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VALVE MECHANISM FOR ROCK DRILLS

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2 Sheets-Sheet 1

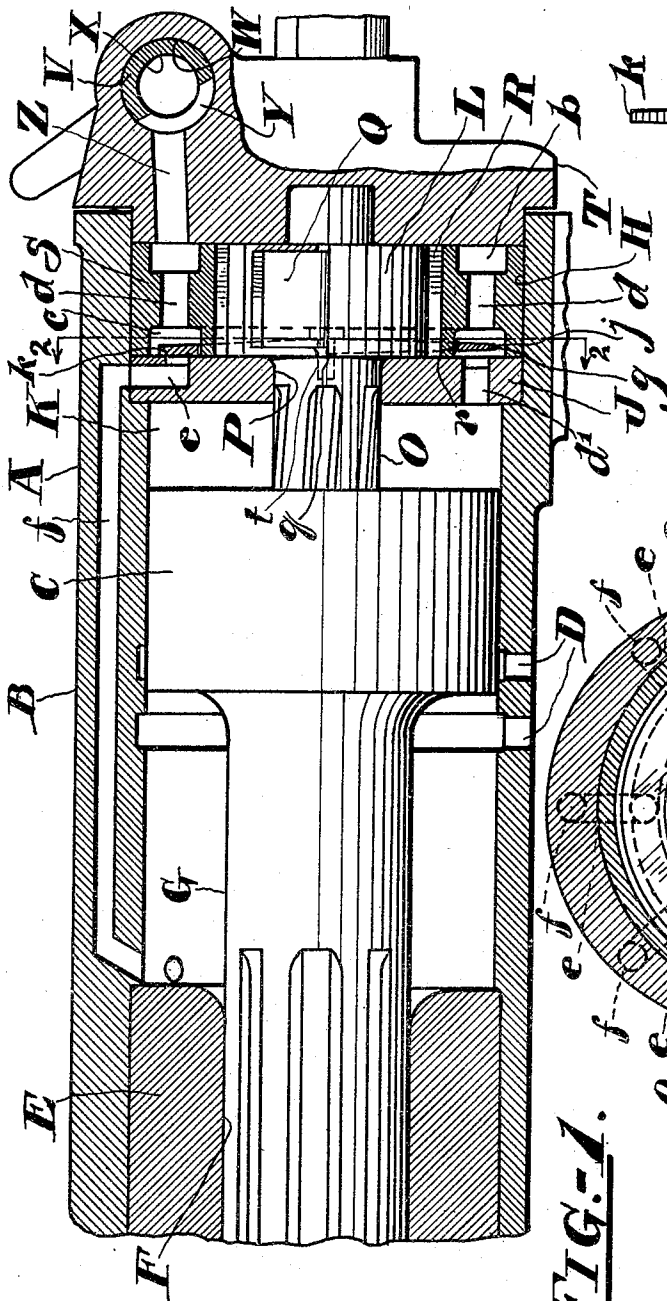


FIG. 1.

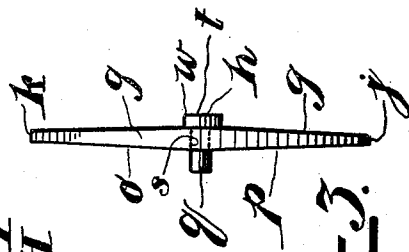


FIG. 3.

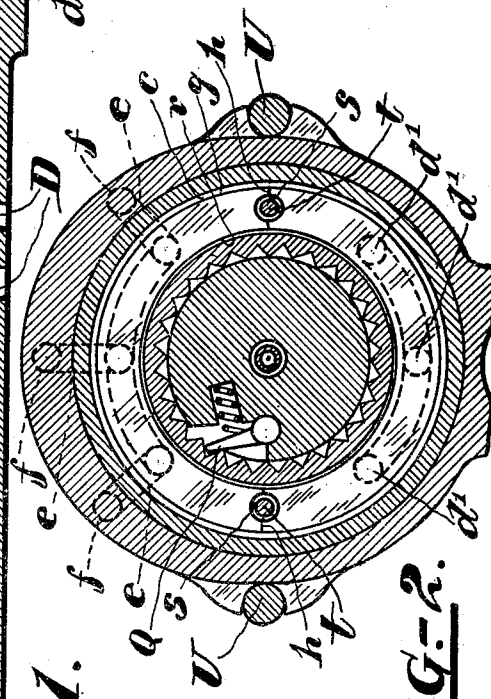


FIG. 2.

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2 Sheets-Sheet 2

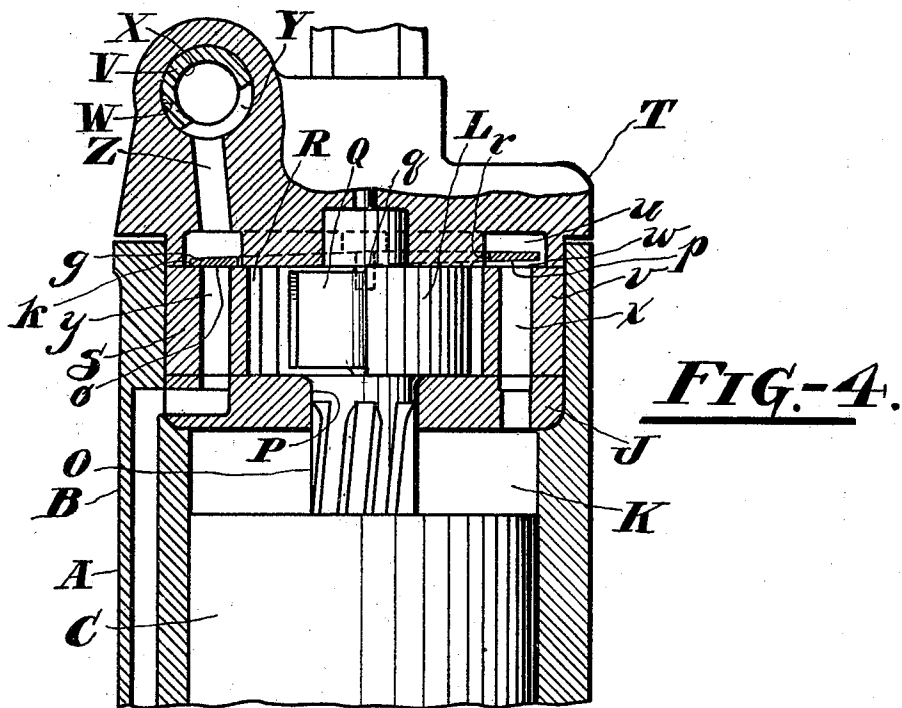


FIG.-4.

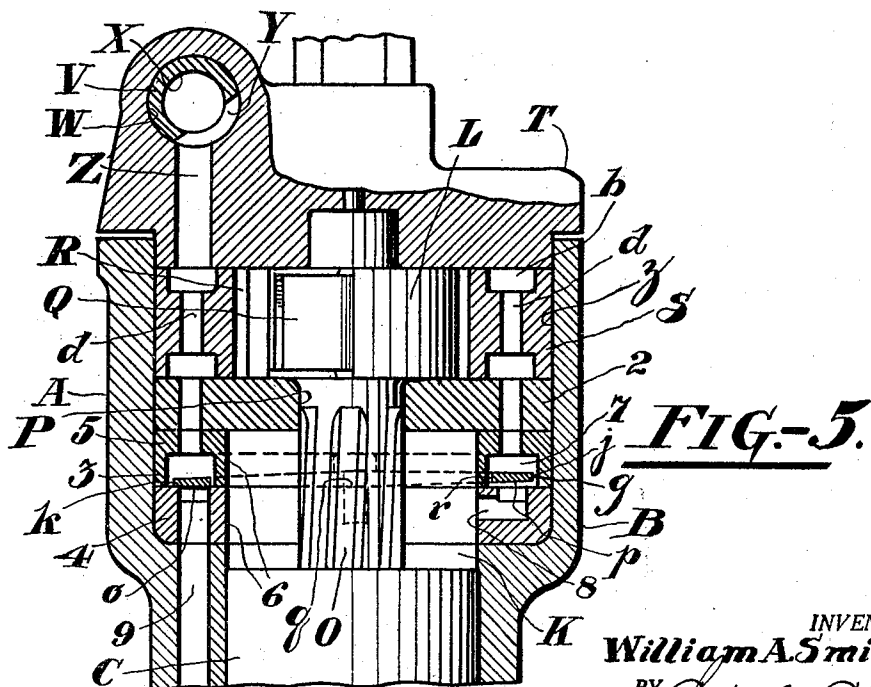


FIG.-5.

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VALVE MECHANISM FOR ROCK DRILLS

Application filed September 7, 1928. Serial No. 304,563.

This invention relates to fluid actuated rock drills, but more particularly to a valve mechanism intended to distribute the pressure fluid to the drill cylinder.

The objects of the invention are to obtain maximum admission of pressure fluid to the cylinder with a minimum lift of the valve, to maintain the weight of the rock drill to a minimum, and to eliminate the use of a multiplicity of parts in devices of this character.

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

In the drawings accompanying the specification and in which similar reference characters refer to similar parts,

Figure 1 is a longitudinal sectional elevation of a portion of a rock drill having the invention applied thereto,

Figure 2 is a transverse view taken through Figure 1 on the line 2—2 looking in the direction indicated by the arrows,

Figure 3 is a side elevation of the valve,

Figure 4 is a sectional elevation of the rearward end of a rock drill showing a modification of the invention, and

Figure 5 is a similar view showing another modified form of the invention.

Referring to the drawings, the invention is shown embodied in a rock drill A having a cylinder B in which is disposed a reciprocatory hammer piston C. The cylinder B is in this instance provided with a pair of free exhaust ports D which are controlled by the piston C. A closure is provided in the form of a front cylinder washer E which may be disposed in the front end of the cylinder B and has a bore F to slidably receive a fluted extension G of the hammer piston C.

In the rearward end of the cylinder B is an enlarged bore H for the reception of a back cylinder washer J which acts as a closure for the rearward end of a piston chamber K in the cylinder B. In addition to the functions stated the back cylinder washer J also acts as a seat for the head L of a rifle bar O. The rifle bar O may be of a well known type which slidably interlocks with the piston C in the usual manner and extends

rotatably through a bore P in the back cylinder washer J.

The head L of the rifle bar O carries the usual spring pressed pawl or pawls Q, only one of which is shown for the purpose of illustration, for engagement with teeth R of a rotation ratchet S which encircles the head L and, like the head L, is also seated on the back cylinder washer J. Although no specific means are shown for securing the back cylinder washer J and rotation ratchet S in the bore H, it is to be understood that these elements may be suitably secured against rotation with respect to each other or with respect to the cylinder B in any well known manner.

The rock drill A has the usual back head T which projects with its front end into the bore H and bears against the rearward end of the rotation ratchet S. The back head T may be securely clamped in operative position by means of side bolts U disposed on opposite sides of the rock drill A.

In the construction shown, the back head T serves as a housing for a throttle valve V which may be disposed rotatably in a valve chamber W. The throttle valve V has a central chamber X which may be in constant communication with a source of pressure fluid supply. In the wall of the throttle valve V is a port Y adapted to register with a passage Z in the back head T leading to an annular supply reservoir b located in this instance in the rearward end of the rotation ratchet S.

In accordance with the practice of the invention, the rotation ratchet S also serves as a valve chest and to this end said rotation ratchet is provided with an annular groove in its forward end and in the same transverse plane as the head L to form a valve chamber c. Preferably the valve chamber c is of substantially the same proportions as the supply reservoir b so that whenever one side of the teeth R becomes worn or damaged the rotation ratchet may be reversed to provide new seating surfaces for the pawls Q. A passage or passages d in the rotation ratchet S serve to convey pressure fluid from the supply reservoir b to the valve chamber c. By

forming the valve chamber *c* in the forward end of the rotation ratchet *S*, the back cylinder washer *J* acts as a closure for one side of the valve chamber.

5 Leading from the valve chamber *c* through the back cylinder washer *J* is a rearward inlet passage *d'* for conveying pressure fluid to the rearward end of the piston chamber *K*. Similarly, an inlet passage or passages *e* are
10 formed in this instance in the back cylinder washer *J* to convey pressure fluid to the front end of the piston chamber and, in the construction shown, a passage *f* in the cylinder *B* forms a continuation of the inlet passage *e*.
15 The distribution of pressure fluid to the ends of the piston chamber *K* is effected by a valve *g* disposed in the valve chamber *c*. The valve *g* is of ring shape and of greater thickness at its transverse median line *h* than at the outer wing portions *j* and *k* which are
20 adapted to overlie the inlet passages *d'* and *e* respectively. The valve *g* accordingly has seating surfaces *o* and *p* which converge to form an apex *q* on the transverse median line of the valve and whereon said valve is adapted
25 to rock from one limiting position to another. The outer or maximum diameter of the valve is preferably somewhat smaller than the maximum diameter of the valve chamber *c*
30 so that pressure fluid may flow freely over the outer edge of the valve into the inlet passages.

In order to insure a maximum admission of pressure fluid into the inlet passages with
35 a minimum lift of the valve, said valve is provided with a bore *r* of somewhat greater diameter than the minimum diameter of the valve chamber so that the pressure fluid from the valve chamber may also flow over the inner
40 edge of the valve into the inlet passages.

As will be observed, the depth of the valve chamber *c* is in this instance greater than the portion of maximum thickness of the valve *g*, as for instance, at the transverse
45 median line *h*. In order therefore to prevent the valve from being lifted bodily from its seat by the force of the pressures used for oscillating the valve, said valve is provided with apertures *s* on the transverse median
50 line to receive dowel pins *t* having heads *u* which serve to maintain the apex *q* in contact with the back cylinder washer *J*. The dowel pins *t* in this instance are seated in the back cylinder washer *J*.

55 The operation of the device is as follows: With the throttle valve *u* in the open position, pressure fluid flowing into the passage *e* from the supply reservoir *b* will pass through the supply passages *d* into the valve chamber
60 *c*. Assuming the valve to be in the position illustrated in Figure 1, pressure fluid will thence flow over the raised end *j* of the valve through the inlet passage or passages *d'* into
65 the rearward end of the piston chamber *K* to

actuate the piston *C* forwardly in the direction of the working implement. As the piston *C* proceeds in a forwardly direction, the exhaust ports *D* will be covered thereby and the air in the front end of the piston chamber *K* will then be compressed. The compression
70 thus created will flow through the inlet passages *f* and *e* and will act against the seating surface of the valve.

Shortly prior to the instant of delivery
75 of the blow of the piston *C* against the working implement, the exhaust ports will be uncovered by the piston to enable the pressure fluid utilized for actuating the piston *C* forwardly to escape to the atmosphere. This
80 will cause an abrupt drop in pressure beneath the raised end *j* of the valve and the pressure fluid then flowing into the inlet passage *d'* will create a suction on the end *j* which, together with the compression acting against
85 the seated end of the valve, will rock the valve to the other limiting position.

In this reverse position of the valve, the end *j* will close the inlet passage *d'* and the end *k* of the valve will be raised to admit pressure
90 fluid from the valve chamber *c* through the inlet passage *e* and the passage *f* into the front end of the piston chamber *K*. The pressure fluid thus admitted to the front end of the piston chamber *K* will reverse the
95 movement of the piston *C* and, as the piston *C* travels rearwardly, the exhaust port *D* will be covered thereby so that the air in the rearward end of the piston chamber *K* will be compressed and will act against the seating surface *p*. Such compression will, however, not
100 be sufficient to tilt the valve to its initial position until the free exhaust ports *D* are uncovered. When the ports *D* are uncovered there will be a drop in pressure beneath the raised end *j* of the valve and the force of the suction created by the air flowing over the inner and outer edges of the raised end *j* together with the pressure of compression will then again rock the valve *g* to its initial position, thus completing the cycle of operation.

In the modified form of the invention illustrated in Figure 4, the back head *T* is provided at its forward or inner end with an annular groove to form a valve chamber *u*. The valve chamber *u* is of such proportions that its minimum diameter exceeds in size the minimum diameter of the rotation ratchet *v* which forms in this instance a closure for
115 the front end of the valve chamber *u* and also a seat *w* for the valve *g*. In this construction rearward inlet passages *x* extend through the rotation ratchet *S* and the back cylinder washer *J* to convey pressure fluid from the valve chamber *u* to the rearward end of the piston chamber *K*. A front inlet passage *y* is likewise formed in the rotation ratchet *S*, in the back cylinder washer *J* and in the cylinder *B* for conveying pressure fluid from the valve
120 125 130

chamber *u* to the front end of the piston chamber *K*.

The manner of securing the valve in the valve chamber *u* may be like that previously described, and the operation of the valve is identical with that described in connection with the previous modification. The present modification differs only in the essential respect that the back head *T* serves the function of the valve chest and the rotation ratchet *S* serves as a seat for the valve.

In the modification illustrated in Figure 5, a bore *z* is formed in the rearward end of the cylinder *B* and is of such proportions as to accommodate a rotation ratchet *S*, a back cylinder washer 2, and a valve chest designated generally by 3. The back cylinder washer 2 is interposed between the rotation ratchet *S* and the valve chest, said valve chest being disposed in the innermost end of the bore *z*. The valve chest 2 in this instance comprises a pair of plates 4 and 5 which are provided with central bores 6 to form a continuation of the piston chamber so that the piston *C* may extend slidably into the said bore 6.

In this form of construction the plate 5 is provided with an annular groove to form a valve chamber 7 for the reception of the ring valve *g*, and the plate 4 forms a closure for the front end of the valve chamber.

The admission of pressure fluid to the rearward end of the piston chamber is effected through a rearward inlet passage 8 in the plate 4 and opening into the bore 6. The admission of pressure fluid to the front end of the piston chamber *K* is effected through a passage 9 leading from the valve chamber through the plate 4 and the cylinder *B* to the front end of the piston chamber. In this modification, the supply passages *d* are formed in the rotation ratchet *S*, the back cylinder washer 2, and in the plate 5 for conveying pressure fluid from the supply reservoir *b* to the valve chamber 7.

A few of the desirable advantages of the present invention are that the valve may be of light weight. This is made possible by the fact that the pressure fluid is admitted to the valve chamber over both the inner and outer edges of the valve. The valve therefore distinguishes from known valves of this type in which the pressure fluid is admitted only over the outer edge of the valve and in which it becomes necessary for the valve to travel a considerable distance from the seat in order to obtain an immediate volume of pressure fluid necessary to insure the best operation of the drill. Another desirable advantage of this type of valve is that it lends itself readily to a variety of positions in the rock drill. This is advantageous since it enables the elimination of a multiplicity of parts and therefore serves to reduce the weight of the drill and, if desired, to greatly shorten the length of the drill.

I claim:

1. In a fluid actuated rock drill, the combination of a cylinder and a piston in the cylinder, an exhaust port for the cylinder, a valve chest having a valve chamber, inlet passages leading from the valve chamber to the cylinder, an oscillatory ring valve in the valve chamber to control the inlet passages and having an outer edge over which pressure fluid flows to the inlet passages, and a bore in the valve to permit the flow of pressure fluid through the valve to the inlet passages.

2. In a fluid actuated rock drill, the combination of a cylinder and a piston in the cylinder, an exhaust port for the cylinder, a valve chest having an annular valve chamber, inlet passages leading from the valve chamber to the cylinder, an oscillatory ring valve in the valve chamber to control the inlet passages and having an outer edge over which pressure fluid flows to the inlet passages, and a bore in the valve and of larger diameter than the minimum diameter of the valve chamber to permit the flow of pressure fluid through the valve to the inlet passages.

3. In a fluid actuated rock drill, the combination of a cylinder and a piston in the cylinder, an exhaust port for the cylinder, a valve chest having an annular valve chamber, inlet passages leading from the valve chamber to the cylinder, a valve in the form of a ring in the valve chamber to control the inlet passages and having inner and outer edges over which pressure fluid may flow into the inlet passages, and seating surfaces on the valve converging to form apices whereon said valve is adapted to rock from one limiting position to another.

4. In a fluid actuated rock drill, the combination of a cylinder and a piston, an exhaust port for the cylinder, rotation mechanism for the piston comprising a rifle bar and a head thereon, a rotation ratchet encircling the head, a valve chamber in the rotation ratchet, inlet passages leading from the valve chamber to the cylinder, and a valve in the valve chamber controlling the inlet passages.

5. In a fluid actuated rock drill, the combination of a cylinder and a piston, an exhaust port for the cylinder, rotation mechanism for the piston comprising a rifle bar and a head thereon, a rotation ratchet encircling the head, an annular valve chamber in the rotation ratchet and lying in the same transverse plane as the head, inlet passages leading from the valve chamber to the cylinder, and a valve in the form of a ring in the valve chamber for controlling the inlet passages.

6. In a fluid actuated rock drill, the combination of a cylinder and a piston, an exhaust port for the cylinder, rotation mechanism for the piston comprising a rifle bar and a rotation ratchet, an annular valve chamber in the rotation ratchet, inlet passages leading from the valve chamber to the cylinder, a valve in

the form of a ring in the valve chamber to control the inlet passages and having inner and outer edges over which pressure fluid may flow into the inlet passages, and seating surfaces on the valve converging to form apices whereon said valve is adapted to rock from one limiting position to another.

7. In a fluid actuated rock drill, the combination of a cylinder and a piston, an exhaust port for the cylinder, rotation mechanism for the piston comprising a rifle bar and a rotation ratchet, an annular valve chamber in the rotation ratchet, inlet passages leading from the valve chamber to the cylinder, a valve in the form of a ring in the valve chamber to control the inlet passages and having inner and outer edges over which pressure fluid may flow into the inlet passages, seating surfaces on the valve converging to form apices whereon said valve is adapted to rock from one limiting position to another.

8. In a fluid actuated rock drill, the combination of a cylinder and a piston, an exhaust port for the cylinder, rotation mechanism for the piston comprising a rifle bar and a rotation ratchet, an annular valve chamber in the rotation ratchet, inlet passages leading from the valve chamber to the cylinder, a plate forming a seat for the rotation ratchet and acting as a closure for one end of the valve chamber and the cylinder, a valve in the form of a ring in the valve chamber to control the inlet passages and having inner and outer edges over which pressure fluid may flow into the inlet passages, and seating surfaces on the valve converging to form apices whereon said valve is adapted to rock from one limiting position to another.

9. In a fluid actuated rock drill, the combination of a cylinder and a piston, an exhaust port for the cylinder, rotation mechanism for the piston comprising a rifle bar having a head, a rotation ratchet in the cylinder encircling the head and having an annular groove in each end, one of said grooves serving as a supply reservoir and the other groove serving as a valve chamber, passages connecting the grooves, inlet passages leading from the valve chamber to the cylinder, and a valve in the valve chamber controlling the inlet passages.

10. In a fluid operated tool, the combination with a cylinder member having a piston chamber and a cell in rear of the piston chamber, of a piston in the piston chamber, a plug fitting the cell and having a valve chamber and a ratchet chamber, an automatic distributing valve in the valve chamber controlling the supply of motive fluid to the piston chamber, and a rifle bar having ratchet mechanism in the ratchet chamber.

11. In a fluid operated tool, the combination with a cylinder member having a piston chamber and a cell in rear of the piston chamber, of a piston in the piston chamber, a plug

fitting the cell and having a valve chamber and a second chamber provided with ratchet means on its peripheral wall, an automatic distributing valve in the valve chamber controlling the supply of motive fluid to the piston chamber, and a rifle bar having ratchet mechanism in the second chamber coacting with the said ratchet means on the wall of said chamber.

In testimony whereof I have signed this specification.

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