Feb. 13, 1934. W. A. SMITH, SR 1,946,989

VALVE FOR ROCK DRILLS

Filed Dec. 17, 1931 2 Sheets-Sheet 1

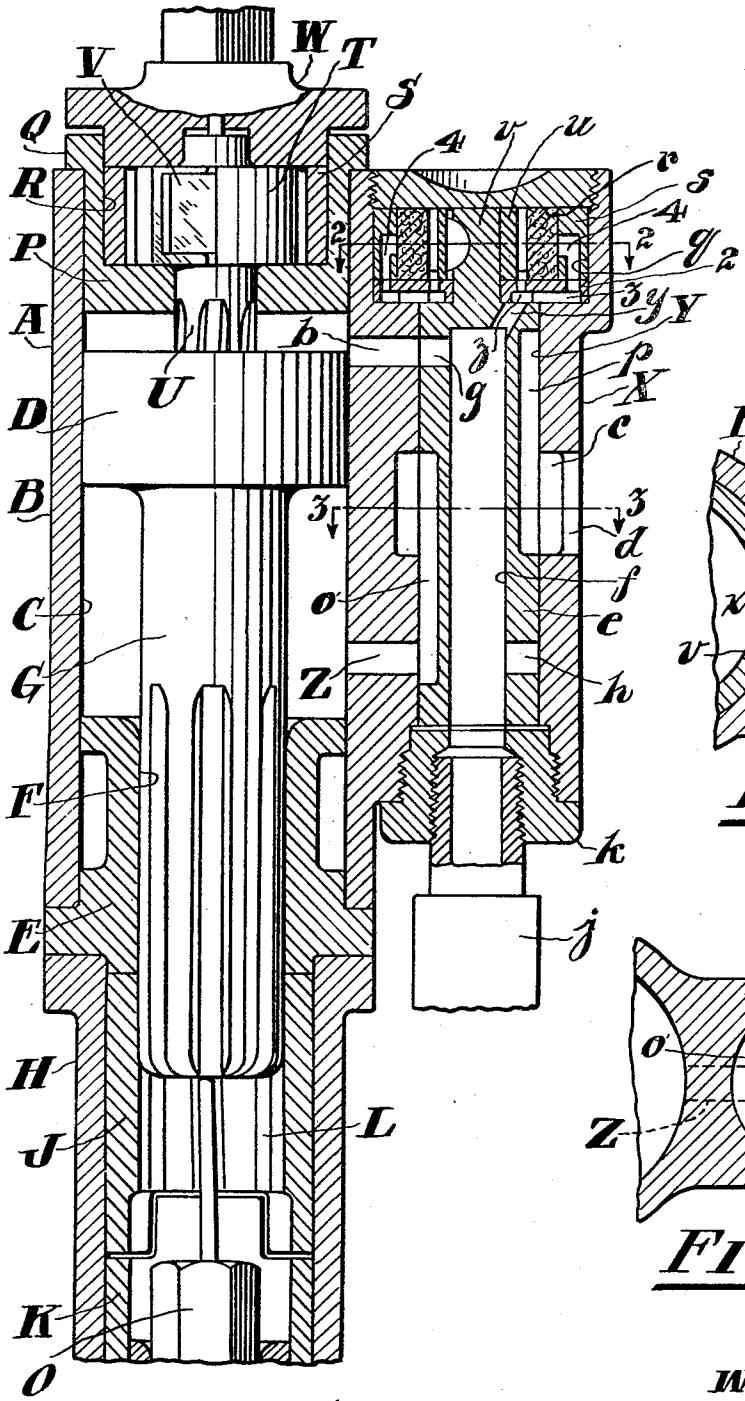

FIG.-1.

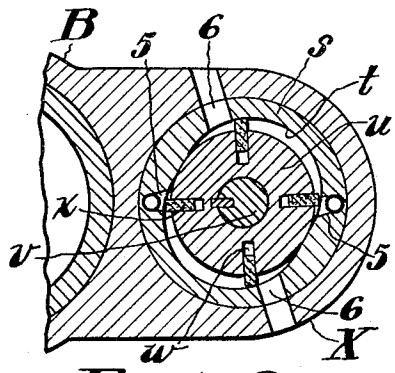

FIG.-2.

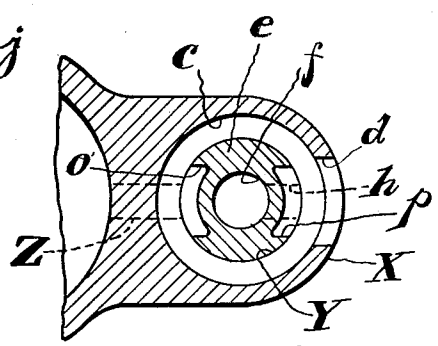

FIG.-3.

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VALVE FOR ROCK DRILLS

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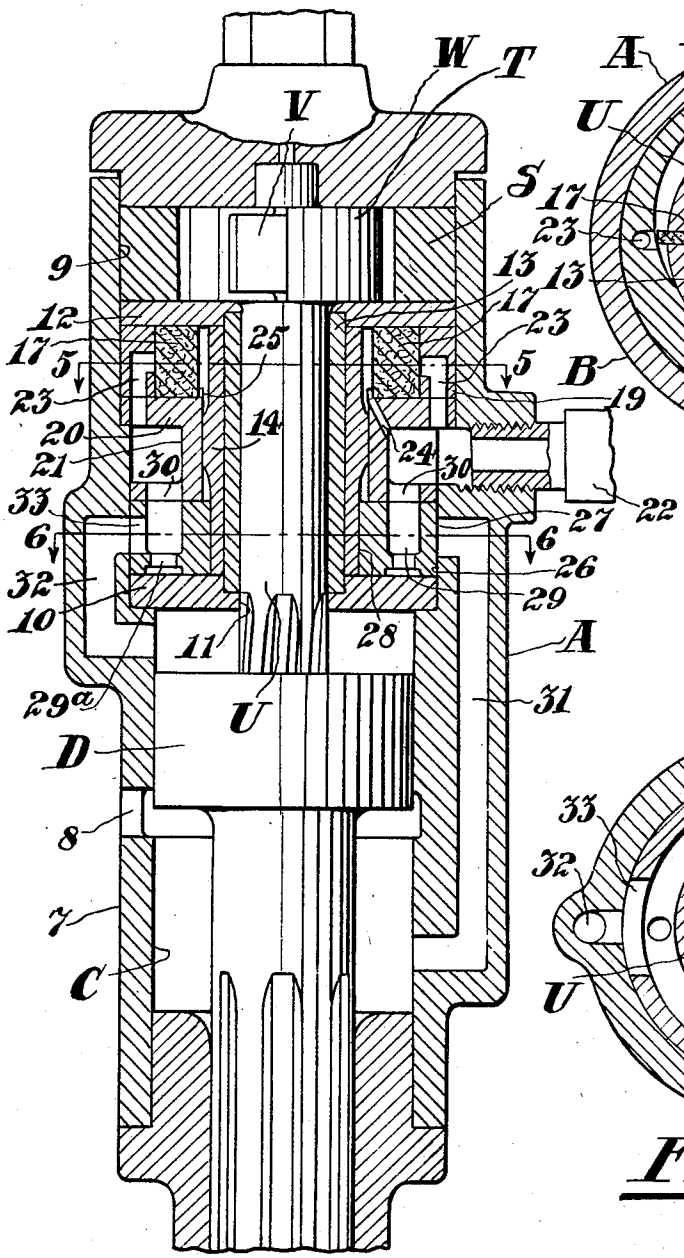

FIG.-4.

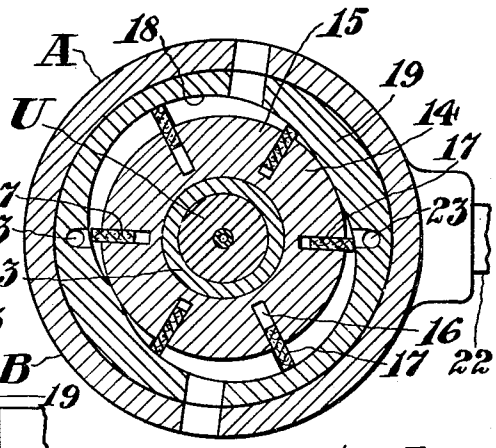

FIG.-5.

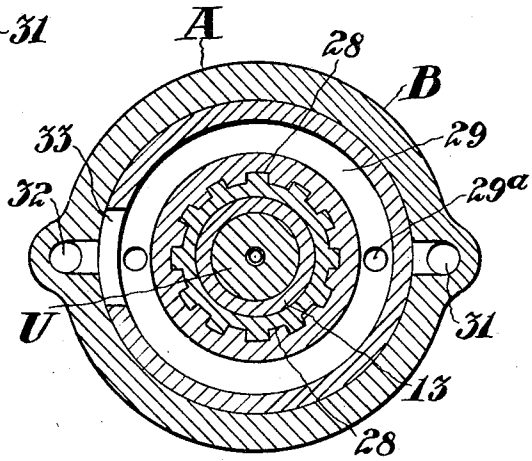

FIG.-6.

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UNITED STATES PATENT OFFICE

1,946,989

VALVE FOR ROCK DRILLS

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Application December 17, 1931
Serial No. 581,599

1 Claim. (Cl. 121—20)

This invention relates to valve mechanisms, but more particularly to a distributing valve for rock drills of the fluid actuated type.

A few of the objects of the invention are to effect a rapid distribution of pressure fluid to the percussive element and a positive action of the fluid distributing element of the rock drill.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying this specification and forming a part thereof and in which similar reference characters refer to similar parts,

Figure 1 is a sectional elevation of a rock drill equipped with valve mechanism constructed in accordance with the practice of the invention,

Figures 2 and 3 are transverse views taken through Figure 1 on the lines 2—2 and 3—3 looking in the directions indicated by the arrows,

Figure 4 is a view similar to Figure 1 showing a modified form of the invention, and

Figures 5 and 6 are transverse views taken through Figure 4 on the lines 5—5 and 6—6, respectively, looking in the directions indicated by the arrows.

Referring more particularly to the drawings, and at first to Figures 1 and 2, A designates, in general, a rock drill comprising a cylinder B having a piston chamber C wherein is arranged a reciprocatory hammer piston D. A closure is provided for the front end of the piston chamber C in the form of a front cylinder washer E having a bore F through which extends slidably a fluted extension or nose G of the piston D.

The front cylinder washer also serves to centralize a front head H with respect to the cylinder B and which may be secured to the cylinder in any suitable and convenient manner.

The front head H serves as a housing for chuck mechanism including in the present instance, two members J and K which may be suitably interlocked with each other. The member J which is the rearmost of the chuck members is provided with suitable ribs L for engagement with the flutes in the extension G, and the member K serves as a guide for a working implement O, such as a drill steel, and against which the piston D strikes.

A closure is provided for the rear end of the piston chamber C by a block P having a flange Q at its rear end to seat against the corresponding end of the cylinder B. The block P is provided with a recess R which opens from the rear end of the block to receive a toothed ratchet ring S of a well known type which may be affixed to the block P in any suitable manner.

The ratchet ring S encircles the head T of a rifle bar U which extends through the front end of block P to interlockingly engage the piston D. The head T carries the usual spring pressed pawls V which are adapted to engage teeth on the ratchet ring S for holding the rifle bar U stationary during one stroke of the piston D thereby imparting a rotary movement to the piston, and to permit the rifle bar to rotate with the piston during the opposite stroke of the piston.

A closure is provided for the rear end of the recess R by a plate or back head W which may be bolted or otherwise secured to the cylinder B to clamp the back head, the ratchet ring S and the block P fixedly in position.

The valve mechanism, constructed in accordance with the practice of the invention, comprises a chest X arranged in the present instance on the side of the cylinder B and having a cylindrical valve chamber Y therein which communicates at points near its front and rear ends with the corresponding ends of the piston chamber C through inlet passages Z and *b*. In the valve chamber Y and intermediate the inlet passages Z and *b* is an enlarged portion in the form of an annular groove *c* which communicates with the atmosphere through an exhaust port *d*.

Disposed within the valve chamber Y is a cylindrical valve *e* having a bore therein which serves as a supply reservoir *f* and which extends in the present instance from the front end of the valve *e* to a point rearwardly of the inlet passage *b* wherewith it may communicate through a supply passage *g*. Near the front end of the valve *e*, although disposed in the side of the valve opposite to that wherein the supply passage *g* is located, is a supply passage *h* to afford communication between the supply reservoir *f* and the front inlet passage Z.

Pressure fluid to be distributed by the valve *e* is supplied to the supply reservoir *f* by a conduit *j* threaded into a plug *k* which itself is threaded into the front end of the valve chamber Y.

In addition to their usual functions, the inlet passages Z and *b* also serve to convey exhaust fluid from the ends of the piston chamber C, and communication between the groove *c* and the inlet passage is afforded by longitudinally extending grooves or passages *o* and *p* in the valve *e*. The passages *o* and *p* are located on diametrically opposite sides of the valve *e*, and the passage *o*, in the present instance, affords communication between the front inlet passage Z and the exhaust groove *c*, while the passage *p* extends from a point adjacent the front end of

the exhaust groove *c* rearwardly to connect the said groove *c* with the inlet passage *b*.

In the rear end of the chest X is a bore *q* to accommodate a motor designated, in general, by *r* and which is connected to the valve *e* for rotating said valve to effect registry between the various ports and passages of the valve and the valve chest. The motor illustrated comprises a cylinder *s* which is seated in the bore *q* and wherein it may be affixed in any well known manner.

In the cylinder *s* is a piston chamber *t* of oblong shape for the accommodation of a rotor or piston *u* which is keyed to a stem *v* on the rear end of the valve *e*. The rotor *u* is provided with a series of radially extending slots *w*, four being shown in the present instance, to accommodate vanes *x* disposed slidably in the slots *w* and against which pressure fluid acts for rotating the rotor and the valve.

Pressure fluid for driving the rotor *u* is supplied to the piston chamber *t* through a supply passage *y* in the valve *e* and which is in constant communication with an annular passage *z* in a plate 2 seated in the bottom of the bore *q* and upon which the rotor *u* and the cylinder *s* are seated. In the plate 2, and leading from the annular groove *z*, are a pair of passages 3 which extend outwardly and communicate with passages 4 in the cylinder *s* and which latter passages communicate with the piston chamber *t* through ports 5.

The piston chamber *t* is provided with a pair of exhaust ports 6 which extend through the cylinder *s* and the chest X to the atmosphere for exhausting the motive fluid from the piston chamber *t*.

The operation of the device so far described is as follows: With the valve *e* in the position illustrated in Figure 1 pressure fluid flows from the supply reservoir *f* through the supply passage *g*, the inlet passage *b* into the rear end of the piston chamber and, acting against the rear end of the piston D, drives the said piston forwardly against the working implement O. During the time the valve *e* occupies this position the exhaust passage *o* will be in registry with the annular groove *c* and the front inlet passage Z and the front end of the piston chamber C will, therefore, be in communication with the atmosphere throughout a portion of the stroke of the piston D.

With pressure fluid present in the supply reservoir *f* a portion thereof will flow into the piston chamber *t* through the connecting passages *y*, *z*, 3 and 4 and, by acting against the vanes *x*, will rotate the rotor *u* and the valve *e* which is attached to the rotor. Upon rotation of the motor and the valve *e* the supply passage *g* will be moved out of registry from the inlet passage *b*, and when the valve is rotated approximately a half revolution, the supply passage *h* will be moved into registry with the inlet passage Z and the exhaust passage *d* will establish communication between the inlet passage *b* and the annular groove *c*.

When the valve arrives at this position pressure fluid will be admitted into the front end of the piston chamber C to drive the piston D rearwardly and the rear end of the piston chamber will be simultaneously communicated with the atmosphere to exhaust the expended motive fluid therefrom.

This action of the valve, the motor and the piston D may continue indefinitely and, as will be apparent, a rapid distribution of the pressure fluid will be effected to the ends of the piston chamber so that the piston D will, in consequence, reciprocate at a rapid rate for actuating the working implement 0 into the work.

In the modified form of the invention illustrated in Figures 4 to 6 inclusive, the cylinder 7 is provided with a free exhaust port 8 arranged intermediate the ends of the piston chamber C and being controlled by the piston D. In the rear end of the cylinder 7 is an enlarged bore 9 and in the front end of the bore is a plate 10 to form a closure for the rear end of the piston chamber C.

The plate 10 is provided with a central aperture 11 to accommodate the rifle bar U which may extend co-axially through the bore 9. The ratchet ring S, against which the pawls V act, encircles the head T and supports the back head W.

A seat is provided for the front ends of the ratchet ring S and the head T of the rifle bar in the form of a plate 12, through which the rifle bar U extends. Interposed between the plates 12 and 10, and preferably extending partly into each, is a bushing 13 which encircles the rifle bar U and serves as a bearing for a hollow spindle 14 carried by a rotor 15. The rotor 15 has radially extending slots 16 therein to accommodate vanes 17 and is arranged within a piston chamber 18 in a cylinder 19 which abuts the front end of the plate 12.

The front end of the cylinder 19 is seated upon a block 20 which may be affixed in the bore 9 in any suitable manner and has an external annular groove 21 to serve as a supply reservoir and into which pressure fluid is conveyed by a connection 22 threaded into the side of the cylinder 7. Leading from the reservoir 21 to the piston chamber 18, and being in this instance arranged in the block 20 and the cylinder 19, are a pair of supply passages 23 for conveying pressure fluid into the piston chamber 18 to actuate the rotor 15.

Preferably the block 20 is provided with a passage 24 which communicates with an annular groove 25 adjacent the rear ends of the slots 16 to assure a balancing pressure rearwardly of the vanes 17.

The block 20 and the plate 10 are suitably spaced with respect to each other to form therebetween a valve chamber 26 for the accommodation of a rotary valve 27 which, in the present instance, is secured to the front end of the spindle 14 by means of a splined connection 28. The valve 27 is in the form of a ring member and is provided with an annular chamber 29 and a series of longitudinally extending ports 29^a which lead from the chamber 29 to the front end of the valve in order to assure the constant exposure of both ends of the valve to pressure fluid of the same value. In the front end of the block 20 are a series of ports 30 which communicate at their rear ends with the supply reservoir 21 and convey pressure fluid into the chamber 29.

Leading from diametrically opposite sides of the valve chamber 26 are the front and rear inlet passages 31 and 32 through which pressure fluid is conveyed to the front and rear ends respectively of the piston chamber C for actuating the piston D and in the side of the valve 27 is a port 33 to afford communication between the chamber 29 and the inlet passages 31 and 32.

The operation of this form of the invention is substantially like that of the form previously described but from which it differs in the respect that the valve controls only the admission of

pressure fluid into the piston chamber. As will be apparent as the valve 27 is being rotated the port 33 will be carried successively into registry with the passages 31 and 32 to admit pressure fluid into the front and rear ends respectively of the piston chamber for actuating the piston D, and during its reciprocations the piston uncovers the exhaust port 8 to permit the exhaust of the pressure fluid whereby the piston is actuated.

I claim:

In a fluid actuated rock drill, the combination of a cylinder having a piston chamber and a piston therein, rotation mechanism for the piston including a rifle bar extending into the piston chamber, rotor and valve chambers encircling the rifle bar, a supply reservoir between the chambers, inlet passages leading from the valve chamber to the piston chamber, a valve in the valve chamber to effect communication between the supply reservoir and the inlet passages, and a rotor in the rotor chamber and being connected to the valve to rotate said valve.

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