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VALVE FOR ROCK DRILLS

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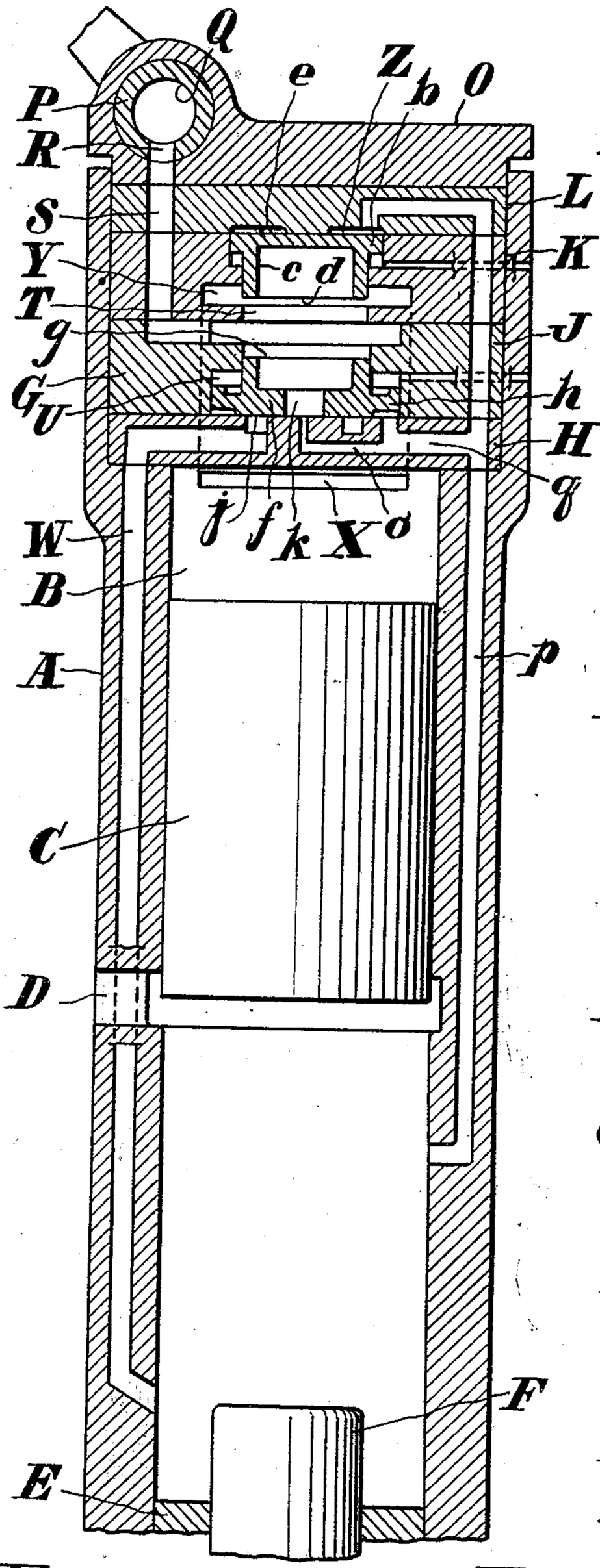

FIG.-1.

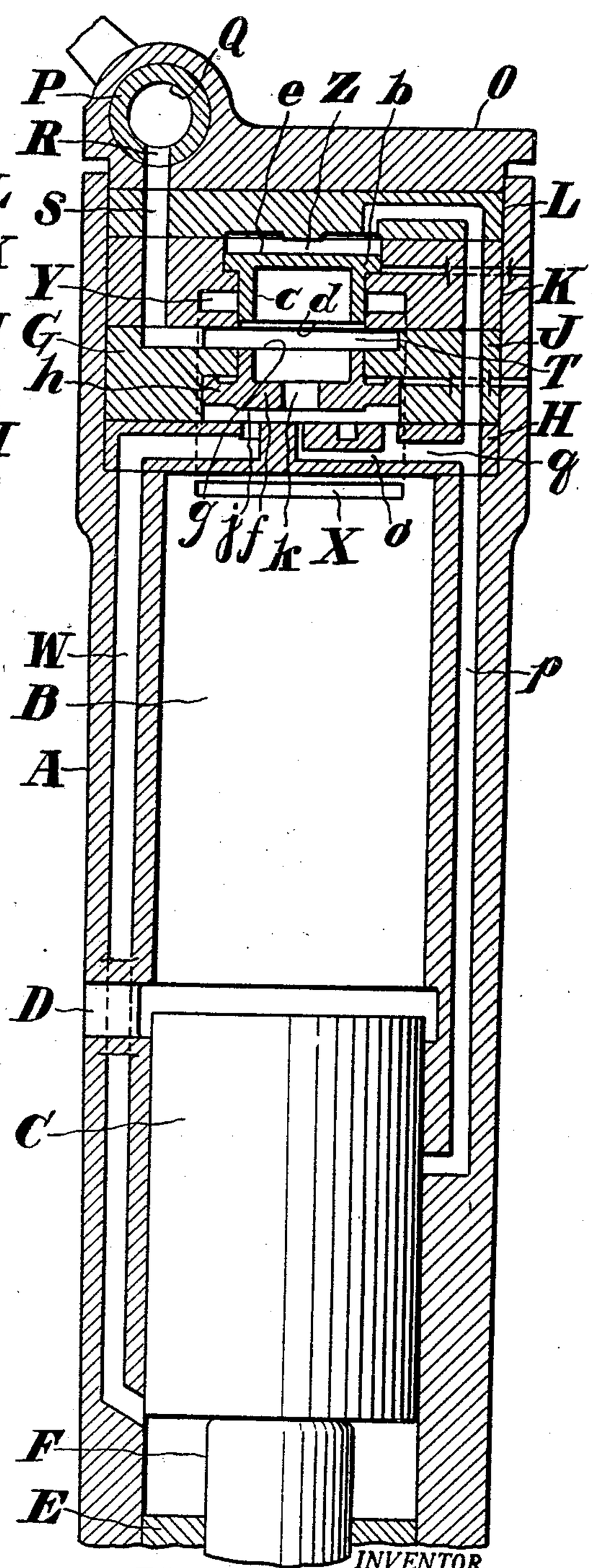

FIG.-2.

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UNITED STATES PATENT OFFICE

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VALVE FOR ROCK DRILLS

Application filed November 27, 1929. Serial No. 410,140.

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

The objects of the invention are to obtain a rapid and positive action of the pressure fluid distributing element and therefore a rapid action of the percussive element to which the pressure fluid is distributed and, in general, to improve in devices of this type.

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

In the drawings illustrating the invention and in which similar reference characters refer to similar parts,

Figure 1 is a sectional elevation of a rock drill constructed in accordance with the practice of the invention and showing the valves in the positions which they will assume when the piston is about to start on its forward stroke, and

Figure 2 is a similar view showing the valves in the other extreme positions which they will assume when the piston is commencing its rearward stroke.

Referring more particularly to the drawings, A represents a cylinder of a rock drill having a piston chamber B in which is disposed a reciprocatory hammer piston C. The cylinder A has a free exhaust port D which leads from the piston chamber B at a point intermediate its ends and is controlled by the piston C.

Any suitable closure, as for instance, a washer E may be provided for the front end of the piston chamber B, and said washer may also serve as a guide for a working implement F which extends into the front end of the piston chamber B to receive the blows of the hammer piston C.

In the rearward end of the cylinder A is a valve chest designated generally by G and comprising plates H, J, K and L. The plate H is disposed adjacent the rear end of the piston chamber B to form a closure therefore and the plate J is seated on the plate H and in turn serves as a seat for the plate K, while the plate L forms the rearmost element of the valve chest G and is seated on the plate K.

The plates comprising the valve chest G may be secured in their proper assembled positions in any suitable manner or may be clamped securely in position by a back head O which is seated on the rearmost plate L to form a closure for the rear end of the cylinder. The back head O may be clamped to the cylinder by means of the usual spring pressed side bolts (not shown).

The back head O serves as a housing for a throttle valve P whereby the admission of pressure fluid into the drill may be controlled. The throttle valve P is preferably of the rotary type having a chamber Q therein into which pressure fluid may be constantly introduced through a conduit (not shown). In the wall of the throttle valve P is a port R which registers with a supply passage S formed in the back head O, the plates L, K and J and opening with its outlet end into an intermediate portion of a valve chamber T in the valve chest G.

The valve chamber T is preferably formed only in the plates J and K, and the plates H and L form closures for the front and rear ends respectively of the valve chamber. The valve chamber T has an enlarged portion U at its front end. From this portion U leads a front inlet passage W which opens at its other end into the front end of the piston chamber B.

The admission of pressure fluid to the rearward end of the piston chamber B for driving the piston C forwardly is conveyed thereto by a rear inlet passage X which has its inlet opening Y at a point in the valve chamber rearwardly of the supply passage S.

At the rearward end of the valve chamber T is an enlarged chamber Z to accommodate a flange *b* of an imperforate distributing valve *c* which is disposed in the rearward end of the valve chamber T to control the inlet opening Y of the inlet passage X. The valve *c* is of the differential type and the small end thereof constitutes a pressure surface *d* against which pressure fluid constantly acts tending to throw the valve *c* rearwardly to open the inlet passage X. The rearward end of the valve or flange *b* constitutes an actuating surface *e* against which pressure fluid intermittently acts tending to close the valve *c*.

A separate valve is provided for controlling the admission of pressure fluid to the front end of the piston chamber B. The valve utilized for this purpose is designated by *f* and is disposed in the front end of the valve chamber T.

The valve *f* is of the differential type and the inner end thereof, which is the portion of smaller area, opposes the pressure surface *d* of the valve *c* and constitutes a pressure surface *g* against which pressure fluid constantly acts tending to move the valve *f* outwardly to prevent communication between the valve chamber T and the inlet passage W. The valve *f* carries a flange *h* which lies within the enlarged portion U of the valve chamber and the forward surface of the valve *f* serves as an actuating surface *j* against which pressure fluid intermittently acts for opening the said valve *f*.

In the front end of the valve *f* is a port *k* through which pressure fluid flows to the front inlet passage W. The port *k* also constantly supplies pressure fluid to a leak passage *o* which opens into a trip passage *p* in the valve chest and in the cylinder A. The rear end of the trip passage *p* opens into the rear end of the chamber Z and with its front end into the piston chamber B at a point forwardly of the exhaust port D. The trip passage *p* also has a branch *q* into which the leak passage *o* opens and said passage *q* in turn opens into the front end of the enlarged portion U of the valve chamber.

The operation of the device is as follows: Upon the admission of pressure fluid into the valve chamber T such pressure fluid will act against the pressure surfaces *d* and *g* of the valves *c* and *f* respectively and will simultaneously actuate said valves outwardly. This movement of the valve *c* will open the inlet passage X so that pressure fluid will enter the rear end of the piston chamber B to actuate the piston C forwardly against the working implement F.

By actuating the valve *f* outwardly communication between the port *k* in the valve and the front inlet passage W will be cut off. Pressure fluid will, however, flow from the port *k* into the leak passage *o* and thence into the trip passage *p*.

While the piston C is still rearwardly of the exhaust port D the pressure fluid flowing into the trip passage *p* will flow through the exhaust port D to the atmosphere. As the piston C moves forwardly and shortly prior to its impact against the working implement said piston will cover the trip passage *p* so that pressure fluid flowing into the trip passage *p* will thereafter be entrapped therein and will act against the actuating surfaces *e* of the valve *c* and *j* of the valve *f*.

The entrapped fluid acting against these surfaces will actuate the valves toward each other immediately prior to the delivery of the blow of the hammer piston against the working implement.

In the new positions of the valves the valve *c* will cut off communication between the valve chamber T and the rear inlet passage X, and the valve *f* will then be opened to permit pressure fluid to flow directly from the valve chamber T through the port *k* and the enlarged portion U of the valve chamber into and through the inlet passage W to the front end of the piston chamber B to return the piston C to its initial position.

As the piston proceeds rearwardly it will overrun the exhaust port D and the pressure fluid utilized for retracting the piston, together with that acting against the actuating surfaces *e* and *j* of the valves, will be exhausted to the atmosphere. The pressure fluid acting against the pressure surfaces *d* and *g* of the valves will then act to again move the valves outwardly to their initial positions.

I claim:

1. In a fluid actuated rock drill, the combination of a cylinder having an exhaust port and a piston in the cylinder, a valve chest having a valve chamber and a supply passage constantly introducing pressure fluid into the intermediate portion of the valve chamber, inlet passages leading from the valve chamber to the cylinder, valves in the valve chamber for controlling the inlet passages and being constantly exposed to pressure fluid at their inner ends for throwing said valves simultaneously outward to cover one inlet passage and to uncover the other inlet passage, and a passage connecting the ends of the valve chamber with the cylinder and controlled by the piston to intermittently expose the outer ends of the valves to pressure fluid, thereby simultaneously actuating the valves toward each other and reversing the order of communication between the valve chamber and the inlet passages.

2. In a fluid actuated rock drill, the combination of a cylinder having an exhaust port and a piston in the cylinder, a valve chest having a valve chamber and a supply passage constantly supplying pressure fluid to the valve chamber, front and rear inlet passages leading from the valve chamber to the cylinder, valves in the valve chamber to control the inlet passages and being constantly exposed at their inner ends for throwing said valves simultaneously outward to uncover the rear inlet passage and to cover the front inlet passage, a trip passage connecting the ends of the valve chamber with the cylinder and controlled by the piston to intermittently expose the outer ends of the valves to pressure fluid for simultaneously actuating the valves toward each other to cover the front inlet passage and to uncover the rear inlet

passage, and a leak passage in the valve chest for constantly admitting pressure fluid into the trip passage.

3. In a fluid actuated rock drill, the combination of a cylinder having an exhaust port and a piston in the cylinder, a valve chest having a valve chamber and a supply passage constantly supplying pressure fluid to the valve chamber, front and rear inlet passages leading from the valve chamber to the cylinder, valves in the ends of the valve chamber, pressure surfaces on the inner adjacent ends of the valves constantly exposed to pressure fluid for throwing the valves simultaneously outward for uncovering the rear inlet passage and for covering the front inlet passage, actuating surfaces on the outer ends of the valves and of greater area than the pressure surfaces, a trip passage connecting the ends of the valve chamber with the cylinder and controlled by the piston to intermittently expose the actuating surfaces to pressure fluid for simultaneously actuating the valves toward each other to uncover the front inlet passage and to cover the rear inlet passage, a leak passage in the valve chest for constantly admitting pressure fluid into the trip passage, and a port in one valve through which pressure fluid flows to one inlet passage and to the leak passage.

4. In a fluid actuated rock drill, the combination of a cylinder having an exhaust port and a piston in the cylinder, a valve chest having a valve chamber and a supply passage constantly supplying pressure fluid to the valve chamber, a rear inlet passage leading from the valve chamber and at a point rearwardly of the supply passage to the rear end of the cylinder, an imperforate valve controlling said inlet passage, a front inlet passage leading from the front end of the valve chamber to the front end of the cylinder, a valve in the front end of the valve chamber controlling the front inlet passage and having a port through which pressure fluid flows to the front inlet passage, pressure surfaces on the adjacent ends of the valves constantly exposed to pressure fluid for throwing the valves simultaneously outward to uncover the rear inlet passage and to cover the front inlet passage, actuating surfaces on the outer ends of the valves and of greater area than the pressure surfaces, a trip passage connecting the ends of the valve chamber with the cylinder and controlled by the piston to intermittently expose the actuating surfaces to pressure fluid for simultaneously actuating the valves toward each other, and a leak passage in the valve chest constantly conveying pressure fluid from the port in the valve to the trip passage.

In testimony whereof I have signed this specification.

WILLIAM A. SMITH, JR.