Oct. 10, 1933. H. TARDIFF 1,929,457

ROCK DRILL

Filed March 14, 1929

Fig. 1.

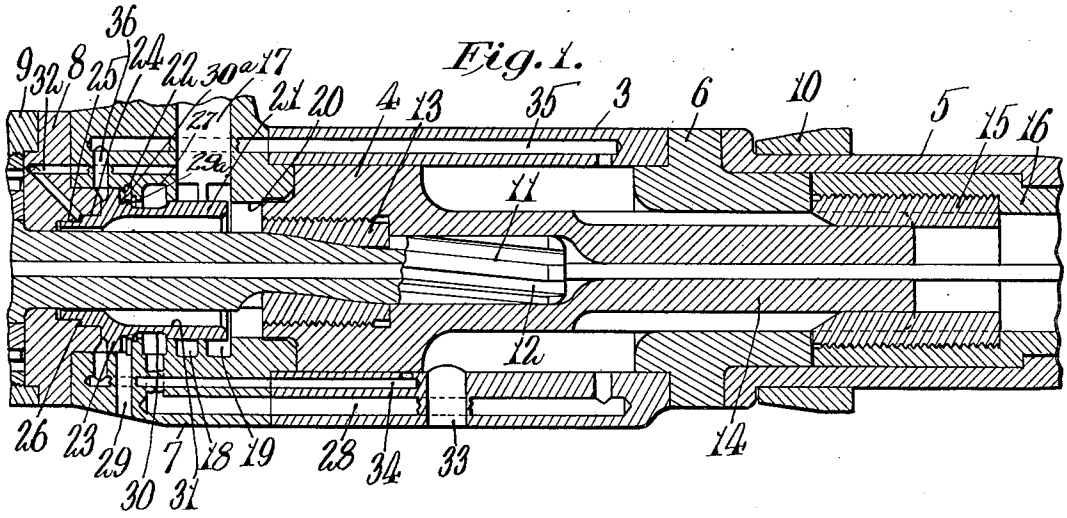
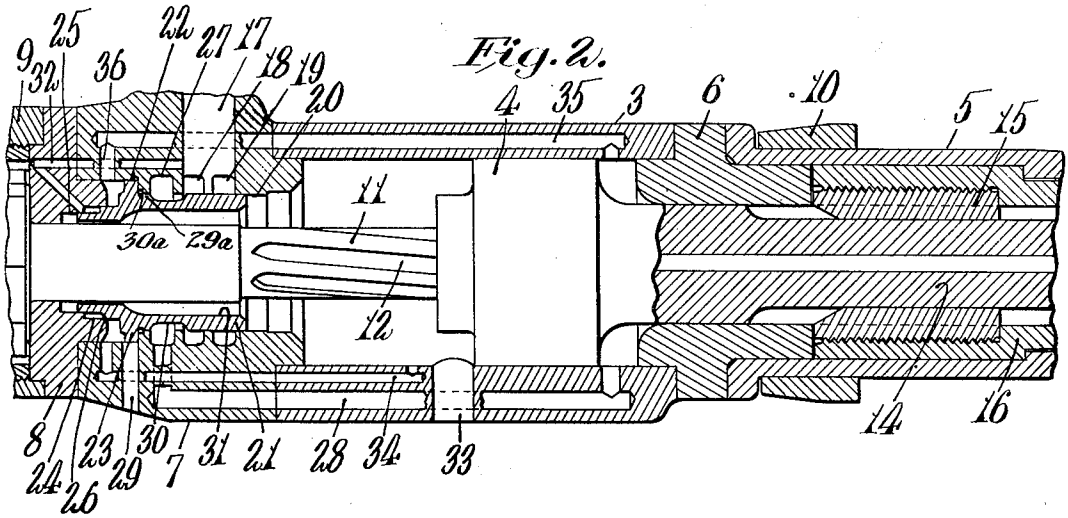


Fig. 2.



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Patented Oct. 10, 1933

1,929,457

UNITED STATES PATENT OFFICE

1,929,457

ROCK DRILL

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Application March 14, 1929. Serial No. 347,046

4 Claims. (Cl. 121—26)

My invention relates to rock drills and particularly to the fluid distribution mechanism thereof.

An object of my invention is to provide an improved valve mechanism for pressure fluid motors. A further object of my invention is to provide improved means for holding the valve of a percussive motor steadily in one extreme position until the time for throwing the valve to the opposite position. A more specific object of my invention is to provide improved means for conducting live fluid to the enlarged flange on a valve of a machine of the same general type as that disclosed in a copending application of Elmer G. Gartin, Serial No. 325,630, filed December 12, 1928. Other objects and advantages of this invention will hereinafter more fully appear.

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

In the drawing,—

Fig. 1 represents a central longitudinal section through a rock drilling motor having the illustrative embodiment of my invention associated therewith.

Fig. 2 is a similar view showing the moving parts in different positions.

The rock drilling machine in connection with which I have illustrated my invention comprises a cylinder 3 in which reciprocates a hammer piston 4 which hammers on a usual rock drill steel (not shown) suitably mounted in a chuck housing 5. A buffer ring 6 is disposed between the chuck housing and the front end of the cylinder and has portions extending into the bores of the cylinder and chuck housing. A valve block 7 is mounted at the rear end of the cylinder and has a portion fitting into the bore of the cylinder to lock the same in position. A rear closure plate 8 and rear head member 9 are mounted rearwardly of the valve block, and the parts of the machine may be held in assembled relation by any suitable means such as longitudinally extending side rods or bolts extending between the rear head member 9 and a collar 10 surrounding the chuck housing. In this machine there is incorporated a well known type of automatic rotation mechanism employing a ratchet mechanism mounted in the rear head and a rifle bar 11 extending centrally through the valve block and into the cylinder. This rifle bar has the usual spiral grooves 12 which cooperate with spiral flutes in a rifle nut 13 to induce relative rotation between the piston and rifle bar upon reciprocation of the piston. Rotation is transmitted to the drill steel by a forwardly projecting striking bar 14 of the piston which has straight lugs interfitting with straight grooves in a chuck nut 15 mounted in a rotatable chuck sleeve 16.

The fluid distribution mechanism for this motor is generally similar to that described in the aforesaid application, and accordingly will be described briefly as to common features. The incoming motive fluid flows through an inlet passage 17 to a pair of twin inlet grooves 18 and 19 formed in the valve block 7. For the purpose of receiving the valve, the valve block has bores of different diameters including a reduced bore 20 for receiving the forward end portion 21 of the valve and an enlarged bore 22 for receiving an enlarged flange 23 on the valve. The plate member 8 also has a plurality of bores 24 and 25, for receiving the rearward end portions of the valve which are formed of the same diameter as the bores 24 and 25, so as to provide a shoulder 26 between the same. A groove 27 in the valve block is in communication with the front end of the cylinder by way of passage 28. One or more exhaust passages 29 open through the valve block from the front end of the enlarged bore 22 to the atmosphere, and the valve is provided with an annular exterior groove 30 for the purpose of alternately connecting the groove 27, leading to the front end of the cylinder, with the inlet groove 18 and exhaust passages 29. Formed in the valve body to the rear of the annular exterior groove 30 is a small annular flange 29^a separated by a small annular groove 30^a from the flange 23 and this flange 29^a fits the reduced bore 20 of the valve chest, the flange 29^a being preferably of the same diameter as the forward end portion 21 of the valve. When the groove 30 is in communication with the exhaust passages 29, the flange 29^a is moved rearwardly out of its bore and the fluid flows to exhaust past the forward face of the flange 29^a. When the valve is in its forward position the communication between the groove 30 and the exhaust passages is cut off by the flange 29^a. It will be noted that the valve is of the hollow sleeve type, so that it may surround the rifle bar and the weight of the valve is further reduced by a counterbore 31 extending throughout the greater part of its length. A passage 32 connects bore 25 with the inlet passage so as to put constant pressures on the shoulder 26. One or more cylinder free exhaust ports 33 take care of the greater part of the exhaust fluid from both ends of the cylinder. A throwing passage 34 controlled by the piston 4

leads from the cylinder, at a point rearwardly of the free exhaust port, to the rear end of the enlarged bore 22 so as to conduct, when uncovered by the piston, pressure fluid to the rearward surface of the enlarged flange 23.

The operation of the mechanism thus far described will now be briefly set forth. When pressure fluid is admitted to the inlet passage 17 with the parts in the position shown in Fig. 1, motive fluid is admitted around the front end of the valve through the bore 20 directly to the rear end of the cylinder. The piston is thus driven forwardly to strike a hammer blow on the drill steel. During its forward movement the throwing passage 34 is uncovered to admit pressure fluid from the rear end of the cylinder to the rear of bore 22 to act on the rearward surface of the enlarged flange 23. This pressure together with the constant pressure acting on shoulder 26 overbalances the pressure acting on the forwardly facing surfaces of the valve in communication with the rear end of the cylinder and throws the valve to its forward position shown in Fig. 2. An instant later the free exhaust port is opened and exhaust occurs from the rear end of the cylinder. Throwing of the valve to the position of Fig. 2 causes admission of motive fluid through inlet groove 18 around groove 30 on the valve, to groove 27 and passage 28, to the front end of the cylinder. This causes the piston to travel rearwardly and, in its rearward travel, it cuts off the free exhaust port 33, and an instant later the throwing passage 34. The fluid remaining in the rear end of the cylinder is quickly compressed by the piston 4 and this compression pressure acts on the front end areas of the valve to reverse the same. The pressure which was admitted through the throwing passage 34 to the enlarged flange 23 to cause throwing of the valve forwardly has been very quickly exhausted through ports 29 as soon as the valve is thrown. Thus the compression pressure on the front end areas needs to over-balance simply the constant pressure acting on shoulder 26 and the pressure acting on the extreme rear end of the valve. The valve has now returned to its rearward position as shown in Fig. 1 and is held in such position by the pressure of live motive fluid admitted to the rear end of the cylinder acting on the front end areas. During the rearward travel of the piston the front end of the cylinder will also be opened to exhaust through the free exhaust port 33 and as soon as the valve assumes the position of Fig. 1, the cylinder front end is also connected with exhaust through passage 28, groove 30 and passage 29.

As the variation in air pressure often encountered makes a proportioning of the shoulder 26 which is ideal for one pressure insufficient for another, with a resultant chance for fluttering of the valve with great deviation from the designed pressure at the throttle, I have devised means to make the functioning of the motor quite independent of line pressure variations. For this purpose I have shown a passage 35 connecting with the cylinder at its front end and leading by a port 36 to the enlarged bore rearward of the flange 23. With the addition of this passage it will be observed that as soon as the valve has been thrown to the position of Fig. 2, pressure fluid is admitted to the front end of the cylinder and passage 35 serves to conduct a portion of this fluid to the bore 22 so as to build up a pressure on the rearward side of flange 23. This space is connected with the exhaust ports 29 as has already been stated, but the flow through the exhaust port is quite restricted due to the fact that the ports are not completely uncovered as will be noted from Fig. 2. This will cause a sufficient pressure on the flange 23 to hold the valve steadily in the Fig. 2 position. Before the port 33 is overrun on the rearward stroke of the piston, the compression pressure will force the valve to its rearward position, but it will be held steadily, by an adequate, but superable force, in its forward position until the proper time. If desired, in the place of the passage 35, a passage leading from passage 28 to the enlarged bore may be substituted.

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 drilling motor, a cylinder having between its ends a free exhaust port, a piston reciprocable in said cylinder and covering and uncovering said exhaust port, a valve chamber, a main fluid inlet opening into said valve chamber, fluid distributing passages opening into opposite ends of the cylinder and at their opposite ends opening into said valve chamber, an auxiliary exhaust port opening into said valve chamber, a fluid actuated distributing valve in said valve chamber controlling communication between said distributing passages and said fluid inlet and also controlling communication between said auxiliary exhaust port and the fluid distributing passage opening into the forward end of the cylinder, said valve having a flange providing a surface on which pressure fluid may act to move the valve to supply fluid to the forward end of the cylinder and close communication between the fluid distributing passage leading to the forward end of the cylinder and said auxiliary exhaust port, piston controlled means for conducting throwing fluid to said surface, and auxiliary means operative during normal running of the motor for conducting holding fluid to said surface subsequent to the movement of said valve in response to the admission of throwing fluid to said surface.

2. In a drilling motor, a cylinder having between its ends a free exhaust port, a piston reciprocable in said cylinder and covering and uncovering said exhaust port, a valve chamber, a main fluid inlet opening into said valve chamber, fluid distributing passages opening into opposite ends of the cylinder and at their opposite ends opening into said valve chamber, an auxiliary exhaust port opening into said valve chamber, a fluid actuated distributing valve in said valve chamber controlling communication between said distributing passages and said fluid inlet and also controlling communication between said auxiliary exhaust port and the fluid distributing passage opening into the forward end of the cylinder, said valve having a flange providing a surface on which pressure fluid may act to move the valve to supply fluid to the forward end of the cylinder and close communication between the fluid distributing passage leading to the forward end of the cylinder and said auxiliary exhaust port, piston controlled means for conducting throwing

fluid to said surface from the rear end of the cylinder, and auxiliary means operative during normal running of the motor for conducting holding fluid to said surface subsequent to the movement of said valve in response to the admission of throwing fluid to said surface.

3. In a drilling motor, a cylinder having between its ends a free exhaust port, a piston reciprocable in said cylinder and covering and uncovering said exhaust port, a valve chamber, a main fluid inlet opening into said valve chamber, fluid distributing passages opening into opposite ends of the cylinder and at their opposite ends opening into said valve chamber, an auxiliary exhaust port opening into said valve chamber, a fluid actuated distributing valve in said valve chamber controlling communication between said distributing passages and said fluid inlet and also controlling communication between said auxiliary exhaust port and the fluid distributing passage opening into the forward end of the cylinder, said valve having a flange providing a surface on which pressure fluid may act to move the valve to supply fluid to the forward end of the cylinder and close communication between the fluid distributing passage leading to the forward end of the cylinder and said auxiliary exhaust port, the movement of said valve to said last mentioned position bringing said surface on said flange into communication with said auxiliary exhaust port, piston controlled means for conducting throwing fluid to said surface, and auxiliary means operative during normal running of the motor for conducting holding fluid to said surface subsequent to the movement of said valve in response to the admission of throwing fluid to said surface.

4. In a drilling motor, a cylinder having between its ends a free exhaust port, a piston reciprocable in said cylinder and covering and uncovering said exhaust port, a valve chamber, a main fluid inlet opening into said valve chamber, fluid distributing passages opening into opposite ends of the cylinder and at their opposite ends opening into said valve chamber, an auxiliary exhaust port opening into said valve chamber, a fluid actuated distributing valve in said valve chamber controlling communication between said distributing passages and said fluid inlet and also controlling communication between said auxiliary exhaust port and the fluid distributing passage opening into the forward end of the cylinder, said valve having a flange providing a surface on which pressure fluid may act to move the valve to supply fluid to the forward end of the cylinder and close communication between the fluid distributing passage leading to the forward end of the cylinder and said auxiliary exhaust port, the movement of said valve to said last mentioned position bringing said surface on said flange into communication with said auxiliary exhaust port, piston controlled means for conducting throwing fluid to said surface from the rear end of the cylinder, and auxiliary means operative during normal running of the motor for conducting holding fluid to said surface subsequent to the movement of said valve in response to the admission of throwing fluid to said surface.

HENRY TARDIFF.