W. A. SMITH.

ROCK DRILL.

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1,418,333. Patented June 6, 1922.

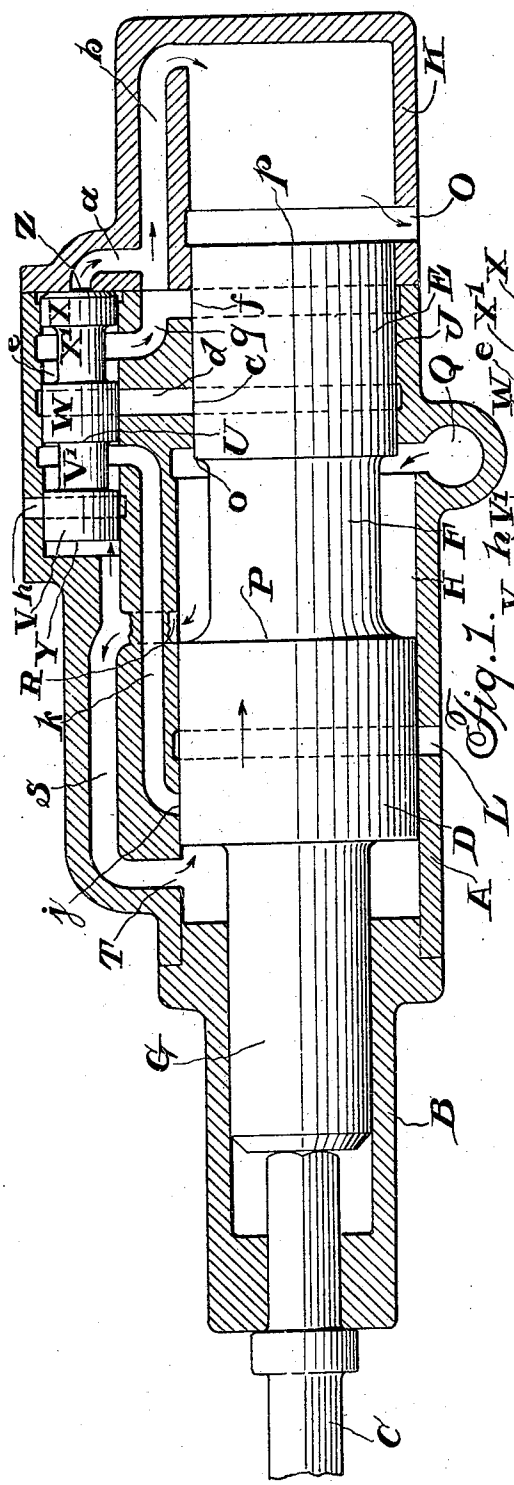


Fig. 1.

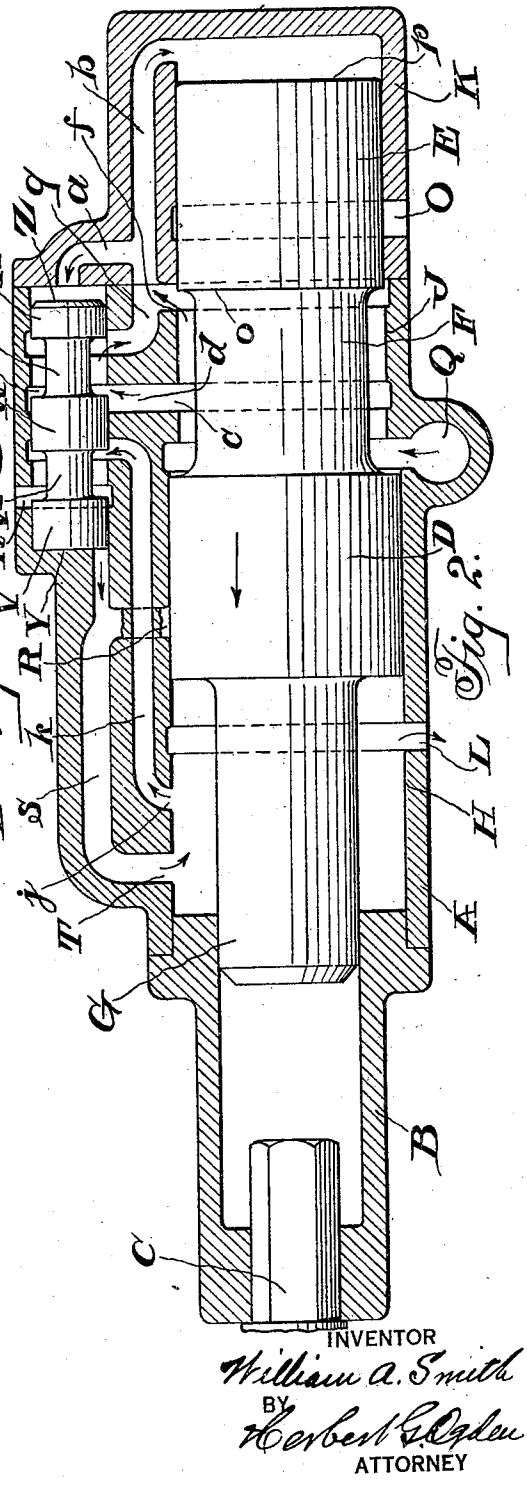


Fig. 2.

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ROCK DRILL.

1,418,333. Specification of Letters Patent. **Patented June 6, 1922.**

Application filed August 13, 1920. Serial No. 403,356.

To all whom it may concern:

Be it known that I, WILLIAM A. SMITH, a citizen of the United States, and a resident of Phillipsburg, county of Warren, State of New Jersey, have invented certain new and useful Improvements in Rock Drills, of which the following is a specification.

This invention relates to a fluid actuated rock drill of the hammer type, but more particularly to such a machine having a differential piston provided with a main head and a second head of smaller diameter connected with the main head by a reduced neck. Means are provided for maintaining constant pressure behind the main head for driving the piston forwardly, and in such case pressure is intermittently supplied to and exhausted from the main bore of the cylinder in front of the main head, and supplied to and exhausted from the smaller bore of the cylinder behind the head of smaller diameter.

The primary objects of the invention are to lengthen the back travel of the piston and also produce a longer admission of fluid pressure against the rear forwardly driving pressure surface of the head of smaller diameter on the forward stroke. This is accomplished by producing a late admission against the said rear surface of the smaller head on the rearward stroke and a late cut-off on the forward stroke. I prefer to provide a valve for carrying out the purposes of the invention controlling communication between forward and rearward admission passages leading respectively to a forward admission port and another admission port located rearward of said forward admission port, but the distribution of fluid pressure is otherwise controlled by the piston itself.

To these ends the invention consists of the features of construction and combinations of elements herein described and claimed and shown in the accompanying drawings, in which

Figures 1 and 2 are diagrammatic longitudinal sectional elevations of a rock drill embodying the invention, showing the piston hammer in two different positions.

Referring to the drawings, A represents the cylinder of a rock drill having the front head B through which the drill steel C extends in position to receive the impact blows of the piston hammer, which comprises the main piston head D and the head E of smaller diameter connected to the main head by means of the reduced neck F. The piston may also be provided with the forwardly extending reduced shank G if desired.

The main piston head D reciprocates within the larger bore H of the cylinder and in this instance the smaller head E reciprocates in a portion of the cylinder having a bore J of smaller diameter and the back head K is bored to the same diameter to receive the head E in its travel. The main cylinder bore H is provided with a main exhaust port L and the back head is provided with the exhaust port O both controlled directly by the piston. Pressure is constantly maintained on the forwardly acting pressure surface or shoulder P of the main head D from the inlet Q and the fluid pressure is distributed to the ends of the cylinder by suitable ports and passages partly controlled by the piston and partly controlled by a valve.

The supply of fluid pressure to the front end of the cylinder in front of the main head D passes through the supply port R and passage S directly to the admission port T, the port R being controlled directly by the piston in its travel. The supply of fluid pressure to the rear end of the smaller bore of the cylinder behind the smaller head E is partly controlled by the valve U, in this instance shown provided with the forward head V, the central head W and the rear head X, connected by the necks V′ and X′. The valve is subject to fluctuating pressure on two of its opposed operative surfaces, in this instance the forward surface Y of the forward head V being subjected to the fluctuating pressure in the supply passage S communicating with the front end of the cylinder, and the rear surface Z of the rear head X is subject to the fluctuating pressure in the passages *a* and *b* leading to the rear end of the smaller bore of the cylinder in the back head K. A forward admission port *c* has a forward admission passage *d* leading to the valve chamber *e* and the rearward admission port *f* has a rearward admission passage *g* leading to the valve

chamber *e*, both forward and rearward admission ports *c* and *f* communicate with the smaller bore of the cylinder. The front end of the valve chamber *e* as shown is provided with an atmospheric port *h* controlled by the front valve head V and an anti-compression port *j* for the front end of the main cylinder bore located forwardly of the supply port R and exhaust port L communicates with the valve chamber by means of the passage *k*, and is opened to the atmosphere when the valve is in the position of Figure 2.

In the operation of the machine, let it be assumed that the piston is at the forward end of its stroke and is about to start on the back stroke as indicated in Figure 1. The exhaust port O at the back end of the smaller bore of the cylinder is open and pressure is also exhausted from the rear pressure surface Z of the valve U through the passages *a* and *b* to the rear end of the cylinder and thence to atmosphere. The live pressure on the front surface Y of the valve head V has caused the valve to throw over or move to its rearward position as indicated in Figure 1, closing communication between the forward and rearward admission passages *d* and *g*.

As the piston travels back, the exhaust port O for the rear of the smaller bore, and the supply port R for the forward end of the larger bore, are closed, but the shoulder *o* at the neck of the piston overruns the forward admission port *c*, without admitting pressure to the rear surface *p* of the smaller head E, because the forward admission passage *d* is still closed by the valve U.

After the main head D over-runs the cylinder exhaust port L, the exhaust from the forward end of the cylinder is opened, which also opens the front end Y of the valve U to exhaust through the passage S and front end of the cylinder and exhaust port L. The shoulder *o* on the neck of the piston then over-runs the rearward admission port *f*, which admits pressure past the piston neck F to the rear of the smaller head E of the piston, and also through the passage *a* to the rear end Z of the valve U, which throws the valve to its forward position as indicated in Figure 2, thus opening communication between forward and rearward admission passages *d* and *g*, and supplying full pressure behind the smaller piston head E for the forward stroke.

Owing to the fact that no pressure is supplied to the rear of the smaller cylinder bore behind the smaller head E when the forward admission port *c* is uncovered by the piston shoulder *o*, the piston has a substantially long rearward stroke, before the forward and rearward admission passages *d* and *g* are placed in communication by the action of the valve U and on the other hand, the piston is given a late cut-off on the forward stroke, because cut-off does not take place when the admission port *f* is over-run by the piston shoulder *o* but is delayed until the forward admission port *c* is over-run by the piston as indicated in Figure 1.

The communication between the anti-compression port *j* and the atmosphere is closed by the valve head V when the valve is in the position shown in Figure 1, but the anti-compression port is open to atmosphere when the valve is in the position in Figure 2, and the piston is on its forward stroke. The anti-compression port remains open after the main exhaust port L is closed by the piston and relieves compression in the forward end of the cylinder.

I claim:

1. In a fluid operated rock drill of the hammer type, the combination of a cylinder and a differential piston constructed with a main head and a rear head of different diameters connected by a reduced neck and having two forwardly acting pressure surfaces and a rearwardly acting pressure surface, means for constantly supplying fluid pressure to one of said forwardly acting pressure surfaces, a supply port controlled directly by the main piston head and communicating directly with an admission port at the forward end of the cylinder for supplying motive fluid to the rearwardly acting pressure surface, a piston controlled exhaust port for the cylinder, an anti-compression port for the forward end of the cylinder located forwardly of said supply and exhaust ports, a forward admission port and another admission port rearward of said forward admission port for supplying motive fluid to the other of said forwardly acting pressure surfaces of the piston, and a fluid actuated valve for controlling communication between forward and rearward admission passages leading to said forward and rearward admission ports and for controlling communication between said anti-compression port and the atmosphere.

2. In a fluid operated rock drill of the hammer type, the combination of a cylinder and a differential piston constructed with a main head and a rear head of different diameters connected by a reduced neck and having two forwardly acting pressure surfaces and a rearwardly acting pressure surface, means for constantly supplying fluid pressure to one of said forwardly acting pressure surfaces, a supply port controlled directly by the main piston head and communicating directly with an admission port at the forward end of the cylinder for supplying motive fluid to the rearwardly acting pressure surface, a piston controlled exhaust port for the cylinder, an anti-compression port for the forward end of the cylinder located forwardly of said supply and exhaust ports, a forward admission port and another

admission port rearward of said forward admission port for supplying motive fluid to the other of said forwardly acting pressure surfaces of the piston, and a fluid actuated valve subject to fluctuating pressure on opposed operative surfaces for controlling communication between forward and rearward admission passages leading to said forward and rearward admission ports and for controlling communication between said anti-compression port and the atmosphere.

In testimony whereof I have signed this specification.

WILLIAM A. SMITH.