(No Model.) 3 Sheets—Sheet 1.

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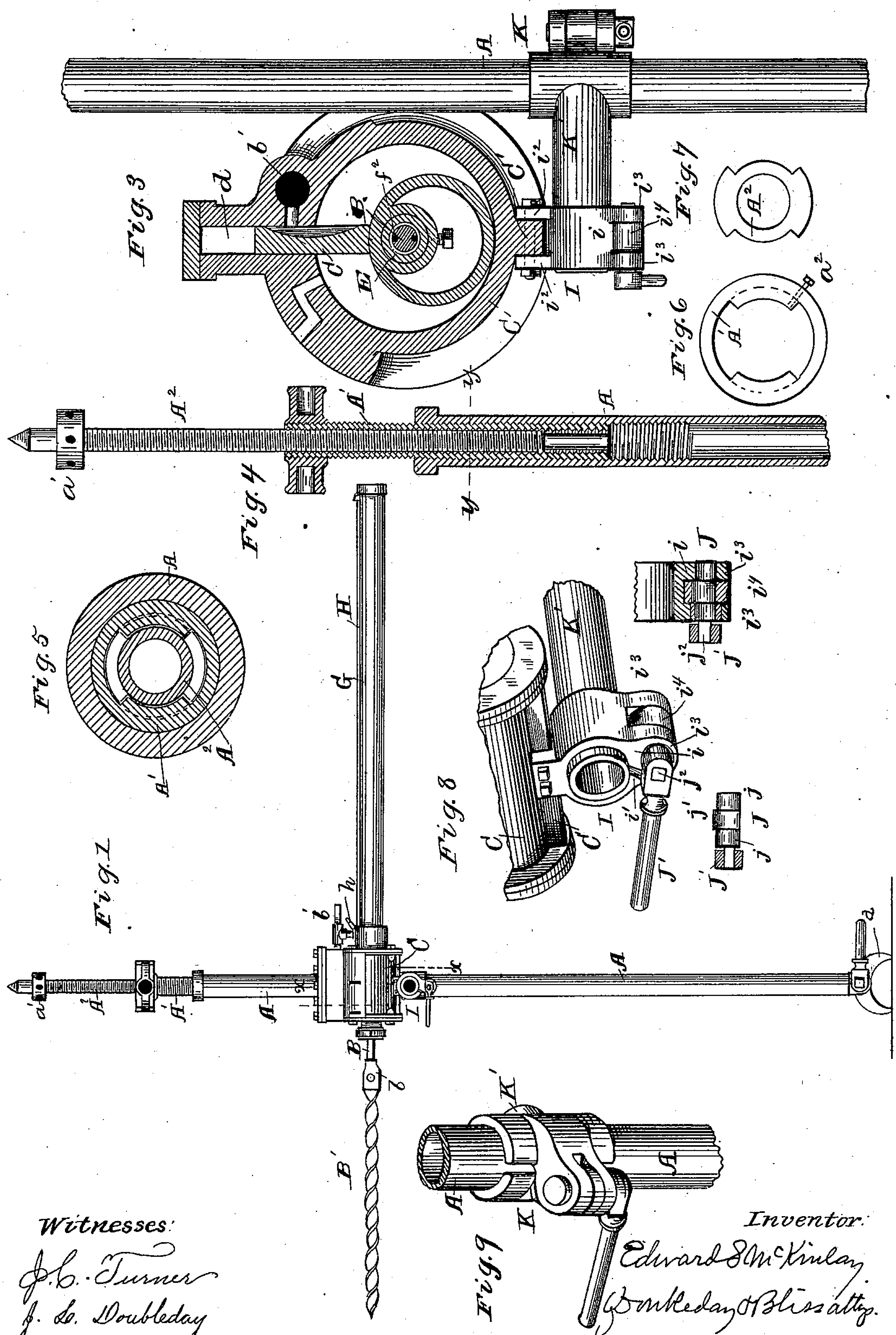
ROCK OR COAL DRILL.

No. 551,139. Patented Dec. 10, 1895.



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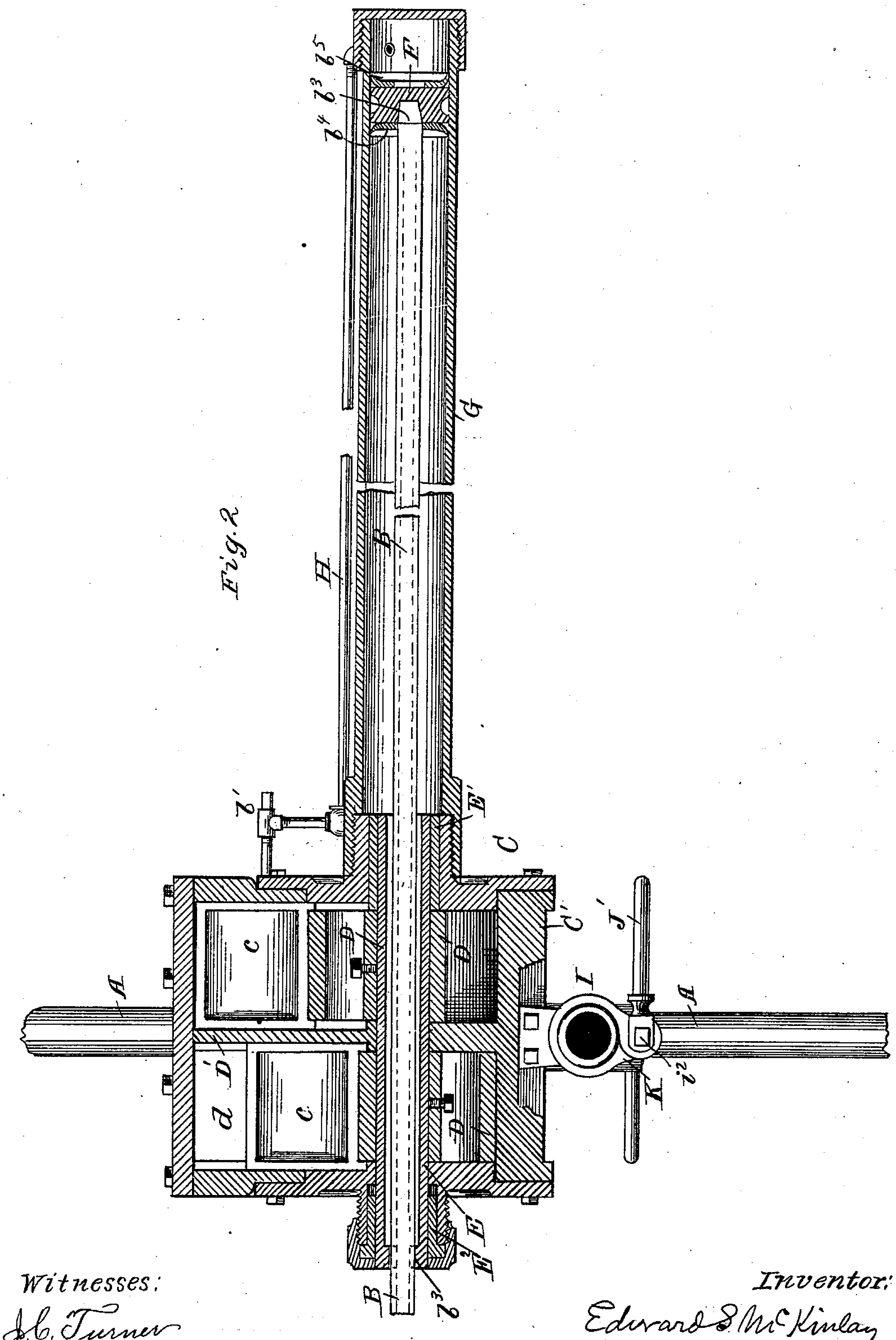

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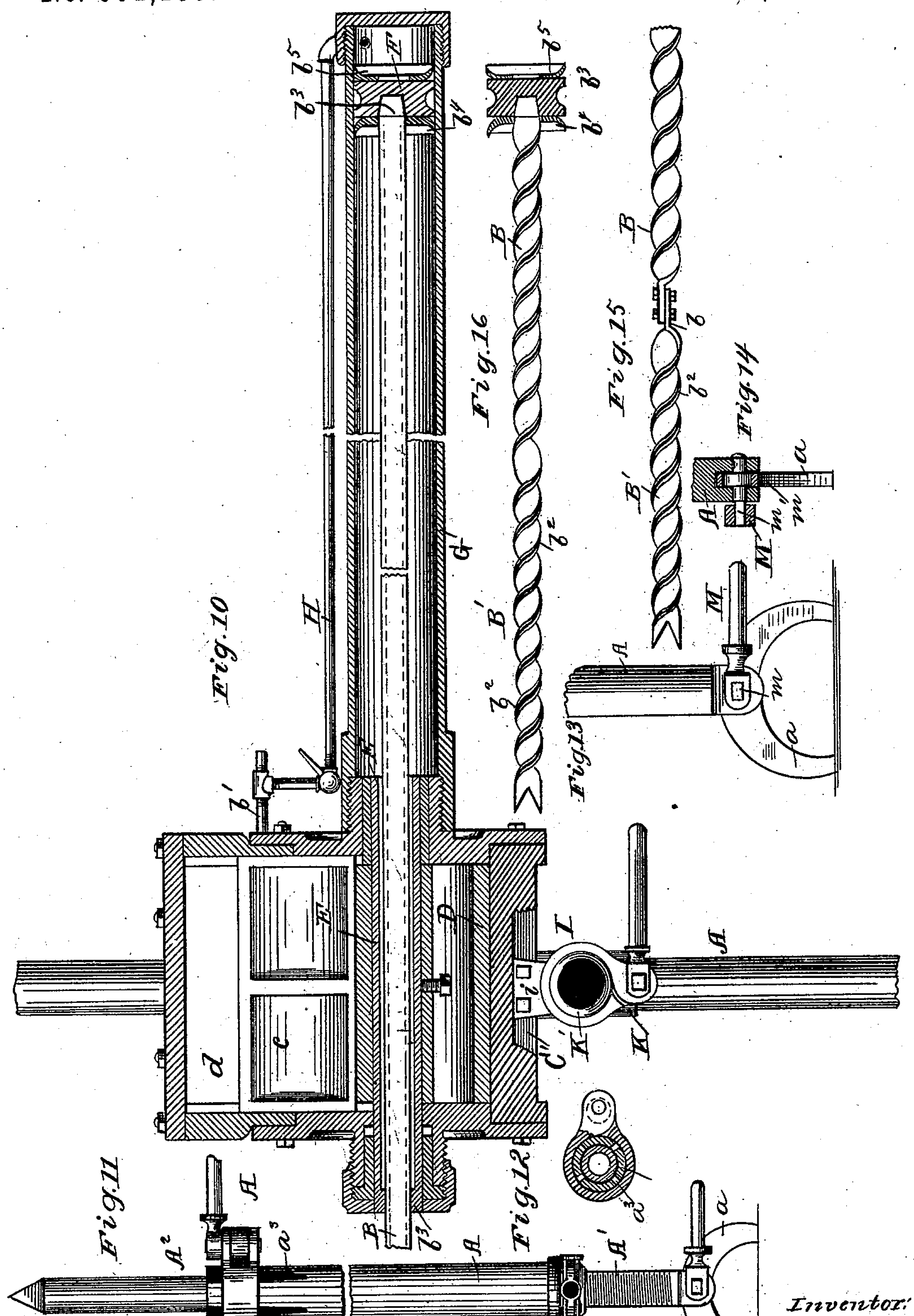

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UNITED STATES PATENT OFFICE.

EDWARD S. McKINLAY, OF DENVER, COLORADO.

ROCK OR COAL DRILL.

SPECIFICATION forming part of Letters Patent No. 551,139, dated December 10, 1895.

Application filed April 7, 1887. Serial No. 234,057. (No model.)

To all whom it may concern:

Be it known that I, EDWARD S. MCKINLAY, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Rock or Coal Drills, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a side view of my improved drill when mounted. Fig. 2 is a longitudinal section. Fig. 3 is a transverse section on line *x x*, Figs. 1 and 2. Fig. 4 is a vertical section of the fastening device for the column. Fig. 5 is a cross-section on line *y y*, Fig. 4. Fig. 6 is a cross-section or end view of one of the tubes of the column. Fig. 7 is a corresponding view of the part which fits into that shown in Fig. 6. Fig. 8 is a perspective of the devices for clamping the cylinder in place. Fig. 9 is a perspective of the devices for clamping to the column. Fig. 10 is a longitudinal section of devices similar to those in Fig. 2, except that there is but one engine-cylinder. Fig. 11 is a side view of the column slightly modified in construction. Fig. 12 is a cross-section through the column and clamp in Fig. 11. Fig. 13 shows the foot or bottom part of the clamp in Fig. 1 on a larger scale. Fig. 14 is a partial section of that in Fig. 13. Figs. 15 and 16 show modified forms of the drill and drill-stem.

In the drawings, A represents the column on which the operative parts are supported. In respect to many of the features of the present invention this column may be of any ordinary or of any approved construction. The one shown has some features of advantage in comparison with those heretofore used. The part A is tubular and at the bottom rests upon legs *a* or upon an expanded base. At the upper end it is fitted to the fastening devices.

A′ is a tube threaded on the outside and adapted to engage with threads on the inside of column.

A^2 is a third tube or a rod which fits into the tube A′ and engages therewith. In order to allow the part A^2 to be moved rapidly longitudinally while inside of the part A′, I cut away sections of the threads on the outside of the former and corresponding sections of those on the inside of the latter—that is to say, I cut away one-quarter of each thread on each side and a quarter diametrically opposite. By turning the part A^2 one-quarter way around its threads are disengaged from those in the tube A′, and it can be moved up or down rapidly, and I thus avoid the delay incident to using those devices in which complete threads are used, requiring a large number of revolutions of one of the parts to attain very considerable longitudinal movement of the parts. After the column is set in the desired position the part A^2 is thus slipped up till it strikes the roof, and a quarter-turn is then given to it to cause its sectional threads to engage with those in tube A′. Stops, as at a^2, are provided, which prevent it from making more than a quarter-turn. After it is thus fastened in the part A′ the latter is turned by means of a wrench and its exterior threads to effect a powerful longitudinal pressure to clamp the column in place. This rapid longitudinal movement of one part of the fastening device can be attained by modified means. Thus in Fig. 11 the upper end of the column is shown as being split into several sections by means of slots a^3. The part A^2 fits into this end and by means of a clamp at A^3 they are rigidly fastened together. At the bottom a threaded section A′ is shown, which can be used to attain the necessary pressure; but if an additional final pressure is necessary it can be readily attained by devices such as shown in Figs. 13 and 14, they being a cam-pintle *m*, to which is fitted a handle M, whereby it can be turned so as to force the column A upward and the foot-piece *a* downward with great power.

The bit or drill proper is represented by B′, it being secured to a rod or stem B by a socket piece or clamp, as *b*. The rod or stem B may be cylindrical, as in Figs. 2 and 10, or may be spiral, as in Figs. 15 and 16, or again the drill can be made in one piece with a spiral stem, as is below described. The stem part extends backward through the engine. The latter is one of the rotary class and may be of any preferred form adapted to carry out my purposes. I prefer, however, to employ an engine with the improvements which I have devised and herein show. The drill passes directly through the engine, the latter comprising two rotary pistons D D, mounted in such way relatively to the shaft as to overcome the difficulties incident to the fact that power is applied with variable efficiency when but a single piston is used. They may be placed diametrically opposite to each other. Each has a sliding valve or abutment c c, mounted in a valve box or chamber d, and each operating with respect to its piston and piston-cylinder in a way which will be readily understood. Each valve-chamber is supplied with steam or air from a duct at b'.

In Fig. 10 a construction is shown in which but a single piston is employed.

D', Fig. 2, represents the partition or wall between the valves and the valve-chambers, so that one part of the engine can be independent of the other.

In either construction the piston is mounted on and secured to a hollow shaft E. This is mounted in bearings at E' E^2 in the walls of the engine. The stem B passes loosely through the tube E, the latter having one or more feathers b^3 fitting in grooves f^2 in the stem. The drill-stem and drill are thus caused to rotate directly with the piston without the intervention of gearing; but, so far as concerns some of the features of the invention, gearing may be employed.

The drill-stem has a piston F at the rear end, which is fitted in a tube G, bolted to the engine. The piston is united to the stem by a loose connection, so that the latter can revolve independently of the former, and I prefer to interpose antifriction devices between them, so that there shall be no cramping or binding.

One form of antifriction-bearing is shown in the drawings, it being provided by a conical end piece b^3 on the stem B, the latter fitting into a corresponding socket on the piston F. The piston-head may be provided with packings of any suitable character, as shown at b^4 b^5.

H is a pipe communicating with the tube G at its outer end and also with inlet b'. By means of a valve at h the operator can introduce steam or air to the tube G behind the piston F, and the pressure thereof effects the forward feed of the drill.

In Fig. 16 I have shown a stem having spiral blades, the grooves b^2 being formed in the edges. When the stem is of this character, it acts as a conveyer for drawing the cuttings out from the drilled aperture, and hence the total length of the drill and the drill-stem need not be so great as it is when the stem is so constructed as not to enter the said aperture, and the whole mechanism can be placed nearer to the material. The stem may be made integral with the drill proper—that is to say, the latter may be extended back to form a stem portion, as is shown in Fig. 16.

The cylinder C is on one side formed or provided with an outwardly-extending projection by which the cylinder and drill are connected to and supported on the column, the support being constructed as follows:

I represents, generally, a clamp. It is of the nature of a ring divided at one point, and adapted to have the ends at the place of division moved more or less toward and from each other. i i' represent these movable ends, and i^2 i^2 ears for bolting the clamp to the cylinder C. The end i' has an ear i^4, and the end i has ears i^3 i^3, these ears being provided with apertures or seats for cams. These cams are formed upon a pivot or bolt indicated by J, the portions at j j being fitted in the ears i^3 and the part at j' in the ear i^4. By means of a handle J', adapted to fit the squared end j^2, the cam-pivot can be so rocked as to force the ends i i' of the clamping-ring inward. I provide the apertures in the ears i^3 i^4 with bushings, not only to receive the wearing action, but also to readily permit the cam-pintles to be inserted or withdrawn. This clamp is fitted to another, the latter being detachably and adjustably connected to the column A. The clamp K is formed with a horizontally-projecting boss K', upon which the aforesaid ring I is adapted to fit. The part K of the vertical clamp which surrounds the column is, as concerns the clamping devices proper, constructed in a manner similar to that in which is made the clamp I—that is to say, the ring is split and its ends are formed with cam seats or bearings, in which is fitted a cam-pintle, adapted to be rocked by a wrench in such way as to force the ends of the ring tightly against the column, or vice versa release it quickly therefrom.

Clamps of the character I have described are much superior to those depending upon bolts or screw-threads for their efficiency, inasmuch as they can be instantly gripped tightly at the desired place and as rapidly released from the engaging part.

It will be understood that there can be a modification of details of construction which I have shown and described without departing from the invention, and it will be seen that some of the devices which I employ can be omitted, or others can be substituted in place thereof. To attain some of the ends at which I aim, a vertical support can be used differing from the column A, other forms of clamp can be used, and engines or power devices of other details of construction.

I am aware that drilling mechanisms have been used in which the drill and drill-stem have been advanced by the pressure of air, steam, or water; but I believe myself to be the first to have arranged the essential parts constituting my improved mechanism in the way shown, by which arrangement and construction I attain several important advantages. The devices which connect the engine to the vertical support A are situated on lines between the ends of the engine, or in the transverse planes thereof, so that the latter can be carried firmly and the power can be economically applied to the drill, and the column and engine can be placed in close proximity to the material to be operated on. I dispense with gearing, and drive the drill directly from the piston of the rotary engine, thereby avoiding the loss by friction, &c., incident to the gearing which has been heretofore interposed between the piston and the drill-stem.

The feed tube or cylinder G is behind the engine, and the space in front is left free, so that the whole mechanism can be advanced close to the work, as described.

I am also aware of the fact that it is not broadly novel to arrange a drill-stem, a rotary engine, and a feed-cylinder all concentric with each other. Machines of two sorts with such an arrangement of parts have been known. In one case all of the said parts were secured rigidly to a car or carriage, and lacked entirely the universal adjustment which I provide by means of the vertical column and the several adjustable connecting devices. In the other class each machine had a more or less complicated feed mechanism comprising numerous parts, because in each case the rotary engine (although concentric with the drill-stem and with the feed-tube) was at the rear end of the tube and, as a result, the latter had to have an annular pressure-chamber and an annular piston connected by two or more rods to the drill-stem, said rods having a cross-head transverse to the drill-stem on a line immediately behind the bit-socket. It is impossible to pass the stem of a drill of that sort into the aperture formed by the bit because of the interference of the cross-head. In my case I can provide not only for passing the stem or feed piston-rod into the aperture, but also for utilizing it for withdrawing the cuttings. (See Figs. 15 and 16.) Again in the earlier drill referred to the adjustable parts as a whole were much more difficult to balance, because of the placing of the rotary engine at the rear end of the feed-tube considerably remote from the plane of support. In the present construction the column is situated in the vertical planes of the engine, as above described, and when the feed-tube is in place behind the engine and the drill in front all of the parts are practically balanced. The column, though portable, is adapted to be fastened in any of the ordinary rooms or entries of a coal-mine, because of the above described wall-engaging devices secured to the upper and the lower end thereof, and the drill-rod or feed-rod is not only bodily adjustable up and down on the column, but is adjustable universally, substantially in relation thereto—that is to say, it can be tipped, rocked, or vibrated vertically around the horizontal bar K′—so that it can be directed at any angle to the horizon, and by means of the hinge-like connection at K it can be rocked or vibrated in horizontal planes, and, too, this universal adjustment can be accomplished when the engine and column are close to the coal, as above stated, the feed-cylinder G and piston F being behind the engine and all gearing being dispensed with.

Gearing for reducing the speed of the rotary engine has been found necessary in those machines in which the feed-rods are threaded and engage with feed-nuts, because the feed is positive and unyielding. The speed is fixed when the machine is made, and it must be put so low that the hardest substances met with can be safely attacked without danger of breaking the drill from a too rapid advance, and such slow speed is a disadvantage when softer material is being drilled, as it is economical and desirable to advance as rapidly as possible. This can be accomplished by employing the yielding or elastic feed furnished by the air-cylinder and the piston therein, and when I arrange these behind the engine and concentrically with the rotary piston, so that the feed-rod or drill-stem can pass directly through the tubular piston-journal or piston-support, I can dispense with the gearing, and when a harder material is being attacked the speed will be automatically reduced because of the greater backward pressure; but when a soft material is being drilled the speed will be automatically raised again and the operation will be more rapid. Experience has shown me that, on the average, cuts can be made by a drill of this sort much more rapidly than when a positive feeding device is used, in connection with which a slowing-down gearing is practically necessary.

I do not herein claim the combination, with the rotary engine, of the drill-spindle supported below the engine and the feed-cylinder, also below the engine, and secured to the drill-support behind the drill.

What I claim is—

1. In a coal drilling mechanism, the combination of the rotary engine, the rotating drill, the drill feeding mechanism the vertical column, the horizontal bar or arm K′ secured to said column, the friction ring-like clamp I rigidly secured to the rotary engine and surrounding said horizontal bar K′, the pivot or bolt J provided with one or more cams for moving the ends of the clamp I toward and from each other, and the lever or handle secured to the pivot J, substantially as set forth.

2. In a coal or rock drilling mechanism, the combination of the drill the rotary engine, the vertically supporting column, the horizontal boss or arm K′, the clamp I having the eyes i^3 i^3 and the intermediate eye i^4, and the cam pintle having the end part j j, and the intermediate part j, eccentric to the part j, substantially as set forth.

3. In a drilling machine a supporting column having the main or body part A, a longitudinally sliding rod or tube, means for clamping the latter with the main or body part, a threaded rod or tube adapted to move longitudinally relatively to the column, when

rotated, a foot piece, and a cam interposed between the foot piece and the column, substantially as set forth.

4. In a drilling mechanism a supporting column having a head and foot piece a cam interposed between the said head and foot piece adapted to force them apart and screw-threaded connecting devices between the head and foot piece supplemental to the cam and also adapted to force them apart, substantially as set forth.

5. In a drilling mechanism a supporting column having a threaded section A with portions of the threads removed, a second corresponding section A' with corresponding portions of its threads removed, whereby the two sections can be moved longitudinally relatively to each other without rotation, the head, and the foot piece, and means substantially as set forth supplemental to the said cut threads for forcing the head and foot pieces apart, as set forth.

6. In a drilling mechanism a supporting column having a top-or head piece A^2 adapted to slide longitudinally relatively to the main or body part of the column, a screw-threaded section A', a foot piece *a*, and a cam interposed between the foot piece and the column, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD S. McKINLAY.

Witnesses:
S. B. McCormick,
F. C. Cover.