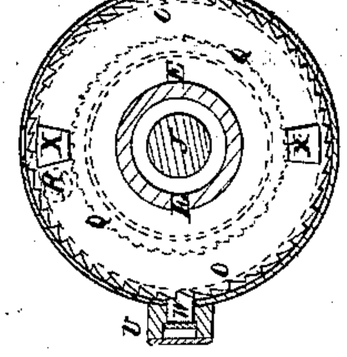

Fig. 5.

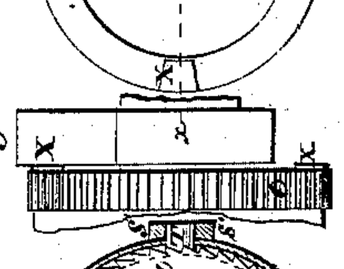

Fig. 6.

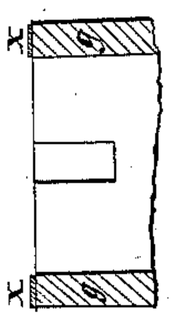

Fig. 8.

Fig. 7.

Witnesses:

Jno L Coombs

Inventor:

H Haupt

UNITED STATES PATENT OFFICE.

HERMAN HAUPT, OF CAMBRIDGE, MASSACHUSETTS.

IMPROVED DRILLING AND BORING MACHINE.

Specification forming part of Letters Patent No. **47,819**, dated May 23, 1865.

To all whom it may concern:

Be it known that I, HERMAN HAUPT, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Steam or Pneumatic Drills or Machinery for Drilling Rocks, &c.; and I hereby declare that the following, taken in connection with the accompanying drawings, is such a full, clear, and exact description of the same as will enable others skilled in the art to make and use the same.

The drilling or boring of rocks or other hard substances for tunneling, mining, and other purposes has been heretofore attempted by mechanical means; but great difficulties have been encountered in the practical application of machinery for that purpose devised, and this was owing to the changeable character of the work, while the means to perform the same in point of operation were permanent. Thus the permanent feed, whether effected by screw or otherwise, has the serious disadvantage of progressing the drill at a given rate irrespective of the penetrability of the rock or the condition of the tool, causing gradual shortening of the stroke of the piston, and, finally, the stoppage of the work.

To remedy these and other evils which have interfered with the introduction of machines for tunneling and mining operations, I have devised a drill operated by the steam or other elastic fluid whose principal characteristic features are as follows:

The drill proper is composed of a cylinder containing a piston whose rod projects through both heads and carries internally or externally one or more drill-bars. With the cylinder is combined, as usual, a valve-chamber and valves preferably balanced to equilibrate pressure, which valves are operated automatically by connection with the piston-rod or other driving part. Around each drill bar or rod (and in the rear of the cylinder and back of the piston-rod, if it be hollow, and if the drill-bar passes through the piston-rod) I arrange a mechanism, which I call a "gripper-box," to firmly grasp and hold the bar during its receding movement, while during part of the advance of the piston, and when at or about the end of the stroke, to release the same, thereby allow of its self adjustment in accordance with the penetrability of the rock. Rotary movement is imparted to the drill rod at each stroke of the piston by means of a stud operating in a helical or oblique slot in the casing of the gripper-box, or by any other equivalent arrangement.

A drill constructed in accordance with my invention is represented in the accompanying drawings, in which—

Figure 1 is a side view, partly in section, showing the internal construction of the gripper-box before referred to. Fig. 2 is a plan view of the same, the outer casing being shown in section to exhibit the mechanism or arrangement for rotating the drill-bar. Fig. 3 is an end view of the drill, the drill-bar at the forward end being cut. Fig. 4 is a transverse section through line *x y*, showing the grippers, gripper-box, and drill or drill-holder. Fig. 5 is a transverse section through line *y z* in Fig. 2. Figs. 6, 7, and 8 are detail views in elevation, plan, and section of the intermediate stops, whereby the feed is effected at given intervals of strokes.

In the said drawings, A is the steam-cylinder, (the following, description, for the sake of brevity, being confined to drills operated by steam, it being understood that air or other elastic or inelastic fluid may, with but slight modification, be adapted for the purpose of operating drills,) having on the sides, at a convenient distance from either end, to properly balance the whole apparatus, trunnions C, whereby the machine is hung or mounted in a suitable frame, so as to admit of a swinging motion in a plane at right angles to the axis of suspension. On top there is cast to the body of the cylinder the usual valve-chamber, B, and orifices or pipe-connections D are arranged for the admission and emission of steam. The cylinder is provided with a piston mounted upon a hollow piston-rod, E, which passes through both heads of the cylinder, and the piston is moved to and fro by the action of steam, whose admission to and exhaust from the cylinder is regulated by the action of the drill itself, in the manner as follows: To the head of the cylinder there is cast a lug, G, to which is pivoted a slotted bell-crank, H, one of the lever ends of which is connected with the valve-rod F. In the slot of the crank, which is timed according to the work to be performed, works a pin, I, projecting from the side of the hollow piston-rod

or tool-holder, so that the reciprocating movement of the latter is transmitted to the valve, whose operation is thus intimately connected with that of the drill itself. The hollow piston-rod E contains the drill-bar J, or both the drill-bar and its holder J′.

In a drill constructed according to this plan it is preferred to make the drill in two parts—viz., the tool and the tool-holder, which latter, being permanently used in and combined with the gripper-box, is necessarily more accurately adjusted. The tool-holder is held in or onto the hollow piston-rod by means of a gripper-box consisting of the following parts: A cylinder, K, held in position by means of the flange or collar E′ on the head of the hollow piston rod E, as well as by the internal flange, *a*, on the casing S, is provided at its rear end with three, four, or more inclines, N, against which are applied wedges M, confined by means of the collar L and the head of the hollow piston-rod E, so as to allow a slight play or sliding movement upon said inclined planes. At the forward end the gripper-box terminates in a disk, O, back of which is an internal recess, which contains a valve-spring, P, whose office it is to give the parts in the gripper-box the requisite degree of tension, so as to compress the wedges against the tool-holder J′ and firmly hold it. The stiffness of the spring is calculated to yield to the momentum of the piston-rod and drill-bar and holder when the motion of the gripper-box is suddenly checked by coming in contact with the stops X for that purpose provided. The drill-bar, it will be understood, is thus caused to advance in the gripper-box until its further progress is stopped by the tool coming in contact with a resisting substance.

The rotation of the tool, which is an important element in drilling machinery, is effected in this case in the following manner: The recessed portion of the gripper-box at *b* is provided with ratchet-teeth Q, meshing in with a pawl, R, hinged to the interior of the ring *c*, from which ring projects a stud, T, which, working in a helical or other properly-shaped slot in the casing of the gripper-box, imparts to the ring rotary movement. The rotation thus produced on the ring is transmitted by means of the pawl to the gripper-box, which in its turn is held steadily or prevented from turning back by means of an auxiliary ratchet cut on the periphery of the disk O, which is caused to mesh in with a dog, W, of a length not less than the stroke of the piston, and which is caused to bear against and into the teeth by means of one or more springs.

To withdraw the drill-bar or holder, I give the head of the piston-rod a conical form, and shape the heads of the wedges in the gripper-box accordingly. With this arrangement I combine the follower L, whose forward end is similarly formed into a cone, while the taper ends of the wedges are formed correspondingly. By this arrangement it will be understood that if the follower be pushed up or screwed in against the wedges the latter will, following the inclined planes of the head of the piston-rod, expand and diverge so as to release their grasp on the tool-holder. It will then be easy to remove the drill-bar for re-change or other purposes. At the rear end of the cylinder there is a wrought-iron ring or anvil, *g*, against which the gripper-box is caused to strike at each forward stroke of the piston. But I have found it preferable to multiply the strokes of the tool on the rock under full head of steam between each advance or feed of the drill. I have therefore arranged the anvil-ring *g* and the hammer-disk O in such manner as to come in contact only once or twice during a complete rotation of the drill. To this effect both the hammer and the anvil are provided with stops or projecting studs X, whereby the two are kept out of contact, except when the studs or stops on the one come opposite the other, at which times only the feed takes place. During the intermediate strokes, however, the drill being firmly held by the grippers, it is driven against the rock with full force of steam.

Having thus described the construction and arrangement of the parts constituting my improved drill, I shall now proceed to describe the operation of the whole. Steam being admitted to the cylinder in the rear of the piston, the drill is moved forward against the face of the rock and occupies the position indicated in Figs. 1 and 2 at the moment the valve has been shifted by the action of the stud I on the bell-crank, and steam is entered the cylinder in front of the piston. As the latter travels back the head of the hollow piston-rod strikes the heads of the wedges, whereby they are caused to converge and firmly grip the tool-holder, and thus carry it with it in its backward movement. The drill when thus withdrawn again shifts the valve to admit steam in rear of the piston, which, moving forward, presses through the medium of the stiff spring P against the gripper-box. The spring, not being sensibly compressed, maintains the proper tension of the parts, so that the wedges do not release their hold on the tool-holder, although moving forward. In this manner a blow can be produced with the full force of the steam on the piston, which operation is repeated successively, rotating the drill during each back-stroke until the stops X, before referred to, come opposite to each other. At this moment the gripper-box in its forward movement is suddenly checked, thereby compressing the spring and loosening the wedges, which release the tool-holder. The tool-holder, thus released by the momentum acquired, slides forward within the gripper-box until it reaches the face of the rock. The drill-bar is in this manner fed forward twice during each revolution.

Having now fully described my invention

and the manner in which the same is or may be carried into effect, I shall state my claims, as follows:

1. The employment in machinery for drilling or boring rocks or other hard substances, operated by steam or other elastic fluid, of a momentum-feed, as described—*i. e.*, a mechanism to firmly connect the piston-rod with the drilling-tool or tool-holder in such manner as that the hold shall be suddenly and automatically released at or before the completion of its forward stroke, to allow of the self-adjustment of the tool in relation to the rock, in accordance with its penetrability and the progress of the work, substantially in the manner herein set forth.

2. In steam-drills or drills operated by air or other elastic fluid, the combination, with a hollow piston-rod when used as a tool-holder, of a gripper-box arranged in the rear of the cylinder and back of the piston-rod, substantially as set forth.

3. In a drill operated by steam or other elastic fluid, the momentum-feed, as described, when applied to the translatory movement, in combination with a positive rotary feed of the drilling-tool, and whether the two feeds are simultaneous, reciprocating, or intermittent in their action with respect to each other, substantially as set forth.

4. The arrangement concentrically with the drill or tool of the gripper-box, containing a series of wedges held in place to firmly grasp the tool through the agency of a spring, in combination with a stationary anvil-ring forward of the gripper-box, for operation as set forth.

5. In combination with the gripper-box operating as described, the arrangement for driving the wedges home against the tool to grasp the same with the full head of steam or the actuating power by causing the rear end of the hollow piston-rod to butt against the heads of the wedges, as described.

6. In combination with the gripper-box constructed and arranged as described, the follower to expand the wedges for the purpose of releasing the drill-tool or tool-holder, substantially as set forth.

7. Recessing the stationary check or anvil-ring so as to leave projecting studs corresponding to similar studs in the forward end of the gripping-box in such manner as that the momentum-feed shall be alternated by blows under full head of steam, substantially as set forth.

8. In combination with the means described for producing rotary motion of the tool, the auxiliary ratchet and dog, or the mechanical equivalent thereof, for the purpose of preventing the tool from turning back after each rotation, substantially as set forth.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

HERMAN HAUPT.

Witnesses:
A. POLLOK,
EDM. F. BROWN.