

No. 675,490.

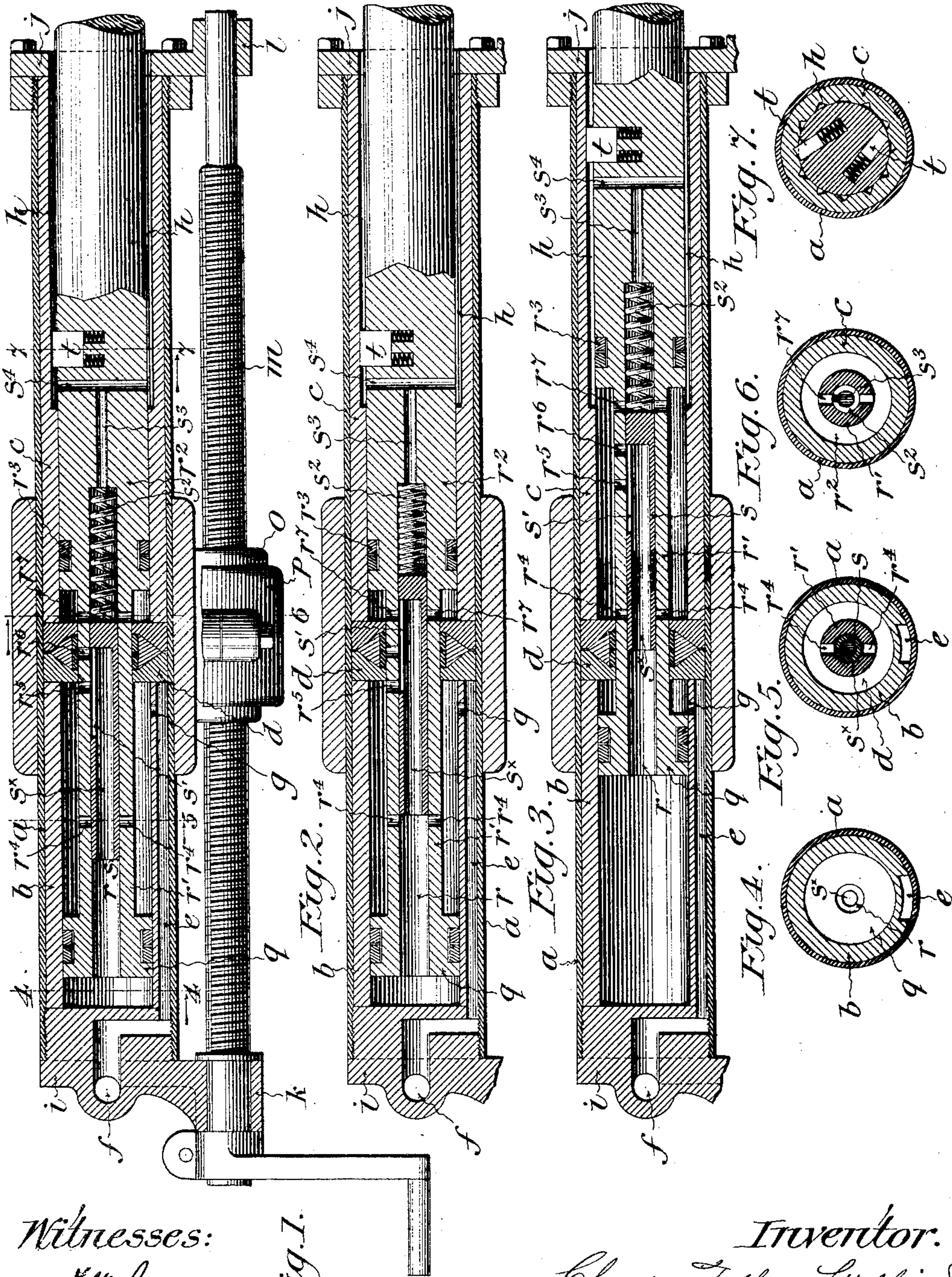
Patented June 4, 1901.

C. T. LITCHFIELD.

ROCK DRILL.

(Application filed Oct. 8, 1900.)

(No Model.)



Witnesses:
M. Long.
E. A. Pinard.

Fig. 1.

Inventor.
Charles Tiffany Litchfield
by W. H. Finckel
Att'y.

UNITED STATES PATENT OFFICE.

CHARLES TIFFANY LITCHFIELD, OF SPOKANE, WASHINGTON.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 675,490, dated June 4, 1901.

Application filed October 8, 1900. Serial No. 32,403. (No model.)

To all whom it may concern:

Be it known that I, CHARLES TIFFANY LITCHFIELD, a citizen of the United States, residing at Spokane, in the county of Spokane and State of Washington, have invented a certain new and useful Improvement in Rock-Drills, of which the following is a full, clear, and exact description.

This invention relates to the valve mechanism of rock-drills and other pneumatic or fluid-pressure tools or apparatus.

The object of the invention is to provide mechanism whereby not only the forward movement, but the return movement to complete the stroke, shall be effected by pressure automatically controlled.

In carrying out my invention I employ a reciprocating piston connected with a plunger, the two being separated by a diaphragm, which permanently divides the pressure-chamber in which the piston moves from that in which the plunger moves, and within the medium connecting the piston with the plunger I employ a valve by which the flow of the fluid or pressure agent is controlled and also by which the pressure is transferred from one side to the other of the piston to effect the forward and backward movements to complete the stroke.

I have illustrated my invention as applied to one form of rock-drill in which compressed air is used as the motive power; but I wish to be understood as not limiting my invention to rock-drills or other apparatus employing compressed air as the motive power.

With this explanation I will proceed now to describe my invention as applied to a rock-drill.

In the accompanying drawings, illustrating my invention, in the several figures of which like parts are similarly designated, Figure 1 is a longitudinal sectional elevation showing the parts in the position they will occupy at the end of the return movement. Fig. 2 is a similar view of only so much of the apparatus as is necessary to show the position of parts at the beginning of the forward movement. Fig. 3 is a view similar to Fig. 2, showing the parts at the end of the forward movement and in position to begin the return movement. Figs. 4, 5, 6, and 7 are cross-sections of the

cylinder, taken, respectively, in the planes of lines 4, 5, 6, and 7 of Fig. 1.

The cylinder *a* is provided with the internal liners *b* and *c*, which liners are separated by a diaphragm *d*, preferably composed of similar metallic shells having recessed adjacent faces, in which is arranged any suitable packing, such as an elastic or compressible outer member and a metallic inner member, in one or more sections. The liner *b* is provided with the longitudinal channel *e*, which communicates at one end with a supply-passage *f* for the introduction of compressed air, steam, or other equivalent motive agent, and this passage extends to the diaphragm and communicates with the interior of the liner by means of a port *g*. The liner *c* has spiral grooves or other exhaust-passages *h* in its inner surface. The ends of the cylinder are provided with heads *i* and *j*, which in the case of a rock-drill provide bearings *k* and *l* for the feed-screw *m*, which is arranged in a nut *o* of a supporting-bracket *p*, and the said feed-screw may be provided with any suitable means, such as a crank-handle, as shown, for rotating it. The chamber formed in the liner *b* between the head *i* and the diaphragm receives the piston *q*, and this piston has a longitudinal channel *r* extending through it and throughout the length of its rod *r'*, which is of less diameter than the piston-head, and this rod is connected with the plunger *r''*, which is arranged in the chamber in the liner *c* between the forward side of the diaphragm and the head *j* and made air or fluid tight therein by suitable packing, as at *r'''*.

The piston-rod is provided with the through ports *r⁴* near one end and with lateral ports *r⁵* *r⁶* and through-ports *r⁷* at or near the other end. Within this hollow piston-rod is arranged a valve *s*, having a longitudinal bore *s^x* extending from one end to near the other and at such closed end having a longitudinally-extended lateral port *s'*, of a length sufficient to uncover the ports *r⁵*, *r⁶*, and *r⁷*. The closed end of this valve projects into a chamber within the plunger *r''* and is backed up by a spring *s²* in said chamber, which normally tends to throw the valve to the left or rearward. The chamber in the plunger which contains the spring has a longitudinal chan-

nel s^3 , leading into a transverse channel s^4 , which communicates with the exhaust-passages h of the liner c . The plunger is provided with spring-pressed dogs t , which are adapted to engage the grooves h of the liner c in order to effect rotation of the piston and plunger whenever it is necessary or desirable—as, for example, in some kinds of rock-drills.

10 Supposing it be desired to start the mechanism at a time when the parts are in the position they will occupy at the completion of the back or return movement of the stroke, as shown in Fig. 1, the motor fluid is admitted
15 through inlet f , channel e , and port g into the space between the forward side of the piston-head and the rear side of the diaphragm and at the same time escapes through ports r^5 and s' and bore s^x and the channel r to the
20 rear of the piston-head on one side of the diaphragm. The pressure being now wholly to the left or rear of the diaphragm serves to move the valve s forward from the position Fig. 1 to the position Fig. 2, thus opening
25 ports r^4 and r^7 , thus admitting the pressure fluid through the hollow valve and ports r^5 and r^7 into the chamber on the other or forward side of the diaphragm, and since the superficial area of pressure-surface, comprising the rear face of the piston, the rear
30 end of the plunger, and the exposed surfaces of the valve, is greater than the superficial area of the forward end of the piston it follows that the piston and its adjuncts will be
35 moved forwardly until the ports r^4 enter the diaphragm and are closed thereby, and thereby further admission of air to the rear of the piston is prevented, and then the air acting by its expansive force will complete the forward
40 movement until the plunger uncovers the exhaust-passages h , as shown in Fig. 2. When this occurs, all of the air in the cylinder escapes excepting that which is confined in the chamber in the liner b between the forward
45 face of the piston-head and the rear face of the diaphragm and air is admitted through channels s^3 and s^4 to the forward solid end of the valve, and that pressure, together with the recoil of the spring s^2 , is sufficient to shift the valve to the left, as in Figs.
50 1 and 3, covering up the ports r^4 , which have been moved to the right of the diaphragm, and uncovering the through-ports r^7 to exhaust the pressure in the right-hand chamber, so that the piston and plunger are relieved from back pressure on the return movement. As soon as the ports r^4 are closed by
55 the reaction of the valve the air-pressure in the inlet-chamber between the forward face of the piston-head and the rear face of the diaphragm, which pressure is constant, forces the piston to the left on the completion of the return movement. When the port r^3 is passed to the rear or left-hand side of the diaphragm
60 on the backward movement, Fig. 1, air is admitted through said port and the hollow valve and hollow piston to the rear of the piston,

and the first result is the return or forward movement of the valve, so as to uncover the ports r^4 and close the ports r^7 from the outer air, and thus the parts are in position for the next forward movement. The diaphragm being made of sections with interposed packing material and being arranged between the liners and the liners being held in place by
70 the heads of the outer cylinder, I am enabled to insure a sufficient compression of the packing against the piston-rod to obtain at all times a fluid-tight joint.

I do not limit my invention to the employment of liners, since the various channels may be made in the body of the cylinder; but for structural purposes and for purposes of renewal and repair I much prefer to use the liners. 85

What I claim is—

1. A fluid-motor, having a cylinder, a diaphragm dividing the cylinder into two chambers one of which is the inlet and the other the outlet for said cylinder, a piston arranged
90 in the inlet-chamber and a plunger arranged in the outlet-chamber, a hollow piston-rod passing fluid-tight through the diaphragm and rigidly connecting the piston and plunger, and having a series of ports near its opposite ends, and a valve arranged in said
95 hollow rod and provided with a longitudinal bore opening axially at one end and laterally near the other end and cooperating with the several ports in the hollow rod to control the admission and exhaustion of the motive fluid
100 so as positively to effect the movement of the piston in both directions, substantially as described.

2. A cylinder having a diaphragm dividing
105 it into inlet and outlet chambers, a piston in the former and a plunger in the latter, a hollow ported rod passing fluid-tight through the diaphragm and connecting the piston and plunger, and an axially-bored and laterally-
110 ported slide-valve arranged within said hollow rod and cooperating with its ports, substantially as described.

3. A cylinder having a diaphragm, channeled liners arranged within the cylinder and
115 on opposite sides of said diaphragm and forming inlet and outlet chambers respectively, a piston in the inlet-chamber and a plunger in the outlet-chamber, a tubular ported connection for the piston and the plunger, and a
120 slide-valve arranged in the tubular connection and bored longitudinally at one end and ported laterally near the other end and cooperating with the ports in the said connection, the plunger itself having pressure-inlets
125 communicating with the valve, substantially as described.

4. A cylinder having a diaphragm dividing
130 it into inlet and outlet chambers, a piston in the former and a plunger in the latter, a hollow ported rod passing fluid-tight through the diaphragm and connecting the piston and plunger, and an axially-bored and laterally-ported slide-valve arranged within said hol-

low rod and cooperating with its ports, the diaphragm itself periodically serving to cut off the admission of the motive agent to the rear of the piston, substantially as described.

5
10 5. A cylinder having a diaphragm dividing it into inlet and outlet chambers, liners arranged in said chambers and having channels opening into the chambers and communicating respectively with a source of supply of power and the external air, on opposite sides of the diaphragm, a piston in the inlet-chamber and a plunger in the outlet-chamber, and valve mechanism for controlling the admis-

sion and exhaustion of the power agent, substantially as described. 15

6. A cylinder having a compressible diaphragm dividing it into two chambers, liners arranged in said chambers and abutting against the diaphragm, and cylinder-heads 20 holding the liners in place, substantially as described.

In testimony whereof I have hereunto set my hand this 1st day of October, A. D. 1900.

CHARLES TIFFANY LITCHFIELD.

Witnesses:

B. LICHTY,
DAN L. WEAVER.

It is hereby certified that in Letters Patent No. 675,490, granted June 4, 1901, upon the application of Charles Tiffany Litchfield, of Spokane, Washington, for an improvement in "Rock-Drills," an error appears in the printed specification requiring correction, as follows: In line 34, page 1, after the word "rock-drills," a comma and the words *or to rock-drills* should be inserted; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 18th day of June, A. D., 1901.

[SEAL.]

F. L. CAMPBELL,
Assistant Secretary of the Interior.

Countersigned:

F. I. ALLEN,
Commissioner of Patents.