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DRILLING MECHANISM

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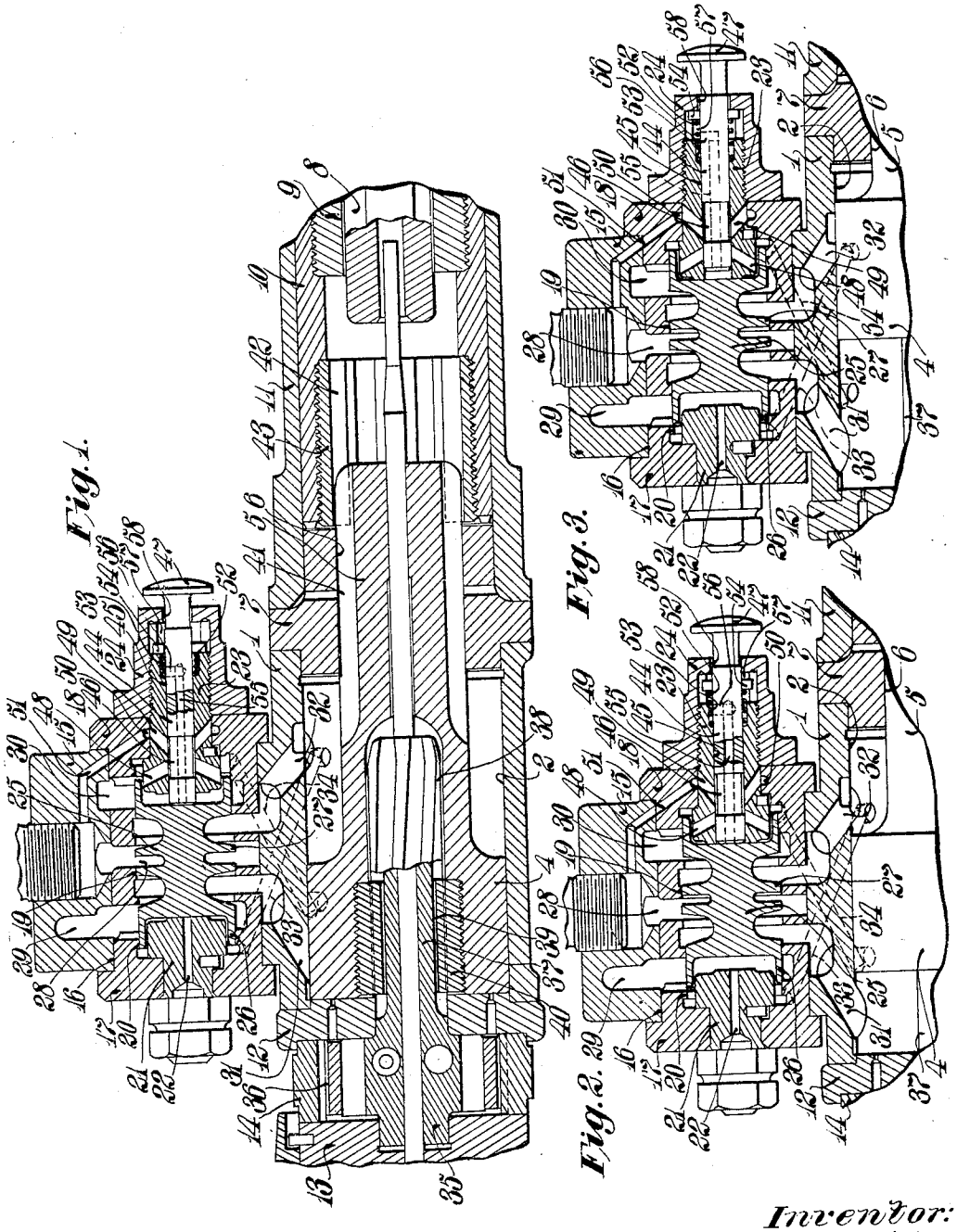

Fig. 1.

Fig. 3.

Fig. 2.

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DRILLING MECHANISM.

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This invention relates to drilling mechanisms, and more particularly to hole cleansing means for pressure fluid actuated rock drills of the impact type.

In rock drills of the impact type having a pressure fluid operated hammer motor for actuating the drill steel, various devices have been provided for holding the automatic fluid distribution valve immovable to effect a hole cleansing operation. Heretofore in numerous instances manually operable push buttons or other similar devices were utilized for moving and holding the automatic fluid distribution valve to accomplish this hole cleansing function. However (it has been found that such push buttons are exceedingly difficult to operate due to the relatively high pressure which resists movement of the valve and in certain instances the resisting pressure is so great and the distribution valve hammers so excessively on the push button that manual operation of the same is practically impossible.

An object of this invention is to provide improved means whereby the automatic fluid distribution valve may be moved and held in position with facility. Another object is to provide improved valve controlling means which can be actuated and held without material resistance and without the necessity of manually shifting the valve against the resisting throwing pressure. Yet another object of this invention is to provide improved manually operable means for supplying a continuous supply of pressure fluid to act on one end of the distribution valve prior to the manual shifting of the valve thereby substantially counterbalancing the throwing pressure acting on the valve, and thereby materially decreasing the exertion necessary on the part of the operator to shift and hold the valve immovable during the hole cleansing operation. These and other objects and advantages of this invention will, however, hereinafter more fully appear.

In the accompanying drawings I have shown for purposes of illustration one form which the invention may assume in practice.

In this drawing,—

Fig. 1 is a central, longitudinally extending, vertical sectional view through a rock drill embodying the improved construction.

Figs. 2 and 3 are detail sectional views illustrating the automatic fluid distributing valve and controlling means therefor in different positions.

In this illustrative construction there is shown a rock drill of the pressure fluid actuated, impact type comprising a cylinder 1 having a bore 2 in which a piston 4 is reciprocably mounted. The piston 4 is provided with a forwardly projecting striking bar 5 reciprocably mounted within a bore 6 formed within a usual front cylinder head or washer 7 and this striking bar is adapted to impart a series of blows on the shank of a hollow drill steel 8. The drill steel 8 is mounted in a usual manner within a chuck bushing 9 secured to a chuck sleeve 10 rotatably mounted within a usual chuck housing 11. As illustrated, the rear end of the cylinder bore is closed by a washer 12 while interposed between this washer and a rear head member 13 is a usual ratchet ring 14. The chuck housing 11, front cylinder washer 7, cylinder 1, rear washer 12, rear head 13 and the ratchet member 14 are held in operative assembled relation in any suitable manner, for instance, by usual side rods or bolts.

In this illustrative construction the cylinder 1 has preferably formed integral therewith a laterally positioned valve chest 15 having a bore 16 disposed parallel with the cylinder bore 2. Disposed within the bore 16 are sleeves 17 and 18 each having an enlarged central bore 19 and a reduced outer bore 20. As shown in Fig. 1, the sleeve 17 has suitably secured thereto a usual buffer member 21 having a central vent passage 22 while secured to the sleeve 18 is a similar buffer member 23 held in position by a suitable nut member 24. Reciprocable within the bores 19 and 20 formed in the sleeves 17 and 18 is an automatic fluid distribution valve 25 herein of the well-known three-spool, differential type having reduced end spools 26 and an enlarged central spool 27, the valve 25 being alternatively engageable with the huffer members 21 and 23 during reciprocation thereof. The central spool 27 of the valve shown controls a central inlet port 28 while the end spools 26 control usual main exhaust ports 29 and 30 formed on opposite sides of the inlet port 28. Motive fluid for actuating the piston 4 is supplied to the rear and front ends of the cylinder bore 2 through supply passages 31 and 32 respectively communicating with the valve chamber on opposite sides of the central inlet port 28. The action of the valve 25 is controlled by throwing passages 33 and 34, the former connecting the front end of the cylin-

der bore with the bore at the rear end of the valve, while the latter connects the rear end of the cylinder bore with the bore at the front end of the valve. These throwing passages are provided for alternatively admitting pressure fluid to the opposite ends of the valve to effect reciprocation thereof, the pressure admitted through the passage 33 throwing the valve forwardly while the pressure admitted through the passage 34 throws the valve rearwardly, all in a well known manner.

The drill steel 8 is adapted to be intermittently rotated during reciprocation of the hammer piston and this is accomplished by a usual ratchet and pawl mechanism including a pawl carrier 35 carrying usual pawls which cooperate with internal ratchet teeth 36 formed within the ratchet ring 14. Herein preferably formed integral with this pawl carrier and projecting forwardly through the washer 12 and within the rear end of the cylinder bore is a rotation bar 37 having spiral grooves 38 on its periphery. The spiral grooves 38 cooperate with spiral lugs 39 carried by a rifle nut 40 threadedly connected within the rear end of the hammer piston 4. As shown, the striking bar 5 of the piston has formed on the periphery thereof straight longitudinally extending flutes or grooves 41 which cooperate with straight lugs 42 carried by a chuck nut 43 threadedly connected to the chuck sleeve 10. During forward movement of the hammer piston 4 the pawls of the pawl carrier slip over the teeth on the ratchet ring 14 and consequently the hammer piston delivers an unimpeded blow to the shank of the drill steel 8. Upon the return stroke of the hammer piston the pawls engage the ratchet teeth 36 thereby preventing rotation of the rotation bar 37 and consequently during this return stroke of the piston 4 the latter is slightly rotated. Rotation of the hammer piston is transmitted through the straight groove 41 in the striking bar, the straight groove 42 on the chuck nut, the sleeve 10 and the chuck bushing 9, and consequently the drill steel is rotated. The construction described above is usual in rock drills of the type disclosed and further description of the same is not considered necessary.

The improved controlling means for moving and holding the distribution valve 25 immovable to effect a hole cleansing operation comprises a reciprocable plunger valve 44 arranged coaxially with the longitudinal axis of the valve 25 and slidably mounted within a bore 45 formed within the front buffer member 23. The valve 44 is externally grooved at 46 and is provided at its outer end with a conveniently located push button 47. As shown, the buffer member 23 has formed therein radial ports 48 connecting the bore 45 with the bore 20 formed within the sleeve 18 while also formed in this buffer member are radial ports 49 which connect the bore 45 with an annular groove 50 formed within the sleeve 18. The groove 50 is connected by a passage 51 to the motor inlet 28. In this instance the valve 44 is held in its released or inoperative position as shown in Fig. 3 by means of a coil spring 52 seated within a bore 53 formed in the buffer member 23 and engaging a transverse pin 54 carried by the valve. The valve 44 has formed therein a central passage 55 which connects the bore at the forward end of the valve 25 through a radial passage 56 with a chamber 57 formed within the nut member 24, this chamber being vented to atmosphere through a passage 58.

In the normal operation of the rock drill pressure fluid enters through inlet passage 28 and with the valve in the position shown in Figs. 2 and 3 the fluid flows past the rear surface of the central spool 27 of the valve to the rear end of the cylinder bore 2 where it acts on the rear surface of the piston 4 and moves the piston forwardly to strike a blow on the drill steel 8. The exhaust from the forward end of the cylinder bore 2 passes out through the passage 32 through the exhaust passage 30 to atmosphere. The valve 25 is held in its forward position by reason of the larger effective area of the central spool. When the piston 4 uncovers the throwing passage 34 pressure fluid is admitted from the cylinder bore to the forward end of the valve and consequently the latter is thrown rearwardly to the position shown in Fig. 1. Pressure fluid now enters the forward end of the cylinder bore through inlet passage 28 past the forward surface of the central spool on the valve and through passage 32 and consequently the hammer piston 4 is moved rearwardly. The exhaust now takes place through passage 31 through the exhaust passage 29 to atmosphere. The vent passage 22 in the buffer 21 and the vent passage 55 in the plunger valve 44 prevent any back pressure from building up in the bores at the ends of the valve and as a result the valve action is materially quickened. As soon as the piston 4 has uncovered the throwing passage 33 the valve 25 is again shifted to its forward position and this cycle continues during the normal operation of the drill.

When it is desired to effect a hole cleansing operation the operator presses against the push button 47 and moves the valve 44 rearwardly from the position shown in Fig. 3 to the position shown in Fig. 2, the groove 46 connecting the ports 48 and 49 and consequently pressure fluid is admitted from the inlet port 28 to the chamber at the forward end of the valve 25. A pressure is therefore built up against the forward surface of the valve 25 which counteracts the opposing throwing pressure on the rear surface of the valve. Upon further rearward movement of the valve 44 the inner end of the latter

directly engages the valve 25, thereby permitting the latter to be manually shifted against the relatively small opposing pressure acting on the central spool 27. After the valve has been moved to the position shown in Fig. 1, it is necessary to manually hold the same against the opposing pressure. When the valve 25 is held in its retracted position as shown in Fig. 1 pressure fluid flows from the inlet 28, past the forward surface of the central spool 27 of the distribution valve and through the passage 32 to the forward end of the cylinder bore. The continuous pressure flowing to this end of the cylinder bore forces the hammer piston 4 rearwardly against the rear cylinder washer 12 and consequently fluid flows through the flutes 41 in the striking bar 5 through the chuck nut 43 and thence through the bore in the drill steel 8 to the drill hole. As soon as the manual pressure on the push button is released the valve 44 will return to its inoperative position and the valve 25 will then resume its normal operation and the drill will again function in the normal manner. These and other uses and advantages of this invention will be clearly apparent to those skilled in this art.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a fluid actuated rock drill of the hammer type, the combination of a cylinder and piston reciprocable therein, a valve chest, and a fluid distribution valve therein controlling both the supply and exhaust of pressure fluid for said cylinder, valve throwing passages between opposed spaces in the valve chest and the cylinder bore for supplying pressure fluid for throwing said valve, and manually operable means for initially admitting pressure fluid to one of said valve chest spaces whereby the pressure tending to throw the valve is counteracted and for thereafter directly engaging the valve to shift and hold the same immovable.

2. In a fluid actuated rock drill of the hammer type, the combination of a cylinder and a piston reciprocable therein, a valve chest and a fluid distribution valve therein controlling both the supply and exhaust of pressure fluid for said cylinder, valve throwing passages between opposed spaces in the valve chest and the cylinder bore for supplying pressure fluid for throwing said valve, and manually operable means including an auxiliary valve for initially admitting pressure fluid from the pressure fluid supply to one of said distribution valve chest spaces whereby the pressure tending to throw the distribution valve is counteracted and for thereafter directly engaging the valve to shift and hold the same immovable at one end of its travel.

3. In a fluid actuated rock drill of the hammer type, the combination of a cylinder having a bore, a hammer piston in said cylinder having flutes in its striking bar communicable with the cylinder bore, a valve chest on said cylinder, a valve in said chest, supply passages for admitting pressure fluid from said chest to said cylinder, throwing passages for admitting pressure fluid from said cylinder to said chest at each end of said valve for throwing the latter, and manually operable means for initially establishing communication between the pressure fluid supply and one end of said valve whereby the pressure tending to throw said valve is counteracted, and for thereafter directly engaging the valve to shift and hold the same immovable whereby the piston is held in its rearward position thus permitting pressure fluid to flow from the front end of the cylinder through the flutes in said striking bar to cleanse the drill hole.

4. In a fluid actuated rock drill of the hammer type, the combination of a cylinder having a bore, a hammer piston in said cylinder having flutes in its striking bar communicable with the cylinder bore, a valve chest on said cylinder, a fluid distributing valve in said chest, supply passages for admitting pressure fluid from said chest to said cylinder, throwing passages for admitting pressure fluid from said cylinder to said chest at each end of said valve for throwing the latter, and manually operable means including an auxiliary valve for initially establishing communication between the pressure fluid supply and one end of said distributing valve whereby the pressure tending to throw the distributing valve is counteracted and for thereafter directly engaging the distributing valve to shift and hold the same immovable whereby the piston is held in its rearward position thus permitting pressure fluid to flow from the front end of said cylinder through the flutes in said striking bar to cleanse the drill hole.

5. In a percussive tool, a cylinder, a piston reciprocable therein, fluid distribution means for effecting reciprocation of said piston including an automatic fluid distributing valve and means for effecting operation of said valve, and manually operable means for supplying pressure fluid continuously to act on one end of said valve and for thereafter directly engaging the valve to shift and hold the latter in one position to effect a hole blowing operation.

6. In a percussive tool, a cylinder, a piston reciprocable therein, fluid distribution means communicating with said cylinder for effect-

ing reciprocation of said piston including a fluid supply port, a valve chest having end bores, an automatic fluid distributing valve disposed in said chest and having end spools slidable in said end bores and means for effecting operation of said valve, and manually operable means for supplying pressure fluid continuously to act on one end of said valve whereby the pressure tending to throw the valve is counteracted and for thereafter directly engaging the valve to shift and hold the latter in one position including a passage formed in the valve chest connecting said supply port with one of said end bores, and a manually operable valve for controlling fluid flow through said passage.

7. In a percussive tool, the combination with a cylinder, a piston operating therein, a hollow drill steel actuated by said piston, and means for admitting fluid to said drill steel when said piston is at the limit of its rearward movement, and a pressure fluid actuated valve controlling the reciprocation of said piston, of manually operable means arranged coaxially with said valve for first pneumatically counterbalancing the pressure tending to throw said valve, and means afterwards directly engaging the valve for holding the latter in a position to retract said piston.

8. In a fluid actuated rock drill of the hammer type, the combination of a cylinder and a piston reciprocable therein, a valve chest and a fluid distributing valve therein controlling both the supply and exhaust of pressure fluid for said cylinder, valve throwing passages between opposed spaces in said valve chest and the cylinder bore for supplying pressure fluid for throwing said valve, and manually operable means arranged coaxially with said distributing valve for admitting pressure fluid from the pressure fluid supply to one of said valve chest spaces whereby the pressure tending to throw the valve is counteracted, said means being operative when manually actuated to hold the valve at one end of its travel thus causing the piston to be held at the rearward end of its stroke to permit pressure fluid to flow from the forward end of the cylinder to the drill hole.

9. In a fluid actuated rock drill, the combination of a cylinder and a piston reciprocable therein, fluid distribution means for effecting reciprocation of said piston comprising inlet and exhaust passages for said cylinder, a valve chest and an automatic fluid distributing valve therein controlling said passages, throwing passages connecting the valve chest spaces at each end of said valve with the opposite ends of said cylinder for supplying fluid from said cylinder to throw said valve, and manually operable means including a passage in said valve chest for connecting one of the valve chest spaces with the fluid supply, and a valve arranged coaxially with said distributing valve for admitting pressure fluid through said passage to one end of said distributing valve for counterbalancing the pressure tending to throw said distributing valve and for directly engaging said distrubuting valve to hold the latter immovable to effect a hole blowing operation.

10. In a drilling mechanism, the combination with a cylinder, a piston therein, and a chuck for holding a hollow drill steel in a position to be actuated by said piston and to receive hole cleansing fluid from said cylinder, means for distributing motive fluid to the cylinder to operate said piston, said means including an automatic distributing valve and means for supplying fluid to the valve for shifting the same, means arranged coaxially with said valve for first pneumatically counteracting the pressure tending to throw said valve, and means operative at a later time for mechanically actuating said valve.

11. In a drilling mechanism, the combination with a cylinder, a piston therein, and a chuck for holding a hollow drill steel in a position to be actuated by said piston and to receive hole cleansing fluid from said cylinder, means for distributing motive fluid to the cylinder to operate said piston, said means including an automatic distributing valve and means for supplying fluid to the valve for shifting the same, and means arranged coaxially with said valve for first pneumatically counteracting the pressure tending to throw said valve and later for directly engaging said distributing valve for shifting and holding the same to stop operation thereof and to hold the piston in position to permit fluid to pass from the cylinder into said hollow drill steel.

12. In a fluid actuated rock drill, the combination of a cylinder, a hammer piston in said cylinder, a valve chest on said cylinder, a valve in said chest, supply passages for admitting pressure fluid from the chest to the cylinder, throwing passages for admitting pressure fluid from the cylinder to the chest for throwing said valve, and a manually operable element arranged coaxially with said valve for establishing communication between said fluid supply and one end of said valve to counteract the pressure tending to throw said valve and for mechanically moving the valve against said latter pressure.

13. In a fluid actuated rock drill, the combination of a cylinder, a hammer piston in said cylinder, a valve chest on said cylinder, a valve in said chest, supply passages for admitting pressure fluid from the chest to the cylinder, throwing passages for admitting pressure fluid from the cylinder to the chest for throwing said valve, and manually operable means arranged coaxially with said valve for establishing communication between said fluid supply and one end of said

valve to counteract the pressure tending to throw said valve, said means including a member adapted to directly engage said valve to hold the latter immovable.

14. In a fluid actuated rock drill of the hammer type, the combination of a cylinder and a piston reciprocable therein, a valve chest and distributing valve therein controlling both the supply and exhaust of pressure fluid for the cylinder, valve throwing ports between opposed spaces in the valve chest and the cylinder bore for supplying pressure fluid for throwing said valve, and means for admitting pressure fluid to one valve chest space and for directly engaging the valve whereby the latter is held at one end of its travel and the piston is held at the rearward end of its stroke to effect a hole blowing operation.

15. In a fluid actuated rock drill of the hammer type, the combination of a cylinder and a piston reciprocable therein, a valve chest and distributing valve therein controlling both the supply and exhaust of pressure fluid for the cylinder, valve throwing ports between the opposed spaces in the valve chest and the cylinder bore for supplying pressure fluid for throwing said valve, and an auxiliary valve for establishing communication between one valve chest space and the inlet supply for pneumatically counteracting the pressure tending to throw the distributing valve, said auxiliarly valve being adapted to directly engage the distributing valve whereby the same is held at one end of its travel and the piston is held at the rearward end of its stroke to effect a hole blowing operation.

In testimony whereof I affix my signature.

ELMER G. GARTIN.

CERTIFICATE OF CORRECTION.

Patent No. 1,691,404. Granted November 13, 1928, to

ELMER G. GARTIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 15, before the word "it" strike out the parenthesis and insert a comma, and line 97, for the word "huffer" read "buffer"; page 3, line 66, claim 2, strike out the word "distribution" and insert the same to follow before the word "valve" line 69; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of January, A. D. 1929.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)