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VALVE FOR ROCK DRILLS

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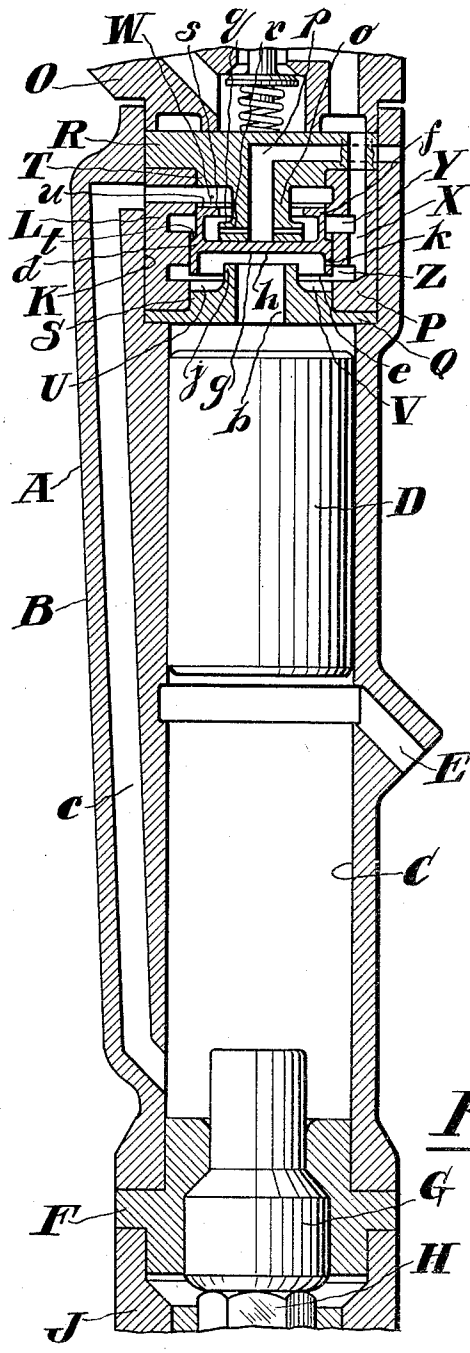


FIG. 1.

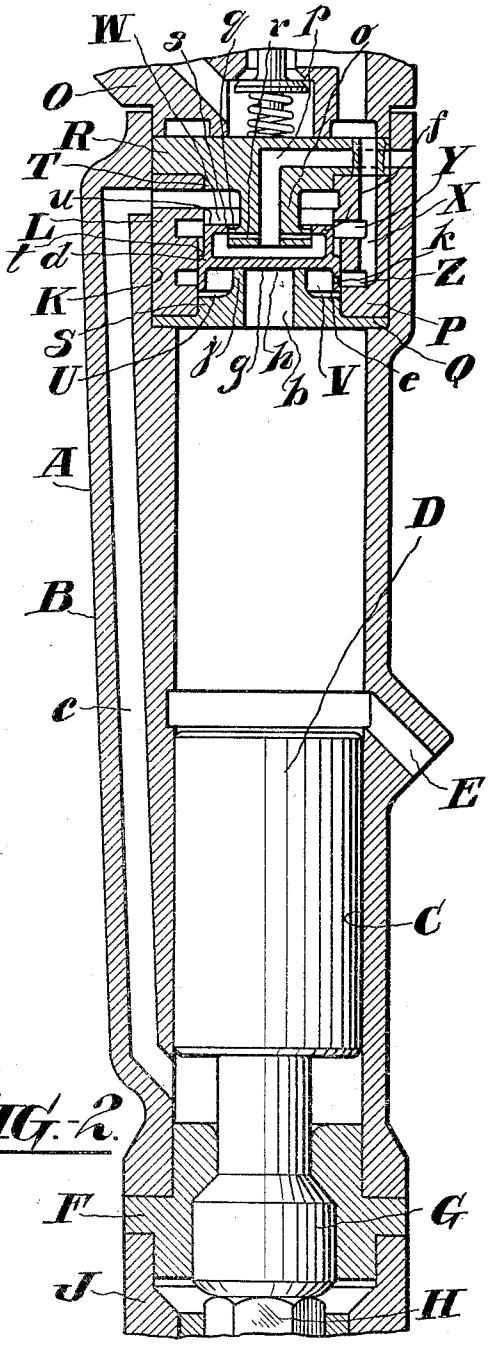


FIG. 2.

INVENTOR.
George W. Hulshizer
BY
HIS ATTORNEY

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UNITED STATES PATENT OFFICE

GEORGE W. HULSHIZER, OF STEWARTSVILLE, NEW JERSEY, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY

VALVE FOR ROCK DRILLS

Application filed November 20, 1929. Serial No. 408,648.

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

The objects of the invention are to obtain a light weight valve which is capable of effecting a rapid distribution of pressure fluid to the cylinder and to assure a heavy uncushioned blow of the hammer piston against the working implement.

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 a valve constructed in accordance with the practice of the invention and showing the valve in one limiting position, and

Figure 2 is a similar view showing the valve in another limiting position.

Referring more particularly to the drawings, A designates a rock drill comprising a cylinder B having a piston chamber C to accommodate a reciprocatory hammer piston D. The cylinder B has a free exhaust port E which is controlled by the piston D.

A suitable closure is provided for the front end of the piston chamber C by a front cylinder washer F which is suitably bored to slidably receive an anvil block G which transmits the blows of the piston D to a working implement H. The working implement is guided by a front head J which is centralized with respect to the cylinder B by the front cylinder washer F.

In the rearward end of the cylinder A is an enlarged bore K to accommodate a valve chest L which forms a closure for the rearward end of the piston chamber C. The valve chest L is held securely within the bore K by a back head O which is seated on the valve chest L and which, together with the front head J, may be secured in the assembled position by means of side bolts (not shown).

The valve chest L in this instance comprises a ring member P and a pair of plates Q and R. The plate Q is disposed adjacent the piston chamber C and the plate R is disposed on the rearward end of the ring member P. The plates Q and R are provided with circular extensions S and T respectively which extend into the ends of the ring member P to hold the parts comprising the valve chest in coaxial relationship with each other.

Within the valve chest L is a valve chamber U comprising a front enlarged portion V and a rear reduced portion W. The pressure fluid intended to be distributed to the ends of the cylinder is conveyed to the enlarged portion V of the valve chamber by a supply passage X which may lead from a suitable source of pressure fluid supply and has a rear port Y which opens into the reduced portion W of the valve chamber and a forward port Z which opens into the enlarged portion V of the valve chamber.

Within the plate Q is an inlet passage *b* which conveys pressure fluid from the front end of the valve chamber to the rear end of the cylinder B for impelling the piston D forwardly against the anvil block. The pressure fluid utilized for returning the piston D passes through a front inlet passage *c* which leads from the front end of the piston chamber C to the rearward end of the reduced portion W of the valve chamber.

The inlet passages *b* and *c* are controlled by a distributing valve *d* disposed within the valve chamber U. The valve *d* has an enlarged head *e* which lies within the portion V of the valve chamber and controls the admission of pressure fluid from the port Z into the front end of the valve chamber. The rear end of the valve is in the form of a ring portion *f* which lies within the reduced portion W of the valve chamber and is adapted to control the flow of pressure fluid from the port Y into the front inlet passage *c*.

Between the head *e* and the ring portion *f* of the valve is a wall *g*. The forward surface as well as the forward surface of the head *e* constitutes a pressure surface *h* against a central portion of which compression from the rearward end of the piston D intermittently acts for throwing the valve *d* rearwardly. The portion thus exposed to com-

pression is determined by the area of the inlet port *b*, the wall *g* seating directly against a valve stop *j* of the plate Q and wherein the inlet passage *b* is formed.

In the head *e* is a leak port *k* which is adapted to register with the port Z for admitting pressure fluid against the annular portion of the pressure surface *h* which lies outside the area of the valve stop *j* to assist the compression acting against the pressure surface *h* to throw the valve rearwardly.

The plate R is provided with a valve stop *o* which extends into the rear end of the valve *d* to form an abutment for the wall *g* for limiting the rearward movement of the valve *d*. Within the valve stop *o* is a vent *p* which affords communication between the interior of the ring portion *f* of the valve *d* and the atmosphere.

On the free end of the valve stop *o* is a lateral flange *q* having ports *r* which lead from the periphery of the flange *q* to the vent *p*, and on the rear end of the valve *d* is a lateral flange *s* which cooperates with the periphery of the flange *q* to control communication between the rear end of the valve chamber and the ports *r*.

At the juncture of the ring portions *e* and *f* is an actuating surface *t* which is in constant communication with the port X and against which surface pressure constantly acts tending to throw the valve *d* forwardly. The actuating surface *t* is of considerably smaller area than the portion of the pressure surface *h* which is constantly exposed to pressure fluid. On the rearward end of the ring portion *f* of the valve is a holding surface *u* over which pressure fluid flows to the inlet passage *c* and against which such pressure fluid acts to assist that pressure fluid acting against the actuating surface *t* to hold the valve forwardly against the valve stop *j*.

The operation of the device is as follows: With the valve in the rearmost position illustrated in Figure 1, pressure fluid will flow from the supply passage X through the port Z and through the front end of the valve chamber U and the inlet passage *b* into the rear end of the piston chamber to drive the piston D forward against the anvil block.

During this movement of the piston the air in the front end of the piston chamber C will be forced therefrom by the piston and such air will flow through the inlet passage *c* into the rear end of the valve chamber, thence into the rear end of the valve *d* and through the ports *r* and the vent *p* to the atmosphere. The piston may therefore move forwardly unhampered by compression in the front end of the piston chamber and, in consequence, a heavy blow will be delivered to the working implement H.

Shortly prior to the delivery of the blow of the hammer piston against the anvil block the piston will uncover the exhaust port E and the pressure fluid used for actuating the piston D forwardly will then be exhausted to the atmosphere. This exhausting of pressure fluid from the piston chamber will cause an abrupt drop in the pressure fluid acting against the pressure surface *h* and the pressure fluid acting against the actuating surface *t* will then move the valve *d* forwardly against the valve stop *j*.

As the valve approaches the stop *j* the rearward end or holding surface *u* will uncover the port Y and the pressure fluid will then flow from the port Y across the holding surface *u* against which it will act to hold the valve forwardly, and thence through the inlet passage *c* to the front end of the piston chamber C to drive the piston D rearwardly.

With the valve in the foremost position described, pressure fluid will flow through the leak port *k* in the valve so that an outer annular portion of the pressure surface *h* will be exposed to live pressure fluid tending to throw the valve rearwardly. This pressure is then opposed by that acting against the actuating surface *t* and the holding surface *u* so that the valve will remain in its foremost position until the piston D passes over the exhaust port E during its rearward stroke.

From this point on the air in the rear end of the piston chamber C will be compressed. Such compression will flow through the inlet passage *b* to act against the central portion of the pressure surface *h* and, with the assistance of the pressure fluid acting against the pressure surface *h*, will throw the valve rearwardly to its initial position, thus completing the cycle of operation.

As will be observed the outer annular portion of the pressure surface *h* is constantly exposed to pressure fluid. When the valve is in its foremost position, pressure fluid will flow into the front end of the valve chamber through the port *k* and as the valve is shifted rearwardly so that said port is moved out of communication with the port Z, the front end of the valve will be sufficiently raised to permit the flow of pressure fluid thereagainst and into the rear inlet passage *b*.

I claim:

1. In a fluid actuated rock drill, the combination of a cylinder and a piston therein, an exhaust port for the cylinder, a valve chest having a valve chamber, inlet passages leading from the valve chamber to the cylinder, a ring-shaped valve in the valve chamber having an internal lateral wall, and an external actuating surface, one side of the wall and said actuating surface forming opposed differential pressure surfaces constantly exposed to pressure fluid for throwing and holding the valve, a portion of one pressure surface being intermittently exposed to compression to assist in throwing the valve in one direction, and a holding area on the

valve against which pressure fluid acts to assist the pressure fluid acting against the pressure surface of lesser area for holding the valve in one of its limiting positions.

2. In a fluid actuated rock drill, the combination of a cylinder and a piston therein, an exhaust port for the cylinder, a valve chest having a valve chamber, inlet passages leading from the valve chamber to the cylinder, a ring-shaped valve in the valve chamber having an internal lateral wall, one side of which forms a pressure surface at one end of the valve, a portion of said pressure surface being intermittently exposed to compression for throwing the valve in one direction and another portion of said pressure surface being constantly exposed to pressure fluid to assist in throwing the valve and to hold it momentarily stationary, an external shoulder on the valve forming an opposing actuating surface constantly exposed to pressure fluid tending to throw the valve in the opposite direction and being of smaller area than the first mentioned constant pressure surface, and a holding surface on the valve intermittently exposed to pressure fluid to assist the pressure fluid acting against the actuating surface to hold the valve momentarily stationary.

3. In a fluid actuated rock drill, the combination of a cylinder and a piston therein, an exhaust port for the cylinder, a valve chest having a valve chamber, inlet passages leading from the valve chamber to the cylinder, a ring-shaped valve in the valve chamber having an internal lateral wall, one side of which forms a pressure surface at the front end of the valve, the central portion of said pressure surface being intermittently exposed to compression for throwing the valve rearwardly and an outer annular portion of said pressure surface being constantly exposed to pressure fluid to assist in throwing the valve and to hold the valve momentarily stationary during the admission of pressure fluid into the rear end of the cylinder, an external shoulder intermediate the ends of the valve forming an actuating surface constantly exposed to pressure fluid tending to throw the valve forwardly, and an introverted flange forming a holding area on the rear end of the valve against which pressure fluid flowing to the front end of the cylinder acts to assist the pressure fluid acting against the actuating surface in holding the valve in its foremost limiting position.

4. In a fluid actuated rock drill, the combination of a cylinder and a piston therein, an exhaust port for the cylinder, a valve chest having a valve chamber, inlet passages leading from the valve chamber to the cylinder, a valve in the valve chamber having opposed differential pressure surfaces constantly exposed to pressure fluid for throwing and holding the valve, a portion of one pressure surface being intermittently exposed to compression to assist in throwing the valve in one direction, a holding area on the valve against which pressure fluid flowing to one end of the cylinder acts to assist the pressure fluid acting against the pressure surface of lesser area for holding the valve in one of its limiting positions, a valve stop for the valve and having a vent for exhausting compression from the valve chamber to the atmosphere, and a flange on the valve cooperating with the valve stop to control the flow of compression from the cylinder to the vent.

5. In a fluid actuated rock drill, the combination of a cylinder and a piston therein, an exhaust port for the cylinder, a valve chest having a valve chamber, inlet passages leading from the valve chamber to the cylinder, a valve in the valve chamber having opposed differential pressure surfaces constantly exposed to pressure fluid for throwing and holding the valve, a portion of one pressure surface being intermittently exposed to compression to assist in throwing the valve in one direction, a holding area on the valve against which pressure fluid flowing to one end of the cylinder acts to assist the pressure fluid acting against the pressure surface of lesser area for holding the valve in one of its limiting positions, a valve stop extending into the valve and having a vent affording communication between the interior of the valve and the atmosphere, and a lateral flange on one end of the valve cooperating with the valve stop to control the flow of compression from one inlet passage to the vent.

In testimony whereof I have signed this specification.

GEORGE W. HULSHIZER.