W. A. SMITH.

ROCK DRILL.

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1,384,216. Patented July 12, 1921.

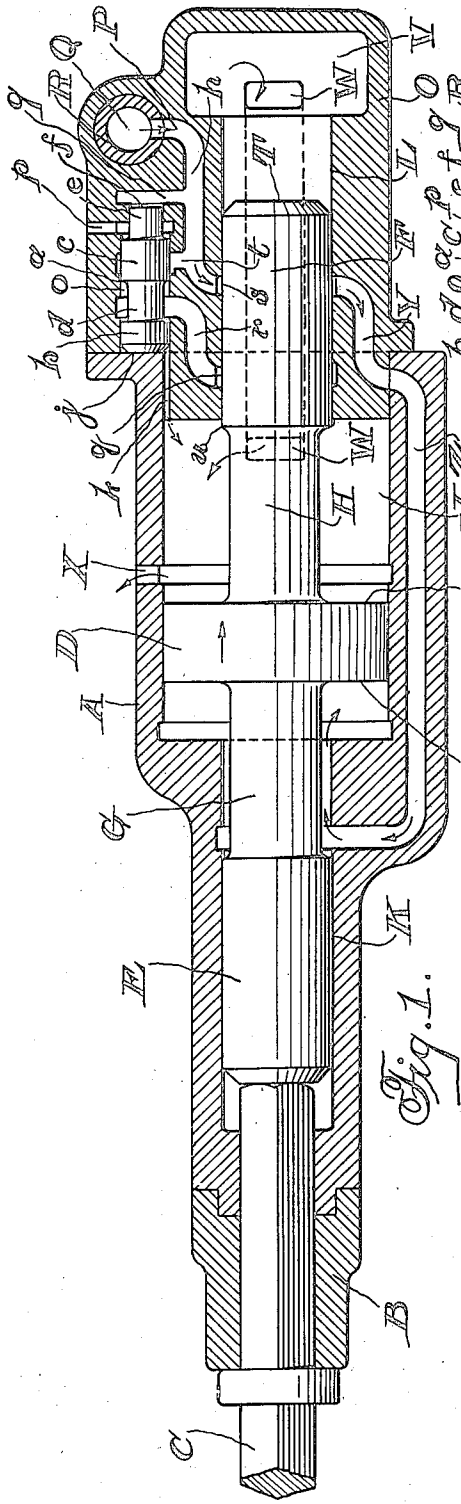


Fig. 1.

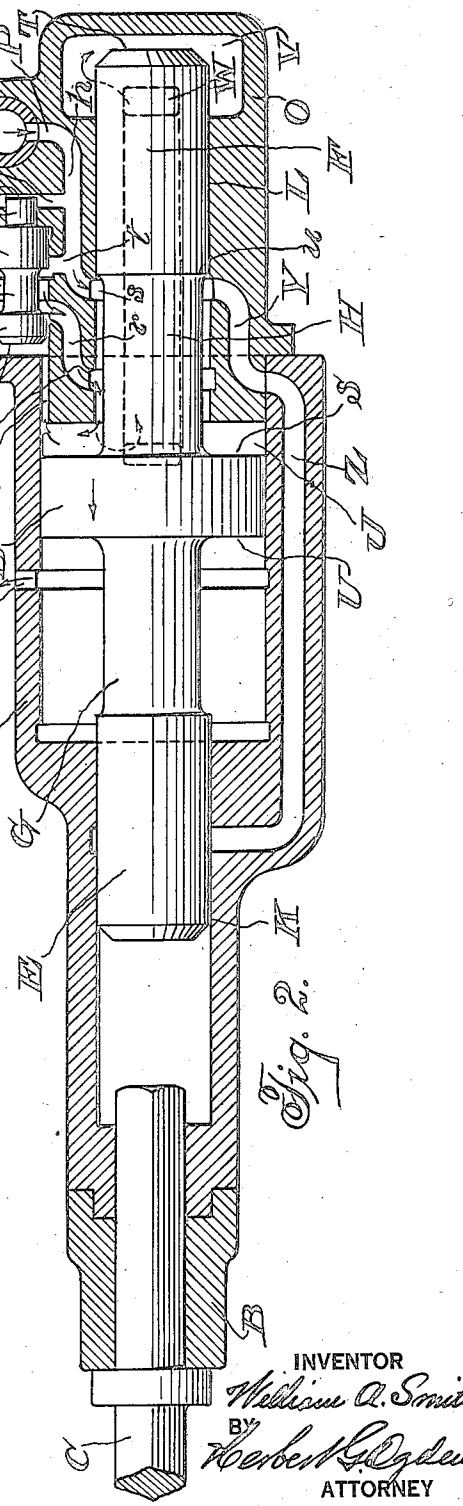


Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## ROCK-DRILL.

1,384,216. Specification of Letters Patent. Patented July 12, 1921.

Application filed August 13, 1920. Serial No. 403,354.

*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 double ended reversible piston provided with a main head, and shanks extending in opposite directions from said head and having reduced necks adjacent the main head. In this particular machine fluid pressure is intermittently supplied to and exhausted from the larger bore of the cylinder in front of and behind the main head and also behind the rearwardly extending shank, so that a fluctuating pressure chamber is provided at the rear or forwardly driving pressure surface of the said shank.

The primary objects of the invention are to lengthen the back travel of the piston and produce longer admission of fluid pressure against the rear or forwardly driving pressure surface of the main piston head on the forward stroke. This is accomplished by means of a fluid actuated differential valve controlling communication between admission passages leading respectively to a forward admission port and another admission port located rearwardly of said forward admission port. In this instance the valve is subjected to fluctuating pressure on one of its differential opposed operative surfaces tending to move the valve in a direction to open communication between said forward and rearward admission ports. In accordance with this invention and as one of its features, I provide means for constantly subjecting another opposed differential pressure surface of the valve to live air pressure tending to throw the valve over and and close communication between the said forward and rearward admission ports.

Further objects of the invention will hereinafter appear and to all of these ends the invention is shown in the accompanying drawings in one of its preferred forms, 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 chuck B through which the drill steel C is inserted in the usual manner in position to receive the impact blows of the reversible reciprocating hammer, which comprises the main piston head D having the forwardly and rearwardly extending reduced shanks E and F of the same diameter connected to the main head D by means of the necks G and H.

The main piston head D reciprocates in the larger bore J of the cylinder and the piston shanks E and F slide in bores of smaller diameter, the forward shank operated in the bore K and the rearward shank *f* operated in the bore L of the back head O. The smaller bores K and L are of the same diameter so that either shank may be inserted in either smaller bore to make the piston reversible in case it is desired to so reverse it.

Fluid pressure is supplied to the admission port P in the back head O through the inlet Q controlled by the usual throttle valve R and ports and passages are provided in the cylinder and back head for distributing motive fluid to and from the different portions of the cylinder. In the present instance the two forwardly driving pressure surfaces S and T and the rearwardly driving pressure surface U are all intermittently supplied with pressure and the chamber V in the rearward portion of the back head O is thus a fluctuating pressure chamber to which pressure is supplied through the passage W communicating with the rear portion of the main cylinder bore J, as indicated in dotted lines in the drawings.

The main cylinder bore is provided with the main exhaust port X and fluid pressure is supplied to the front end of the main cylinder bore in front of the piston head D through the passages Y and Z in the back head and cylinder respectively.

The supply of fluid pressure to the main cylinder bore behind the main head D is controlled partly by the valve *a* having a forward head *b* and a rearward head *c* connected by the reduced neck *d* and also provided with the reduced shank or extension *e*. The smaller operative surface, in this

case the rearward surface *f* of the valve, is subjected to constant pressure through the passage *g* communicating with the supply passage *h* from the inlet Q. Another and larger opposed surface *j* of the valve, in this instance the front end of the valve is subjected to a fluctuating pressure through the passage *k* communicating with the main bore of the cylinder. The valve chamber *o* is open to atmosphere at one point at the port *p*.

The forward admission port *q* opens into the smaller bore in the back head and communicates with the valve chamber *o* by means of the forward admission passage *r*. Another rearward admission passage *s* communicates with the valve chamber *o* by means of the rearward admission passage *t*, which also communicates with the supply passage *h*.

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 Fig. 1. The main cylinder bore is shown exhausting through the exhaust port X and the rear fluctuating pressure chamber V behind the rearwardly extending piston shank F is also exhausting as indicated by the arrows. Pressure is exhausted from in front of the pressure surface *j* of the valve through the passage *k* and exhaust port X so that the constant pressure on the rearward surface *f* of the valve tends to hold the valve in its forward position as indicated in Fig. 1, closing communication between the forward and rearward admission passages *r* and *t*. The piston is ready for the rearward stroke and as it travels back, the exhaust port X to the back of the main head D is closed and the supply passage Z to the forward end of the cylinder is also closed by the forward piston extension E, but the shoulder *u* on the rearward extension F of the piston over-runs the forward admission port *q*, without admitting pressure to the rear surface S of the main head D, because the rearward admission passage *t* is still closed by the valve O. When the shoulder *u* on the rearward extension of the piston over-runs the rearward admission port *s* as indicated in Fig. 2, pressure is admitted past the piston neck H to the rear of the larger bore J of the cylinder, and also through passage K to the front end *j* of the valve *a*, which throws the valve to its rear position against the constant pressure exerted on the smaller surface *f* of the valve and communication is opened between the forward and rearward admission passages *r* and *t* thus supplying full pressure behind the main head D for driving the piston forward.

Owing to the fact that no pressure is supplied to the rear of the main cylinder head D when the forward admission port *q* is uncovered by the piston shoulder *u* the piston has a substantially long rearward stroke before the forward and rearward admission passages *r* and *t* are placed in communication by the action of the valve *a*, 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 rearward admission port *s* is over-run by the piston shoulder *u* but is delayed until the forward admission port *q* is over-run by the piston as indicated in Fig. 1.

I claim:

1. In a fluid operated rock drill of the hammer type, the combination of a cylinder and reversible piston, means controlled by the piston for supplying motive fluid to the forward end of the cylinder, a forward admission port and another admission port rearward of said forward admission port for supplying motive fluid to the rearward end of the cylinder, and a fluid actuated valve subjected to fluctuating pressure on one operative surface and to constant pressure on an opposed operative surface for controlling communication between forward and rearward admission passages leading to said forward and rearward admission ports.

2. In a fluid operated rock drill of the hammer type, the combination of a cylinder and reversible differential piston subject to fluctuating pressure on one of its forwardly acting pressure surfaces, means controlled by the piston for supplying motive fluid to the rearwardly acting pressure surface of the piston, a forward admission port and another admission port rearward of said forward admission port for supplying motive to the other forwardly acting pressure surface of the piston, and a fluid actuated valve subjected to fluctuating pressure on one operative surface and to constant pressure on an opposed operative surface for controlling communication between forward and rearward admission passages leading to said forward and rearward admission ports.

3. In a fluid operated rack drill of the hammer type, the combination of a cylinder and reversible piston, means controlled by the piston for supplying motive fluid to the forward end of the cylinder, a forward admission port and another admission port rearward of said forward admission port for supplying motive fluid to the rearward end of the cylinder, and a fluid actuated valve for controlling communication between forward and rearward admission passages leading to said forward and rearward admission ports, said valve being subject to constant pressure on one operative surface tending to close communication between said forward and rearward admission passages and subject to fluctuating pressure on an opposed operative surface tend-

ing to open communication between said forward and rearward admission passages.

4. In a fluid operated rock drill of the hammer type, the combination of a cylinder and reversible differential piston subject to fluctuating pressure on one of its forwardly acting pressure surfaces, means controlled by the piston for supplying motive fluid to the rearwardly acting pressure surface of the piston, a forward admission port and another admission port rearward of said forward admission port for supplying motive fluid to the other forwardly acting pressure surface of the piston, and a differential fluid actuated valve controlling communication between forward and rearward admission passages leading to said forward and rearward admission ports, said valve being subject to constant pressure on one operative surface tending to close communication between said forward and rearward admission passages, and subject to fluctuating pressure on an opposed operative surface tending to open communication between said forward and rearward admission passages.

In testimony whereof I have signed this specification.

WILLIAM A. SMITH.