W. A. SMITH.

PERCUSSIVE TOOL.

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1,359,119. **Patented Nov. 16, 1920.**

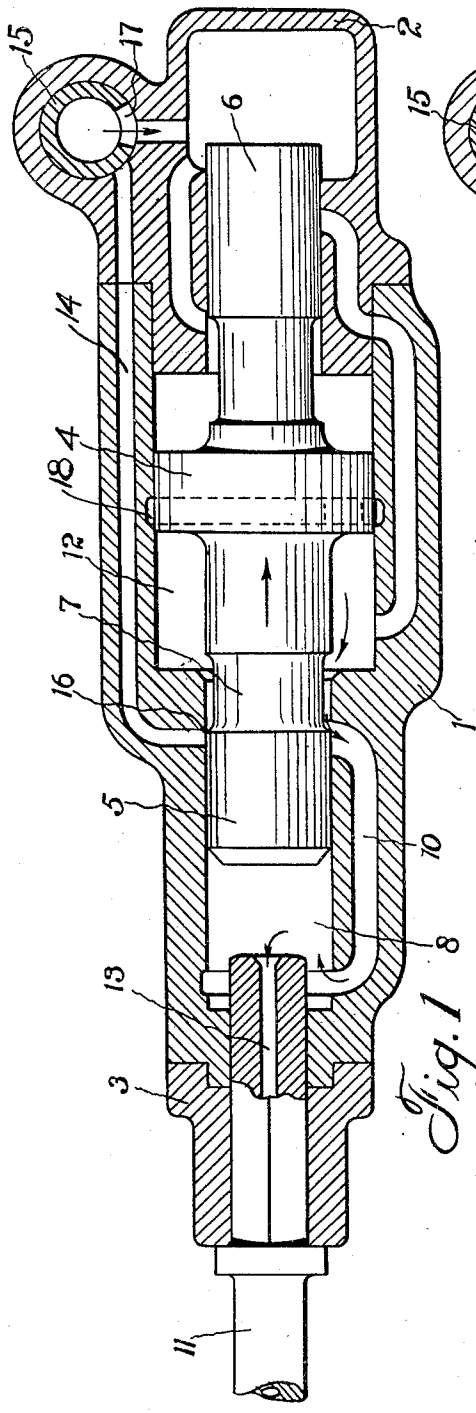

Fig. 1

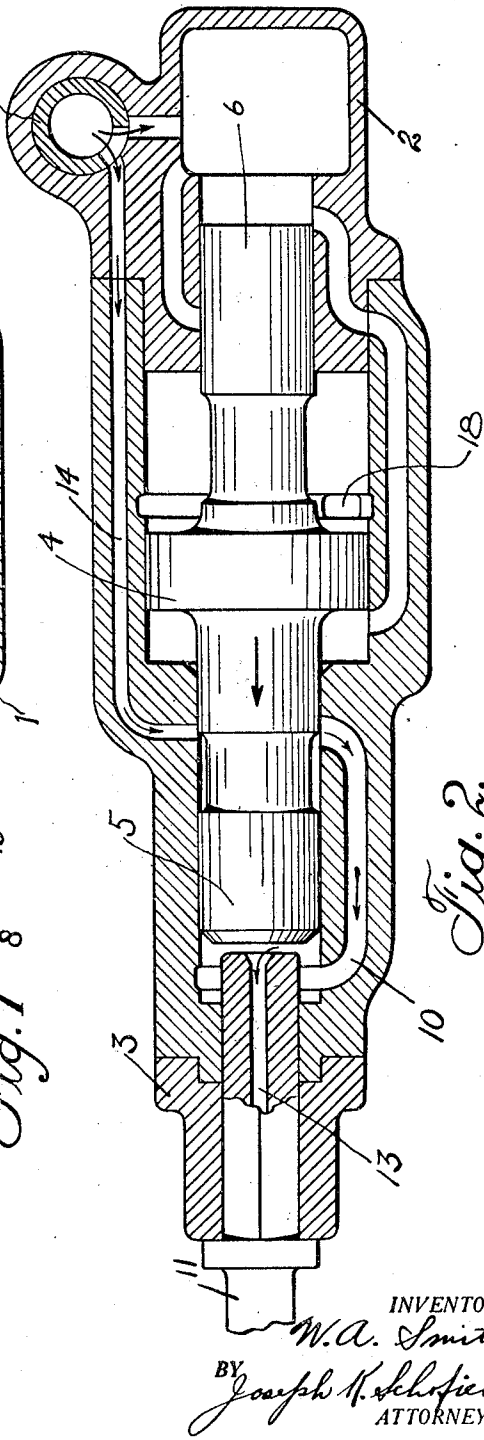

Fig. 2

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PERCUSSIVE TOOL.

1,359,119. Specification of Letters Patent. Patented Nov. 16, 1920.

Application filed August 15, 1918. Serial No. 250,069.

To all whom it may concern:

Be it known that I, WILLIAM A. SMITH, a citizen of the United States, residing at Easton, in the county of Northampton and State of Pennsylvania, have invented a certain new and useful Improvement in Percussive Tools, of which the following is a specification.

This invention relates to percussive tools such as hammer drills, and in particular relates to a construction of cylinder for a hammer drill which will increase the efficiency and drilling speed of the drill.

The object of the present invention is to provide a construction of cylinder and piston for percussive tools which will permit motive fluid to be admitted from the throttle valve to the central bore of the drill to cleanse the hole being drilled from cuttings; to permit the amount of fluid thus admitted to the bore to be regulated; and admitted to the bore during a portion only of the stroke of the piston. Further, to permit a portion of said fluid to be admitted to the drill bit from the front end of the larger bore of the cylinder to supplement the amount of fluid supplied directly from the throttle, so that in drilling short holes when the amount of the cleansing fluid supplied to the drill steel is not great it may be obtained entirely from the front end of the cylinder and without any additional fluid being supplied from the throttle.

A further object is to permit fluid from both the throttle and front end of the larger cylinder bore to be admitted simultaneously to the drill steel for a brief interval when the piston reaches a certain point in its stroke.

With the above and other objects in view the present invention consists in the features of construction set forth in the following description and illustrated in the accompanying drawings, forming a part hereof, in which—

Figure 1 shows a longitudinal section of a hammer drill made in accordance with the present invention, with the piston about midway of its rearward stroke; and

Fig. 2, a similar view with the piston in its position just before striking the drill steel near the end of its forward stroke.

Referring more particularly to the drawings, 1 refers to the cylinder, 2 the back head, and 3, the drill chuck, which may be provided with means (not shown) for rotating the drill steel 11. Within the cylinder 1 reciprocates the piston 4 which is provided with a forward striking portion 5 and a rearwardly extending portion 6. The forward portion 5 of the piston 4 is provided with a reduced neck portion 7 about midway between the piston head 4 and the extreme forward end of the striking portion 5. This striking portion 5 of the piston 4 operates within a reduced bore 8 of the cylinder 1 extending forwardly from the main bore 12 of the piston 4. A fluid passage 10 bored in the forward end of the cylinder 1 connects the front and rear ends of the bore 8, one extremity of the passage 10 being passed over by the reduced portion 7 of the forward extending portion of the piston 4 to open and close communication between a conduit 14 and the forward end of bore 8. The drill steel 11 extends a short distance within the bore 8 of the cylinder 1 sufficient to be struck by the piston 4 at the extremity of its forward stroke, being provided with a central hole 13 extending throughout its length as usually found in drills of this type.

It will be seen that with the piston in the position shown in Fig. 1 in which its movement is rearward, fluid pressure may pass from the pressure area on the forward face of the piston 4 past the neck portion 7 through the passage 10 into the drill steel 11, thus supplying some of the cleansing fluid from the forward end of the cylinder bore 12. This fluid supplied from the front end of the cylinder is sufficient for cleansing purposes when the hole being drilled is short and when the amount of fluid necessary to keep the bit free from cuttings is relatively small.

In addition to the above means for supplying cleansing fluid to the drill 11 through its central hole 13, conduit 14 is provided extending from the throttle valve 15 to a point in the smaller bore of the cylinder 8 as shown at 16. This point is preferably in alinement with the rear extremity of the hole 10 described above. Fluid for cleansing the hole is supplied through conduit 14 only when the hole being drilled is deep, or the conditions such that an extra amount of cleansing fluid is required.

In operating or starting the tool, the position of the throttle valve 15 may be varied to direct the fluid entirely into the hammer cylinder 1 as shown in Fig. 1, or into both hammer cylinder 1, and conduit 14 as shown in Fig. 2. This construction of throttle permits the variation in amount of fluid supplied to the hammer or cleansing means as the condition of the drilling may vary. For instance, if uneven drilling is encountered in soft rock which drills rapidly even with light blows of the hammer, a relatively large amount of air is necessary to remove the cuttings. This can be readily taken care of in the present construction by simply varying slightly the position of the throttle valve 15. With the throttle in the position shown in Fig. 2 an ample supply of fluid is available at the orifice 16 of the conduit 14 to supply sufficient fluid down the hole 13 to maintain the cutting edges of the drill 11 free from cuttings even in deep holes.

While the piston is in the rear portion of its stroke the reduced portion 7 of the forwardly extending portion 5 of the piston 4 overruns the rear orifice of the passage 10 thus closing connection between the conduit 14 and passage 10. This is designed to occur just prior to the opening of the main exhaust through port 18 so that the fluid in the front end of cylinder 12 may first exhaust through the reduced portion 7 into passage 10 and thence into the drill steel 11. As soon, however, as the piston 4 reaches the position shown in Fig. 1 on its forward stroke, communication between these passages is again opened and fluid supplied to the drill bit 11. In this way fluid is supplied to the drill 11 during the major portion of the stroke of the piston and due to the reduced portion 7 of the extension 5 overrunning the smaller bore 8 fluid in the forward portion of the larger bore 12 of the cylinder 1 is admitted to passage 10 and thus to the drill 11.

It will be seen, further, that with the throttle valve 15 in operation, and when the piston reaches a predetermined point in its stroke, there will be, for a very brief interval, an augmented flow of fluid to the drill steel due to a simultaneous admission of fluid from the front end of the larger cylinder bore 12 and from the conduit 14 past the forward portion of the piston neck 7 to the passage 10 and thence to the drill steel. This position of the piston is illustrated in Fig. 1 of the drawings. The brevity of the interval during which this dual communication exists, together with the speed of the piston stroke and the configuration of the piston and cylinder walls, serve to prevent any backing up of live pressure into the larger bore of the cylinder, and the increased flow through the drill steel resulting during this period causes the discharge of the air through the steel to be accompanied by slight additional puffs which materially assist in the dislodgment of the debris from the bottom of the hole being drilled.

It will thus be seen that a construction has been provided which will efficiently supply cleansing fluid to the drill bit from the front end of the cylinder bore, and where an additional amount of cleansing fluid is required it may readily be admitted through a small conduit extending from the throttle valve to a position to communicate with passage 10 during a portion of the stroke of the piston.

It is to be understood that the present showing and description disclose only one specific embodiment of the present invention and that other forms and modifications are included within the spirit and scope of the invention as expressed in the appended claims.

What I claim is:

1. In a percussive tool, a cylinder having a main bore, a piston within said main bore having a forwardly extending striking portion, a neck portion in said forwardly extending portion of the piston overrunning the rear end of a passage provided in said cylinder at its forward end, said passage opening into the front and rear ends of the forward portion of the cylinder, communication between the rear end of said passage and the forward end of the main bore being opened and closed as the said neck in the forwardly extending portion of the piston moves backward and forward, thereby controlling the supply of motive fluid for blowing the cuttings from the bottom of the hole being drilled.

2. In a percussive tool, a cylinder having a main bore, a piston within said main bore having a forwardly extending striking portion, a neck portion in said forwardly extending portion of the piston overrunning the rear end of a passage provided in said cylinder at its forward end, said passage opening into the front and rear ends of the forward portion of the cylinder, and a conduit extending from the throttle to a point at the rear end of the forward portion of said cylinder, to permit passage of fluid from the throttle to the drill steel only when the neck in said piston is in alinement with the openings of said passage and conduit at the rear end of the forward portion of the cylinder.

3. In a percussive tool, a cylinder, a piston within said cylinder having a forwardly extending striking portion, a neck portion in said forwardly extending portion overrunning a passage provided in the front portion of the cylinder, and a conduit extending from the throttle and terminating in alinement with said passage to permit passage of fluid from the throttle to the

drill steel the adjacent ends of said conduit and passage being opened and closed by the forwardly extending portion of the piston.

4. In a percussive tool, a cylinder, a piston within said cylinder having a forwardly extending striking portion and neck portion in said forwardly extending portion overrunning a passage provided in the forward portion of the cylinder, a main exhaust port opened by said piston near the end of its stroke in each direction and means to exhaust fluid from the front end of the cylinder into the drill steel before the main exhaust port opens, said means being at all times under the control of the forwardly extending striking portion of the piston.

5. In a percussive tool, a cylinder having a main bore, a piston within said cylinder having a forwardly extending striking portion operating within a reduced bore of said cylinder, a neck portion in said forwardly extending portion of the piston overrunning the rear end of a passage provided in said cylinder, said passage opening into the front and rear ends of said reduced bore of the cylinder, and a conduit extending from the throttle and terminating in alinement with one end of the passage in the forward portion of the cylinder to permit fluid to be admitted to the drill steel directly from the throttle and also from the forward end of the main bore of the cylinder, the adjacent ends of said conduit and passage and communication between the forward end of said main cylinder bore and said passage being opened and closed as the said neck in the forwardly extending portion of the piston moves backward and forward.

6. In a fluid operated percussive tool, a cylinder, a piston therein having a forwardly extending striking portion and means permitting fluid to pass from the forward pressure chamber of the cylinder to the central hole of a drill steel during an intermediate portion of the stroke of the piston while preventing such passage of the fluid at either end of the stroke of the piston.

7. In a fluid operated percussive tool, a cylinder, a piston therein having a forwardly extending striking portion and means permitting fluid to pass from the forward pressure chamber of the cylinder to the central hole of a drill steel during an intermediate portion of the stroke of the piston only, said means being controlled by the forwardly extending striking portion of the piston, but closed when the piston is near either end of its stroke.

8. In a fluid operated percussive tool, a cylinder having two pressure chambers, a piston therein having a forwardly extending striking portion, means to admit fluid from the forward pressure chamber of the cylinder to the central hole of a drill steel and also means to admit fluid simultaneously to said drill steel directly from the motive fluid supply throttle.

9. In a fluid operated percussive tool, a cylinder having two pressure chambers, a piston therein having a forwardly extending striking portion, means to admit fluid from the forward pressure chamber of the cylinder to the central hole of a drill steel and also means to admit fluid simultaneously to said drill steel directly from the motive fluid supply throttle when the piston reaches a predetermined point in its stroke.

10. In a fluid operated percussive tool, a cylinder having two pressure chambers, a piston therein having a forwardly extending striking portion, means to admit fluid from the forward pressure chamber of the cylinder to the central hole of a drill steel and also means to admit fluid simultaneously to said drill steel directly from the throttle, both of said means being under the control of the forwardly extending portion of the piston.

11. In a fluid operated percussive tool, a cylinder having two pressure chambers, a piston therein having a forwardly extending striking portion, means to admit fluid from the forward pressure chamber of the cylinder to the central hole of a drill steel and also means to admit fluid simultaneously to said drill steel directly from the throttle, when the piston reaches a predetermined point in its stroke, both of said means being under the control of the forwardly extending portion of the piston.

12. In a fluid operated percussive tool, a cylinder having two pressure chambers, a piston therein having a forwardly extending striking portion, a drill steel located forwardly of said striking portion, means for supplying fluid to said drill steel from the forward pressure chamber while the piston is approximately midway of the cylinder in its stroke and means to supplement the supply of fluid to said drill steel while the piston is in the forward portion of the cylinder.

13. In a fluid operated percussive tool, a cylinder having two pressure chambers, a piston therein having a forwardly extending striking portion, a drill steel located forwardly of said striking portion, means for supplying fluid to said drill steel from the forward pressure chamber while the piston is approximately midway of the cylinder in its stroke and means to supplement the supply of fluid to said drill steel while the piston is in the forward portion of the cylinder, said latter means being opened and closed by the forwardly extending portion of the piston.

14. In a percussive tool for operating on a hollow drill steel, a cylinder, a piston in said cylinder having a reduced forwardly extending striking portion, a neck portion

in said forwardly extending portion of the piston, and ports and passages controlled by said neck for admitting motive fluid under pressure to the drill steel only when the piston is approximately in mid stroke, said ports and passages being closed at all other times in the stroke of the piston.

In testimony whereof, I have hereunto set my hand.

WILLIAM A. SMITH.

Witnesses:
ROBERT L. AMBROSE,
HARRY D. POWELL.