(No Model.) 2 Sheets—Sheet 1.

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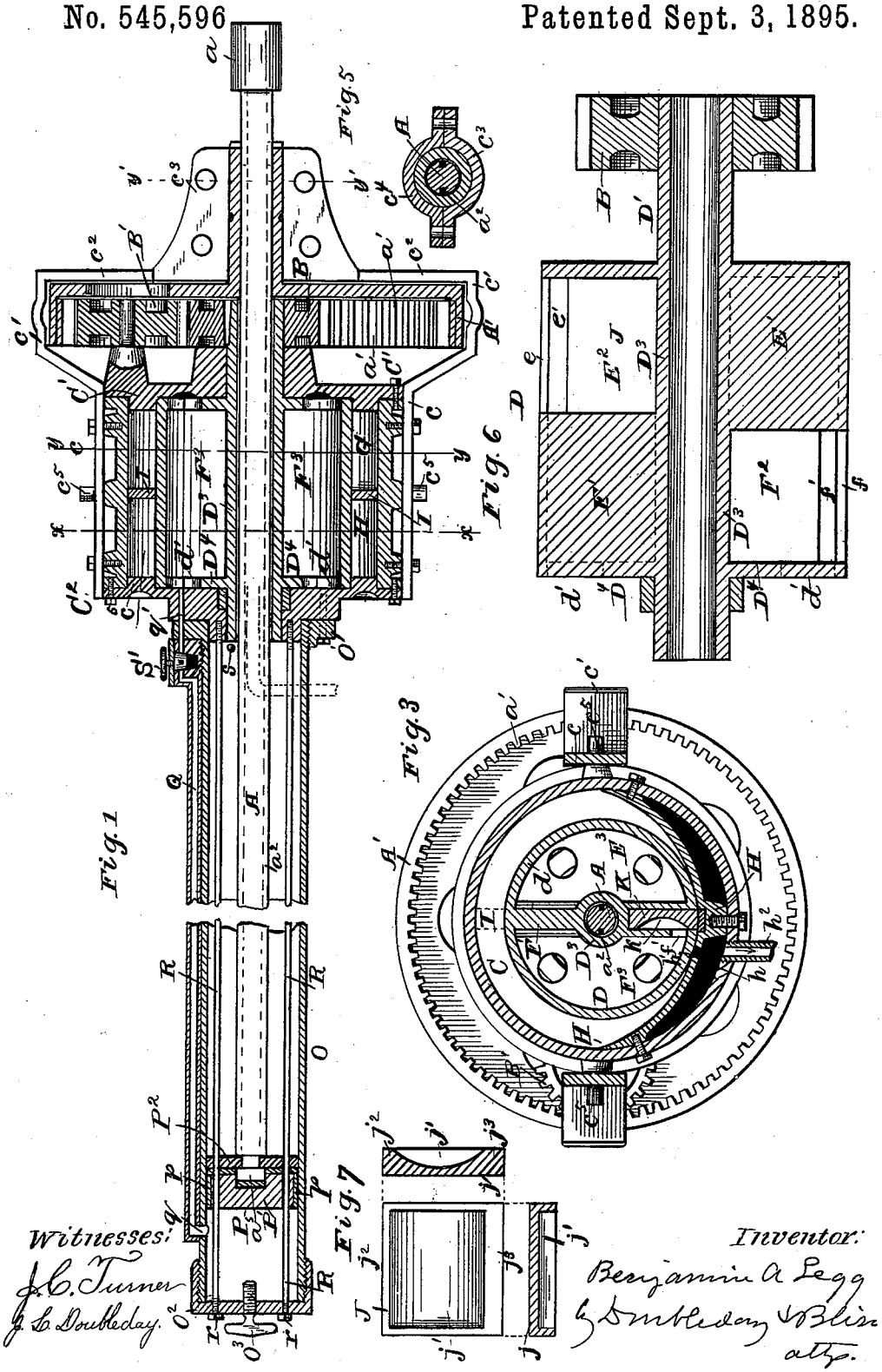
COAL OR ROCK DRILL.

No. 545,596 Patented Sept. 3, 1895.



Witnesses:
J. C. Turner
J. L. Doubleday.

Inventor:
Benjamin A. Legg
by Doubleday & Bliss
atty.

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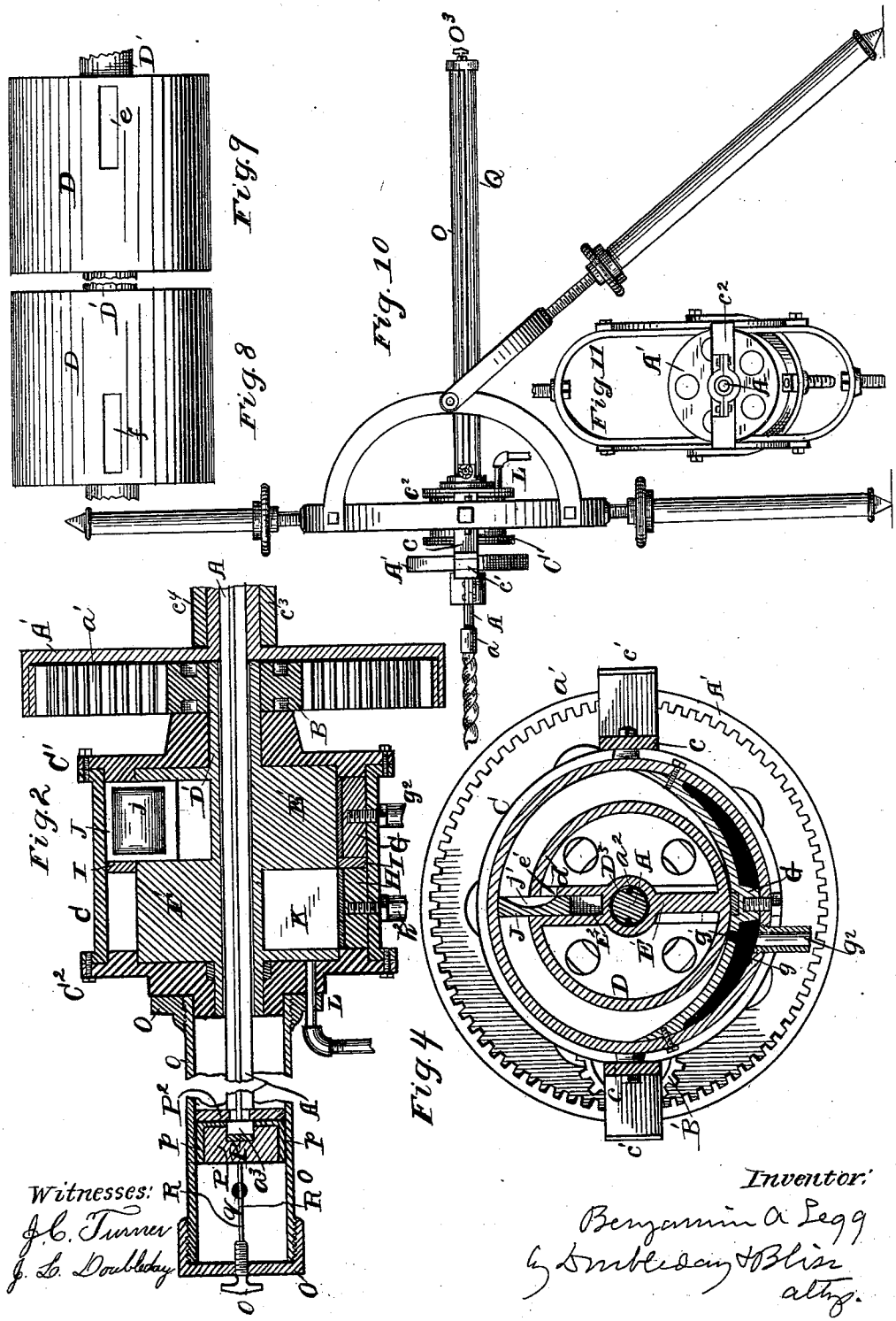

UNITED STATES PATENT OFFICE.

BENJAMIN A. LEGG, OF COLUMBUS, OHIO, ASSIGNOR TO THE LECHNER MANUFACTURING COMPANY, OF SAME PLACE.

COAL OR ROCK DRILL.

SPECIFICATION forming part of Letters Patent No. 545,596, dated September 3, 1895.

Application filed December 8, 1886. Serial No. 221,014. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN A. LEGG, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Coal and Rock Drills, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an improved mechanism for imparting rotary motion to drills, more particularly drills of the class used in working upon coal, rock, &c.

It relates also to improved devices for feeding and withdrawing the drill during or after the operation of boring.

I have shown in the drawings a mechanism embodying my improvements; but it will be understood that in numerous respects there can be variation from the construction shown without departing from the essential features of the invention.

Figure 1 is a longitudinal section of a mechanism embodying my improvements. Fig. 2 is a longitudinal section at right angles to that in Fig. 1. Fig. 3 is a cross-section on the line *x x*, Fig. 1, on an enlarged scale. Fig. 4 is a cross-section on the line *y y*, Fig. 1. Figs. 5, 6, and 7 show some of the details. Fig. 8 is a face view of the piston detached. Fig. 9 is a face view of the same from the opposite side. Fig. 10 is a side view of an entire apparatus embodying my invention. Fig. 11 is a face view from the front of the apparatus in Fig. 10, some of the details at the top and bottom being omitted.

In the drawings, A represents the shaft or rod, which is detachably connected with the drill, and which receives the power from the driving mechanism. It is provided at the forward end with a socket at *a* for attachment to the drill. It is also formed with one or more longitudinal sections a^2, by which it is feathered to the parts giving it rotation.

A′ represents the main wheel or master-wheel, it being connected to the shaft A by a feather. In the construction shown it has an internal gear *a′*, to which power is transmitted by a pinion B′, rotated by the prime pinion B.

The engine from which the power is received is mounted in or upon a suitable framework, and it consists of a stationary cylinder wherein is mounted a rotary piston. The cylinder is represented generally by C, it having heads C′ C^2. To the outside of the cylinder are secured strap-pieces *c c′* c^2, which extend around the master-wheel A′, and are formed with or rigidly secured to a boxing having the lower part c^3 and the cap c^4, there preferably being a bushing at c^6. These strap-pieces can be provided with the trunnions c^5, as shown, upon which the engine and the drill are mounted, so as to be turned into any desired position.

Within the cylinder C there are secured two abutments G and H, between which there is an annular diaphragm I. These abutments G and H are situated in the same position relatively to the axis of the cylinder—that is, the corresponding parts of the abutments lie in the same longitudinal radial planes. Preferably each abutment is long enough to have its ends situated diametrically opposite to each other. The abutment G is formed with a chamber *g*, to which the exhaust-steam first passes through aperture *g′*. The abutment H is provided with a similar chamber *h* and ports *h′*. With the chambers *g* and *h* communicate exhaust-ducts g^2 and h^2.

The piston consists of a cylinder, generally represented by D. It is formed with a cylindrical wall *d*, the outer surface of which is continuous except where it is provided with apertures *e* and *f* to receive the sliding valves J and K. In the interior of this cylindrical piston there are two chambers, separated from each other by a partition. In this partition are formed two chambers E^2 and F^2, they being diametrically opposite to each other, and one formed at one end of the piston and the other at the other end, that at E^2 extending inward from the aperture *e*, and that at F^2 extending inward from the aperture *f*. Diametrically opposite to the chamber F^2 the partition is closed, as shown at F′, and diametrically opposite the chamber E^2 it is also closed, as shown at E′. Through the whole piston there is a tubular chamber or passage for the shaft A—that is, the shaft is continuously surrounded by metal, as shown at D^3. The metal of the piston is extended to form, or to

it is attached, a sleeve D′, which is mounted in the head C′ of the cylinder. To the outer or forward end of this sleeve D′ the prime pinion B is keyed, and therefore, when the piston is rotating relatively to the cylinder, the said pinion B, through the pinion B′, imparts rotation to the master-wheel A′ and shaft A. It will be seen that the above-described separate chambers (which are indicated generally by E^3 F^3 in the piston, respectively,) communicate with the valve-chambers E^2 F^2 through ports e' f'.

The valve J consists of a block fitted snugly in the chamber E^2. Upon the side j it is flat, but upon the other side it is formed with a cavity j', extending somewhat nearer to the edge j^2 than to the edge j^3. The valve K is constructed similarly to that shown at J.

The valve J and chamber E^2 are so situated as to revolve over the abutment G, so that intermittingly the port e registers with the ports g', whereas the valve K and the chamber F^2 revolve in the planes of the abutment H so that the port f intermittingly registers, with the ports h'.

The piston is formed with webs D^4, having apertures d', these apertures being as much elongated as is practicable near the periphery of the piston.

The inlet-port is shown at L, through which the steam or air passes through the head C^2, and into the interior of the piston D through the apertures d', it being received alternately into the main piston-chambers E^3 F^3.

The outer or rear end of the piston (the end having the inlet-apertures d') is fitted tightly against the head-plate C^2 of the stationary cylinder, the latter having preferably an inwardly-projecting annulus, as at c^6, surrounding the extreme portion of the said end of the piston, and the opposite head C′, having a corresponding inwardly-projecting annulus. It will be noticed that the distance from outside to outside between the ends of the piston is somewhat greater than the corresponding distance from the end of one abutment G to the end of the other H, the difference being equal to the thicknesses of the last-said annular inward projections of the heads of the cylinder. If air or steam or other motive agent be admitted at L, it will enter alternately the chambers E^3 F^3, and from these passes through the ports e' f' into the chambers E^2 F^2 and into the cavities j' k' of the valves J K and tends to force the said valves outward against the wall of the cylinder, so that the outer parts of the cavities j' k' alternately communicate with the cylinder-chamber around the piston, and when out far enough the live steam or air enters said cylinder-chamber behind the valves and imparts rotary motion to them and the pistons. The rotation continues until the valves, respectively, come in contact with the abutments G and H, and by which they are gradually pushed in until the parts at j^2 k close the steam or air inlets, which closing continues until the valves have passed the exhaust-ports at g' h', through which exhaust-steam escapes to the pipes g^2 h^2, as above described.

It will be seen that by reason of the presence of the annular partition I there are two steam or air chambers in the cylinder around the piston, one arranged to receive the valve J and the other the valve K, and as the valves are diametrically opposite to each other they take the steam or air in such way as to have the power applied substantially uniformly during the complete rotation, and this is accomplished from virtually a single feed-duct, for, although the piston-chamber is divided into two parts, the inlet communicates when in operation with these substantially continuously.

In order to move the shaft A longitudinally while the drill is rotating I combine with the parts above described means for applying air or steam in such way that its pressure can be utilized to effect such longitudinal movement. In the construction which I have selected for illustrating this part of my invention the tube O is employed, arranged around and concentrically with the shaft A. At one end it is bolted to the stationary cylinder-head C^2 by means of a flange or plate O′, formed on or secured to the tube, and at the other end it is closed air-tight or steam-tight by a cap O^2. The outer or rear end of the shaft A is provided with a piston, generally indicated by P. As shown, it consists of a metal head P′, having a packing p surrounding the periphery of the head, this packing being secured in place by a bolted annulus P^2.

The shaft A is provided with a head a^3, lying between the annulus P^2 and the part P′.

In order to prevent the piston from rotating and yet allowing it to freely slide longitudinally I employ guides R R, engaging with it. Preferably these guides are of the form of rods, which, as shown, are at one end screwed into sockets in the head-plate C^2 of the engine-cylinder, and are at the other end passed through the cap-piece O^2 and are secured by nuts r r. With a piston thus loosely connected with the shaft and held by guides the shaft can be readily moved longitudinally, although it may be at the same time rotated by means of other mechanism.

Q represents a duct for air or steam, communicating with the main steam duct or chamber which supplies the engine or with the steam-chamber in the engine-cylinder, and adapted to convey the steam or air to a point near the outer end of the tube O. At said point it communicates with an inlet-port q, through which steam or air can enter behind the piston P. Thus a forward pressure can be readily brought to bear upon the shaft, as will be clearly understood.

As shown, q' is the port by which the steam or air is taken into the duct Q. At some suitable point, preferably near the engine, a stop-cock is applied, it being adapted to regulate the direction or passage of the motive

agent. The return movement of the piston may be caused in a similar way—that is to say, by the pressure of steam or air upon the forward side of the piston—the motive agent to be admitted in substantially the same way as that described, or where it is not desirable to employ power of this character for this purpose it may be forced back by other means.

In the end of the tube O there is an opening closed by a detachable screw O^3 or equivalent means, through which aperture may be withdrawn any water of condensation that may form in the tube when steam is employed, or a lubricant may be admitted.

I do not herein claim the features incident to the engine which I have shown, limiting myself in this case to the novel matters involving the drilling apparatus adapted for working rock and coal, and for other analogous purposes.

I have December 9, 1886, filed another application—to wit, Serial No. 221,140—for rotary engines, with the intention of claiming therein the novel features of the engine, whether applied to uses of the sort now particularly referred to herein or to others in which a power mechanism of that sort is advantageous.

I am aware that use has been heretofore made or proposed of rock-drills each comprising a rotary engine, a drill-shaft, and a cylinder and piston for advancing the drill-shaft by their pressure while the engine is rotating it. In machines of one sort the drill-stem passed directly through the rotary piston of the engine, there being no gearing interposed for reducing speed, and I entirely disclaim as of my invention any combination of parts in a drilling mechanism comprising as elements of said combination the drilling-shaft and the rotary piston directly connected together without gearing. In the machines of the other earlier sort above referred to the drill-shaft and its feed-tube were arranged on an axis at right angles to the axis of the rotary engine and its piston, so that the power had to be transmitted to beveled wheels which were of equal dimensions, so as to avoid the reduction of speed, and this engine being rigidly secured, after the manner common in rock-drills, to a stiff vertical frame. I also disclaim such mechanisms, the operative parts in mine being mounted universally adjustably, and being so arranged relatively to each other that both compactness and the reduction of speed necessary in light portable coal-drills can be attained. Nor do I herein claim specifically any combination of parts in a drilling-machine comprising a driver or initial rotation producer other than the piston of an engine adapted to be operated by steam, water, air, or similar substances.

I am aware of the fact that at the date of this patent drilling-machines have been known or proposed comprising as substitutes for the rotary motor herein (to be actuated by air, steam, or the like material) engines to be actuated by different agents, such as electricity, said latter engines having parts which in construction and arrangement are more or less similar to and are equivalents of some of the parts of the rotary engine herein—as, for instance, the centrally-perforated piston, the tubular shaft upon which it revolves, and the drill-stem passing through such tubular shaft; and while I do not, as before said, make any specific claim to such other driving-engine I do not wish to limit the claims herein referring to a "rotary engine" or to a "rotary piston" to exactly the prime motor or to the driving agent herein referred to, although, as I have above set forth, I do not mean to include in any way machines which dispense with gearing between the piston and drill-shaft.

What I claim is—

1. In a drilling apparatus, the combination of the rotary drill shaft, the rotary engine having a rotary piston concentric with the drill shaft the driving wheel secured to the piston and the gear wheel driven thereby and connected to the drill shaft, substantially as set forth.

2. The combination of the rotary engine the piston thereof having a hollow axis or shaft, the gear wheel secured to said hollow shaft, the rotary drill shaft passing loosely through the said gear wheel, and means connecting the said gear wheel with the shaft, substantially as set forth.

3. The combination of the rotary engine, having its piston mounted on a hollow shaft formed with journals secured in bearings on the engine, the gear wheel secured to the said hollow shaft, the drill shaft situated loosely in the said hollow piston shaft, the wheel concentric with said gear wheel and engaging with the drill shaft and provided with a hollow shaft or journal, the bearing for the last said hollow shaft or journals secured to the stationary parts of the engine, substantially as described.

4. In a coal or rock drill the combination of the engine, the rotating engine shaft; the driving wheel actuated by the engine, the drill shaft parallel to the engine shaft, the driven wheel which actuates the drill shaft and has a hollow shaft or journal on that side of the wheel opposite to the engine and parallel to the engine shaft, a bearing for said hollow shaft or journal, a support for the said bearing secured to the engine, and a driving wheel for actuating the aforesaid driven wheel mounted on the axis thereof, substantially as described.

5. In a coal or rock drill the combination of the engine, the driving wheel rotated by the engine, the drill shaft, and the driven wheel connected to the drill shaft, said drill shaft, driving wheel and driven wheel being all mounted on the same axis, substantially as set forth.

6. In a coal or rock drill the combination of the drill shaft, the engine, the driving wheel connected to the engine and situated concentrically with the drill shaft, the driven wheel connected to the drill shaft, and the intermediate wheel between the driving and the driven wheels and supported upon the engine, substantially as described.

7. The combination of the drill shaft, the wheel engaging therewith, the feed tube and piston for advancing the drill shaft, the engine with rotary piston, said drill shaft, feed tube, driven wheel and rotary piston being all concentric, and the intermediate devices for transmitting power from the engine piston to the said driven wheel, substantially as described.

8. The combination of the drill shaft, the driven wheel engaging with the shaft, the rotary engine having its piston concentric with the said wheel, the stationary frame and the trunnions situated on a line above the bottom of the piston chamber and in the plane of the drill shaft, substantially as set forth.

9. In a drilling apparatus the combination with the rotating drill shaft, of a feed tube, a non-rotating piston therein and one or more guides stationary relatively to the drill shaft, and on lines eccentric to the drill shaft and engaging with the piston to prevent it from rotating substantially as set forth.

10. In a drilling apparatus the combination with a rotating drill shaft of the feed tube O, the piston therein and the rods R R passing directly through the piston, said rods being held stationary relatively to the drill shaft at the ends of the tube, substantially as described.

11. In a drilling apparatus, the combination with a rotary drill shaft, of a feed tube, the piston therein, and guides for said piston parallel to said drill shaft, and mounted stationarily in the ends of the feed tube, substantially as set forth.

12. In a drilling apparatus, the combination with a rotary drill shaft of the feed tube, a non-rotating piston therein, and guide rods mounted entirely within the feed tube, substantially as set forth.

13. In a drilling apparatus, the combination with a rotary drill shaft, of a feed tube, the non-rotating piston therein loosely connected to said shaft, guide rods passing through the piston, and a stop to limit the backward movement of the piston, substantially as set forth.

14. In a drilling apparatus, the combination with the drill shaft and the power devices for rotating said shaft, of the feed tube mounted directly behind the power device, the non-rotating piston loosely connected to the end of the drill shaft, and means stationary relatively to the feed cylinder engaging positively with said piston to prevent it from rotating, substantially as set forth.

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

BENJAMIN A. LEGG.

Witnesses:
A. T. THRALL,
T. M. LIVESAY.