(No Model.) 3 Sheets—Sheet 1.

H. R., H. L. & L. G. HANCOCK.

ROCK DRILL.

No. 603,529. Patented May 3, 1898.

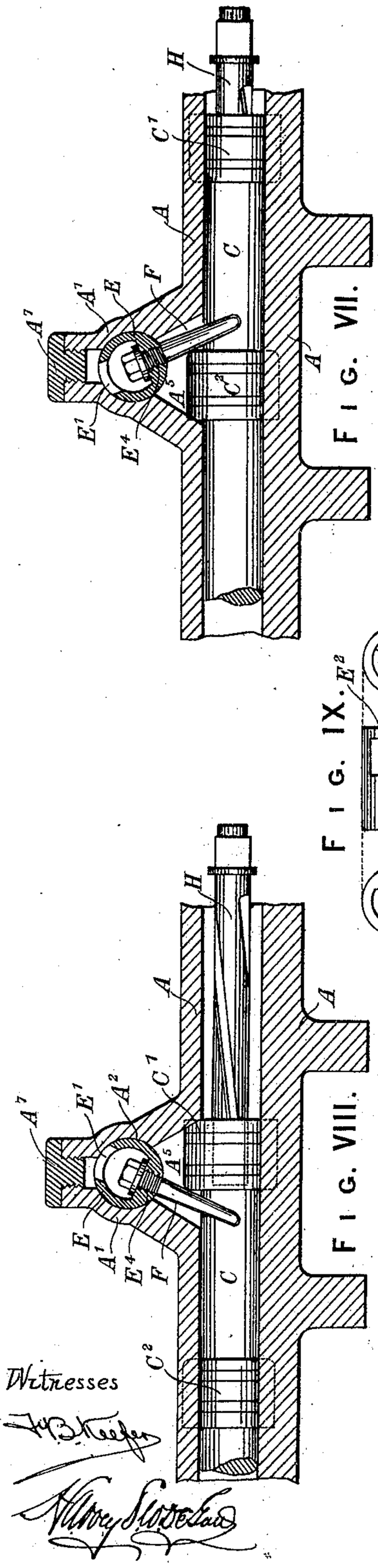

FIG. VII.

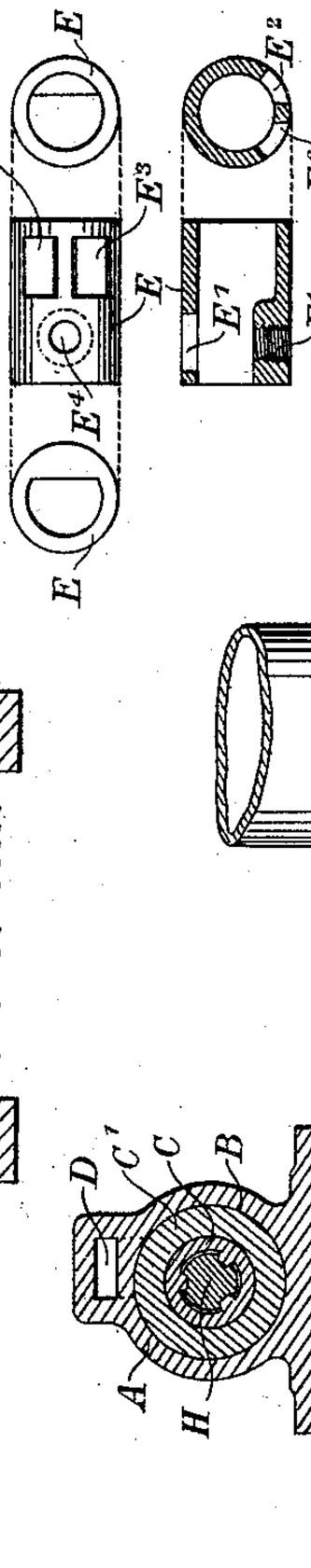

FIG. IX.

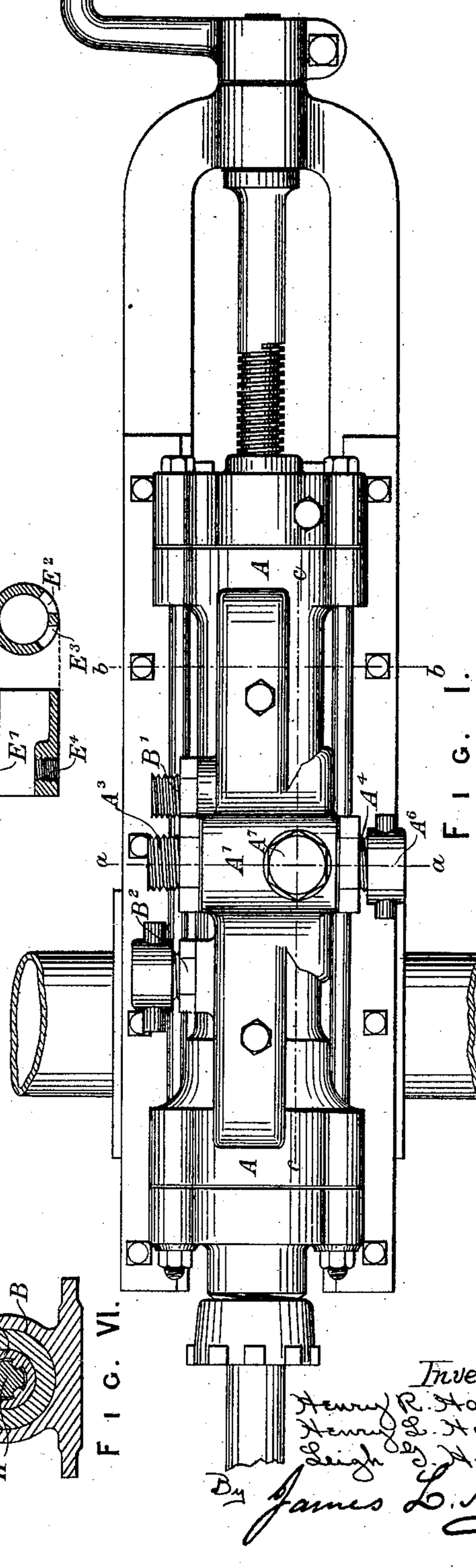

FIG. I.

FIG. VIII.

FIG. VI.

Witnesses

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(No Model.) 3 Sheets—Sheet 2.

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FIG. II.

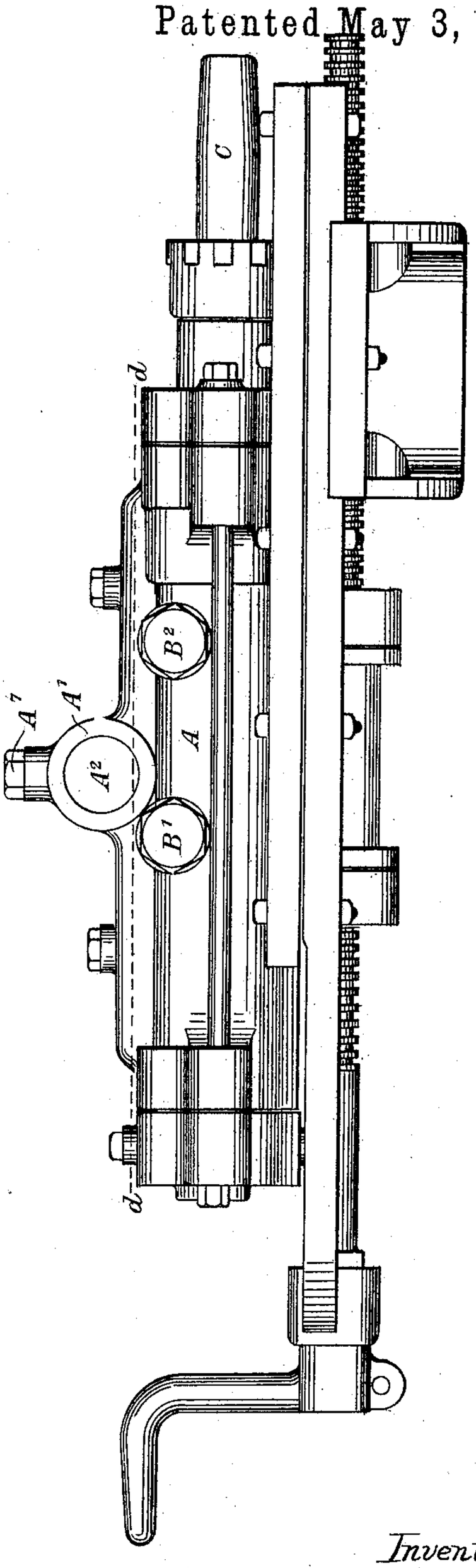
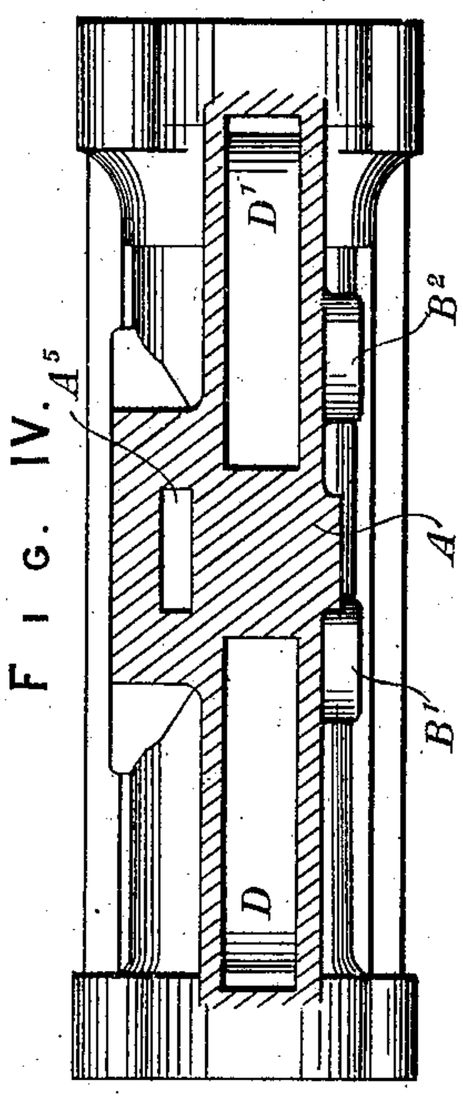


FIG. IV.



Witnesses

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(No Model.)

3 Sheets—Sheet 3.

H. R., H. L. & L. G. HANCOCK.

ROCK DRILL.

No. 603,529.

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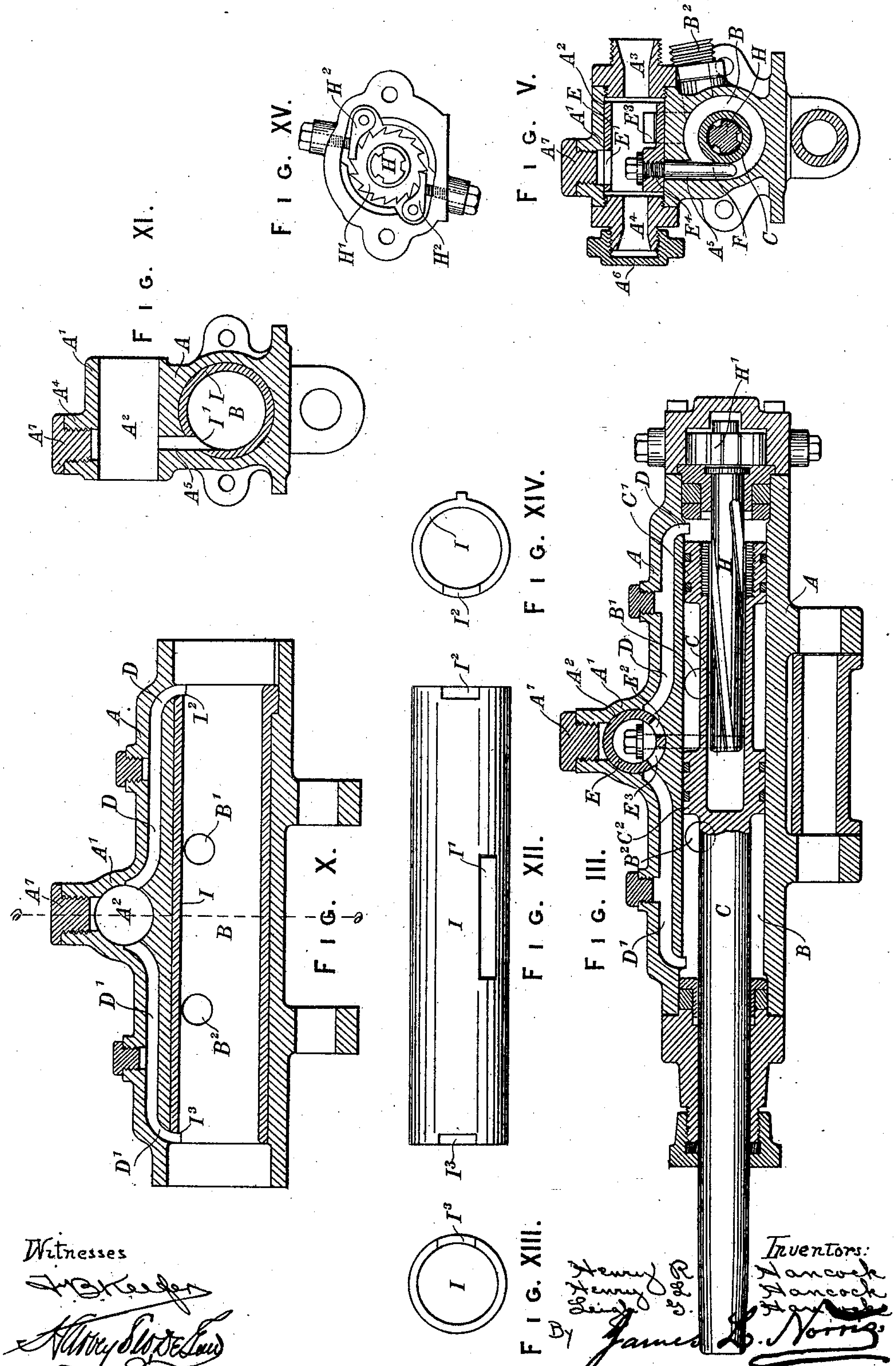

FIG. III. FIG. V. FIG. X. FIG. XI. FIG. XII. FIG. XIII. FIG. XIV. FIG. XV.

Witnesses

Inventors:

By James L. Norris, Atty.

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UNITED STATES PATENT OFFICE.

HENRY RICHARD HANCOCK, HENRY LIPSON HANCOCK, AND LEIGH GEORGE HANCOCK, OF MOONTA MINES, SOUTH AUSTRALIA.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 603,529, dated May 3, 1898.

Application filed September 2, 1897. Serial No. 650,391. (No model.)

To all whom it may concern:

Be it known that we, HENRY RICHARD HANCOCK, mine superintendent, and HENRY LIPSON HANCOCK and LEIGH GEORGE HANCOCK, mining engineers, subjects of the Queen of Great Britain, residing at Moonta Mines, in the Province of South Australia, have invented certain new and useful Improvements in Rock-Drills and other Like Machines, of which the following is a full, clear, and exact description.

Our invention relates to certain improvements in direct-acting machines driven by air or steam pressure. For convenience we propose to describe it with reference to rock-drills driven by compressed air, to which it is intended more particularly to refer; but it may also be applied to any direct-acting machine, such as pumps driven by steam.

With the drills and other like machines at present in use considerable difficulty is experienced in preventing leakage of the compressed air. Owing also to the multiplicity of the parts employed in the construction of the drill a further considerable amount of power is lost by friction, and when the cylinder becomes worn the machine can only be repaired by providing a new cylinder.

The objects of our invention are to lessen this leakage of the compressed air; to utilize as fully as possible the power supplied to the machine by simplifying the number of parts, and by a special construction of the cylinder to permit of the worn parts being renewed without the necessity of a new cylinder. We accomplish these purposes by constructing the drill or other machine with (*a*) a new and improved inlet-valve; (*b*) by an improved contrivance attached to the valve whereby it is automatically opened and closed by the action of the drill-piston; (*c*) by a general simplification of the parts which we are enabled to effect by means of our improved inlet-valve, and (*d*) by providing the cylinder with a removable liner which can be readily replaced when it becomes worn.

In the accompanying drawings, illustrating our invention, Figure I is a plan of the drilling-machine complete; Fig. II, an elevation of the machine, showing the exhaust-openings covered with stoppers; Fig. III, a longitudinal section showing the internal parts of the machine, but without the internal liner to the cylinder; Fig. IV, a horizontal section of the cylinder along the lines *d d* in Fig. II, showing air-ports and slot-hole for the valve-spindle, also the position of the exhausts; Fig. V, a cross-section through the parts marked *a a* in Fig. I, showing valve-spindle in position and air-ports; Fig. VI, a cross-section through *b b*, Fig. I, showing the air-port admitting air to the piston-chamber; Fig. VII, a longitudinal section along a line *c c*, Fig. I, showing the valve in section and piston and valve-spindle actuated by the same, together with the action of the piston of the valve-spindle at the end of the instroke; Fig. VIII, a longitudinal section of the same, showing the action of the piston of the valve and valve-spindle at the end of the outstroke; Fig. IX, details of the valve, the valve-spindle being removed in order to show the ports more clearly; Fig. X, a longitudinal section of the cylinder of the machine with removable liner inserted; Fig. XI, a cross-section along a line *e e* in Fig. X, showing the slot-hole for the valve-spindle and the cylinder with inner lining; Fig. XII, a plan of the removable cylinder-liner, showing the slot-hole for the valve-spindle and openings at each end leading from the air-ports; Figs. XIII and XIV, elevations of the front and rear ends of the removable cylinder-liner, showing the position of the ports; Fig. XV, an end elevation of rifle-bar, ratchet-wheel, and pawls for holding the bar in position during the back stroke of the piston.

Similar letters of reference refer to similar parts in all the figures.

Our improved rock-drill is mounted upon a bed-plate or cradle, along which the machine is caused to travel forward by the usual screw device, as shown more particularly in Figs. I and II. It is provided with certain appliances and connections common to such machines, but which, as they form no part of our invention, we do not describe.

Referring to the accompanying drawings, in which the several parts forming our invention are shown in detail, A is the main body of the machine, having an internal cylinder B, in which works a piston C, as more particularly described later. The cylinder B

is provided with two exhaust-openings B′ B², Figs. III and X. At either end of the cylinder B are air-ports D D′, Figs. III and X, leading from the cylinder B to the inlet-valve chamber A², formed in the body of the machine at A′. The inlet-valve chamber A², Figs. X and XI, is cylindrical and is provided at either end with suitable removable caps A⁶, fastened to A′. The inlet-valve E has a rocking motion, causing it to partially rotate in the inlet-valve chamber A², permitting the air to enter from the valve first into one and then the other of the ports D D′. The details of the construction of the valve E, which consists of an open-ended tubular piece, are shown more particularly in Fig. IX. The compressed air from the air-compressor is introduced into the interior of valve E through a channel A³, formed in the side of the casing A′. A similar channel A⁴, closed with a cap A⁶, is provided at the opposite end of the valve-chamber A², so that the compressed air can be introduced from either side. The head of the machine at A′ is provided with a circular opening closed by a removable cap A⁷ in order to permit access to the interior of the valve E and to the valve-spindle F through a circular opening E′. The compressed air passing into the interior of the valve E through either of the channels A³ or A⁴ flows through one or other of the openings E² E³, formed in the lower portion of the valve, into one or other of the ports D D′, with which the openings E² E³ correspond. In order to automatically impart a rocking motion to the valve E, causing it to partially rotate, so as to bring alternately the opening E² opposite the port D and the opening E³ opposite the port D′ and to admit the compressed air alternately to one or the other, the valve E is brought in communication with the piston C by a valve-spindle F. This valve-spindle F is tightly fastened to the valve E by having a screw-thread formed upon it, Figs. VII and VIII, and by being tightly screwed into an opening E⁴, having an internal screw-thread provided for the purpose in the lower part of the valve E. A washer and screw-head to the valve-spindle prevent any leakage of the air. The valve-spindle F projects downward into the cylinder B through a slot A⁵, provided for the purpose in the body of the machine A, as shown more particularly in Figs. V, VII, VIII, and XI, and is actuated by the movement of the piston C.

The piston C is provided with spring-rings in the ordinary way formed in the heads C′ C², the body of the piston C between the heads C′ C² being recessed in order to allow room for the valve-spindle F. The compressed air entering the valve E, as before described, through either of the channels A³ A⁴ flows through the valve-opening E², (if that is then open,) through the port D into the rear end of the cylinder B, driving forward the piston C until the head C′ has passed the exhaust B′, from which the air then escapes. At the same time the piston-head C′, pressing against the valve-spindle F, causes the valve E to partially rotate, shutting the port D and opening the port D′ by bringing the valve-opening E³ opposite to it. The compressed air then flows in the front end of the cylinder B, and by its pressure upon the head C² drives the piston back until the exhaust B² has been opened, allowing the air to again escape. Meanwhile the head C², similarly engaging the valve-spindle F, again causes the valve to partially rotate, closing the port D′ and again opening the port D, and so on alternately driving the piston backward and forward. To the piston C is attached the piston-rod, to which the drill is fixed.

We find in practice that in order to secure good despatch with the return stroke of the piston C and to economize air one and thirteen-sixteenths inches is a very suitable diameter for the piston-rod, but do not bind ourselves to any dimensions.

The head C′ of the piston C is constructed with internal rifling corresponding with similar grooves formed in the rifle-bar H, Fig. III, by means of which a rotatory motion is imparted to the drill on the back stroke in the usual manner. Upon the head of the rifle-bar H is fixed a ratchet H′, provided with pawls H² for holding the ratchet in position during the back stroke of the piston G, while allowing it to slide forward during the forward stroke of the piston C. This, however, is of usual construction for such purpose and forms no part of our invention.

In practice, owing to the action of the piston-heads C C′, the interior of cylinder B becomes worn, allowing the air to leak past the piston-heads, and thus causing loss of power and interfering with the efficiency of the drill. In the drills at present in use the whole cylinder when worn has to be replaced. To obviate this, we on occasion construct the cylinder of our improved drill with a removable internal lining I, as shown more particularly in Figs. X, XI, XII, XIII, and XIV. This removable lining I is provided with an opening I′, through which the valve-spindle passes, with holes corresponding with the exhaust B′ B², and with openings I² I³, corresponding with the outlet ends of the ports D D′. As the internal face of the lining I becomes worn by the action of the cylinder-heads a fresh lining can be easily fixed in its place and the efficiency of the drill thoroughly restored at small expense.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a rock-drill, the combination with a working cylinder provided with a cylindrical valve-chamber and passages leading from said valve-chamber to opposite ends of the working cylinder, of a hollow cylindrical valve working in said valve-chamber, said valve being provided with ports which regis-

ter with the aforesaid passages, a fluid-supply opening leading into one end of the hollow valve, a double-headed piston in the working cylinder, and a spindle fixed to the hollow valve and depending into the working cylinder between the two piston-heads so as to be alternately acted upon by said heads, substantially as described.

2. In a drill or similar machine, the combination with a working cylinder provided with a cylindrical valve-chamber and passages leading from said valve-chamber to opposite ends of the working cylinder, an opening in the top of the said chamber, and a screw-cap for said opening, of a hollow cylindrical valve working in said valve-chamber, said valve being provided with ports which register with the aforesaid passages, and provided also with an opening A^7, in its top, a spindle F, tapped through an opening E^4, in the lower wall of the valve, a fluid-supply opening leading into one end of the hollow valve, and a piston in the working cylinder, said piston being arranged to operate the valve-spindle, substantially as described.

3. In a rock-drill, the combination with a cylindrical valve-chamber formed in the body of the machine and provided with oppositely-disposed side openings A^3, A^4, and a cap A^6, adapted to close either of said openings, of a hollow cylindrical valve having open ends registering with said side openings in the valve-chamber and provided also with passages which have communication with opposite ends of the working cylinder, a piston in the working cylinder, and a connection between said valve and piston, for the purpose specified.

4. In a rock-drill or similar machine, the combination with a working cylinder provided with a cylindrical valve-chamber and passages leading from said valve-chamber to opposite ends of the working cylinder, of a hollow cylindrical valve working in said chamber and provided with ports which register with the aforesaid passages, a fluid-supply opening leading into the hollow valve, a piston in the working cylinder, and exhaust-openings in the cylinder so disposed that the working fluid exhausts at either end of the stroke of the piston, substantially as described.

5. In a rock-drill or the like, the combination with a working cylinder provided with a cylindrical valve-chamber and passages leading from said valve-chamber to opposite ends of the working cylinder, of a hollow cylindrical valve working in said chamber, said valve being provided with ports which register with the aforesaid passages, a valve-operating spindle tapped into the hollow valve and depending into the working cylinder, a removable lining for the working cylinder, said lining being provided with openings I^2 I^3, at its opposite ends which register with the passages leading from the valve-chamber, and provided also with a slot I′, for the valve-spindle, and a piston in the working cylinder, said piston being arranged to engage and operate the valve-spindle, substantially as described.

In witness whereof we have hereunto set our hands in presence of two witnesses.

HENRY RICHARD HANCOCK.
HENRY LIPSON HANCOCK.
LEIGH GEORGE HANCOCK.

Witnesses:
ANNIE TAYLOR UFFINDELL,
KATIE WINIFRED LOUISA POTTS.