Dec. 2, 1924. 1,518,124

H. H. MERCER

APPARATUS FOR DRILLING HOLES

Filed Sept. 28, 1918

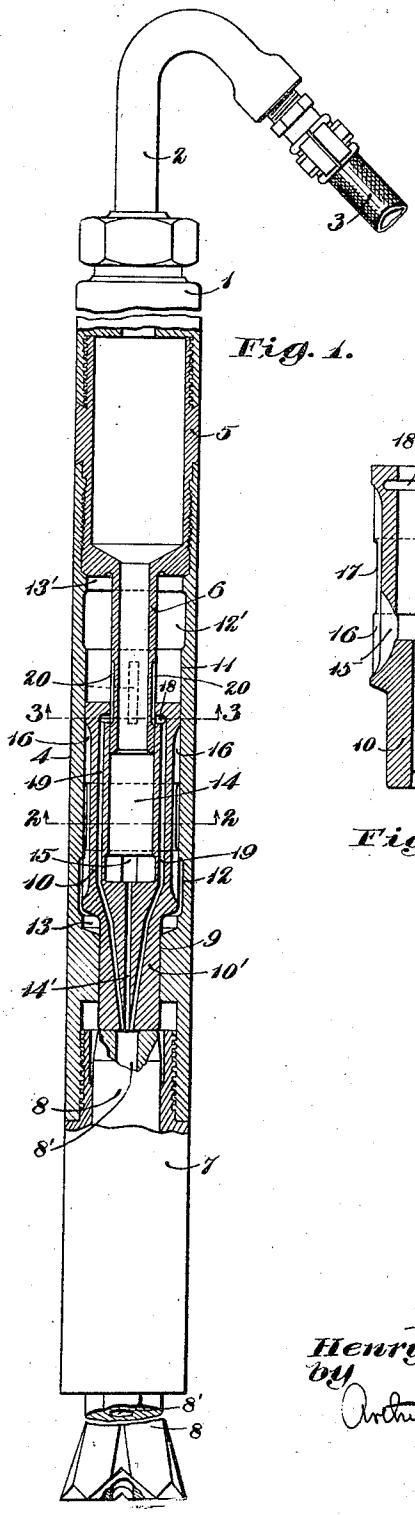


Fig. 1.

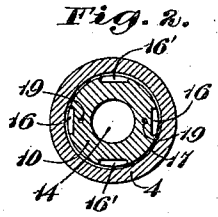


Fig. 2.

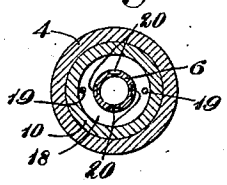


Fig. 3.

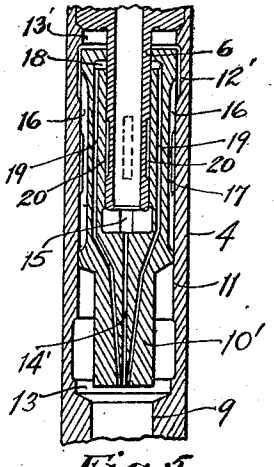


Fig. 5.

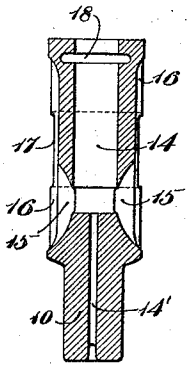


Fig. 4.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DRILLING HOLES.

Application filed September 28, 1918. Serial No. 256,055.

To all whom it may concern:

Be it known that I, HENRY H. MERCER, a citizen of the United States, residing at Claremont, in the county of Sullivan and State of New Hampshire, have invented certain new and useful Improvements in Apparatus for Drilling Holes, of which the following is a full, clear and exact specification.

This invention relates to apparatus for drilling holes, and more particularly, though not necessarily exclusively, to apparatus used in mines or quarries, the object of the present invention being to provide an improved hammer piston pneumatic tool for driving a drill steel, the embodiment herein illustrated and described being applied to a drill of the so-called "ground hog" type in which the pneumatic hammer follows the tool into the hole.

In the use of ground hog drills it has been difficult to drill holes of considerable depth because the exhaust pressure would not force the cuttings out of the holes and because pulverized rock would be drawn into the exhaust pipe of the pneumatic hammer used and would clog the passages therein and wear the operating parts rapidly.

These defects I overcome in my present invention which will best be understood by reference to the following specification and to the accompanying drawings of one illustrative embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings,—

Fig. 1 is a longitudinal sectional view of a ground hog drill embodying my invention.

Fig. 2 is a cross section thereof on the line 2—2.

Fig. 3 is a cross section thereof on the line 3—3.

Fig. 4 is a longitudinal sectional view of the piston shown in Fig. 1, taken in a plane at right angles to the section plane of Fig. 1.

Referring to the drawings, I have therein shown for the purpose of illustrating the principal features of the invention, a hollow pipe 1 made in sections which are added as the hole is deepened, to the upper end of which is attached an air supply pipe 2 and hose 3, and to the lower end of which is attached a cylinder 4 by means of a coupling sleeve 5, carrying on its lower end a reduced grooved sleeve 6 which projects into the cylinder 4.

The cylinder 4 is preferably, though not necessarily, cored from a single piece having at its lower end a threaded portion to receive a tool guide 7, in which a tool 8 having a longitudinal bore 8′ is held, and a reduced portion or collar 9 adapted to receive one end 10′ of a piston 10 and to form a stop or abutment for the piston. The bore 11 of the cylinder 4 is of constant diameter throughout the cylinder except for two annular recessed portions 12, 12′, one of which is adjacent the upper end of the cylinder, the other being adjacent the collar 9. These annular recesses 12, 12′ are spaced from the upper end of the cylinder and the stop or collar to provide small cushioning spaces 13′, 13 in which the air is trapped and compressed when the piston 10 is at either end of the cylinder to cushion the piston and to give it an initial movement toward the opposite end of the cylinder.

The piston 10 is made of a single casting or drop forging and is bored centrally to provide passageways 14, 14′ for conducting pressure fluid to the ends of the cylinder and to the steel, the larger passage 14 communicating through one or more (herein two) ports 15 (see Fig. 4) which connect the central passage 14 with longitudinal grooves 16 cut in the outer surface of the piston. Additional grooves may, if desired, be provided intermediate the grooves 16, said grooves 16 and 16′ being all connected with one another by an annular passage 17. An annular recess 18 is provided near the top of the piston 10 and is connected by two oppositely disposed longitudinal passages 19 with the lower end of the piston to conduct exhaust fluid from the upper end of the cylinder to the hole 8′ in the tool.

The projection or striking head 10′, formed integral with the piston 10, contacts with the drill steel to transmit the energy of the piston to the drill steel upon a downward movement of the piston, and exhausts the pressure fluid from the lower end of the cylinder upon an upward movement of the piston. For the latter purpose the length of the head 10′ is so proportioned to the length of the cylinder that when the piston is at or near the upper end of the cylinder the lower end of the striking head clears the opening in the collar and permits the fluid under partial compression in the lower end of the cylinder to exhaust through the

opening in the collar to the upper end of the steel.

The reduced portion or projection 6 on the coupling sleeve has a sliding fit in the passage 14 of the piston 10, and has formed thereon near its lower end a plurality of longitudinal grooves 20 equally disposed thereabout.

The hollow pipe 1 should always project out of the drill hole so that the annular space between the pipe and wall of the hole being drilled is restricted to insure a sufficiently high velocity of the air passing upward from the bit to carry the cuttings out of the hole. The use of a hollow pipe for this purpose provides a fluid pressure reservoir from which the fluid is fed to the cylinder so that a relatively small supply hose 3 may be used.

When in operation, fluid pressure is conducted by the supply line, reservoir, and projection 6 to the passageway 14 in the piston. A small part of the fluid will pass through the smaller passage 14′ in the piston and the longitudinal passage 8′ in the steel, to blow the cuttings away from the bit and to prevent the formation of a partial vacuum above the steel when the piston moves upward. This latter function is very important for when the piston moves upward it tends to suck the dust laden air from around the steel into the lower end of the cylinder, where it scours the cylinder and piston surfaces and clogs the ports and passages.

When the piston is in the position shown in Fig. 1, the pressure fluid in the passage 14 flows through ports 15 and recess 12 to the lower side of the piston head and forces the piston upward. As the lower ends of the grooves 16 pass above the recess 12, the supply of pressure fluid is cut off from the lower end of the cylinder, and upon a further movement of the piston in an upward direction the projection 10′ on the lower end of the piston clears the collar 9, exhausting the pressure fluid from this end of the cylinder. At or near this point in the movement of the piston, the grooves open into the upper recess 12′ and conduct the fluid under pressure to the upper end of the piston to reverse its movement. Upon a predetermined downward movement of the piston, the grooves 20 exhaust the pressure fluid from the upper end of the cylinder through the annular recess 18 and passages 19 to the opening 8′ in the drill steel. The exhaust fluid is still under considerable pressure, and under usual cutting conditions will force the cuttings out of the hole. The provision of the passage 14′ to admit fluid under initial pressure insures the expulsion of detritus under any working conditions.

In my improved construction I have formed the air passages on the outside of the piston and the projection 6, chiefly as longitudinal grooves, this construction being preferred to the spooled construction now commonly used, because of the long, relatively thin wall that would result from spooling out the outer surface of a hollow member. However, it is to be understood that where the strength and thickness of the material will permit, a single annular recess, or a series of communicating annular recesses, may be used in place of the grooves 16, 16′ and recess 17 on the piston, and the grooves 20 on the projection 6.

All of the fluid passes out of the hammer through the drill steel, and since the connections between the pipe and cylinder are screw connections and are made air tight, this fluid will carry the cuttings out of the hole without permitting them to come into contact with the operating parts to affect the action of the latter. Thus it is seen that I have provided means for utilizing all of the pressure fluid entering the drill for removing the rock particles from the bottom of the hole, so that maximum cutting speed is obtained, and that the pneumatic operating means is always free from the dust laden exhaust fluid.

While I have herein shown for the purpose of illustration one specific form of my invention, it is to be understood that the same is not limited to the details of construction, to the relative arrangement of parts, to the application herein made of the invention, or to the particular form of drilling machine shown, but that extensive deviations may be made from the specific embodiment shown herein without departing from the spirit of the invention.

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

1. In a valveless pneumatic tool, the combination comprising a cylinder, a single movable member therein, means for delivering fluid pressure to the member and from the member to both ends of the cylinder to move the member, and means lying within the transverse limits of the cylinder bore extended for exhausting in the same direction fluid pressure used to effect each stroke in either direction during the succeeding stroke.

2. In a ground hog drill, the combination comprising a cylinder, a hollow drill steel, means for continuously delivering fluid under pressure to the cylinder and the hollow drill steel, and means for delivering exhaust fluid from the hammer to the drill steel, said means for delivering exhaust and pressure fluid to said drill being located within the transverse limits of the bore of said cylinder.

3. In a valveless pneumatic hammer, the combination comprising a cylinder, a piston therein, said piston and cylinder having co-

operating means for delivering a fluid under pressure to the ends of the cylinder, means for exhausting fluid from one end of the cylinder, and means for exhausting fluid from the opposite end of the cylinder through an opening disposed in the first mentioned end and within the transverse limits of the cylinder bore extended.

4. In a valveless pneumatic hammer, the combination comprising a cylinder, a piston, means for delivering a fluid under pressure to the ends of the cylinder, ports controlled by the piston for exhausting fluid from one end of the cylinder through an opening adjacent the opposite end of the cylinder, and piston controlled means for exhausting fluid under pressure from said last named end of the cylinder through the opening through that end.

5. In a pneumatic hammer, the combination comprising a cylinder, a single movable member associated therewith, means controlled by the member for admitting actuating fluid under pressure alternately to the ends of the cylinder, and means controlled by the movable member for exhausting through one end of the cylinder, the fluid used during each stroke of the member.

6. In a pneumatic hammer, the combination comprising a cylinder, a single movable member associated therewith, means controlled by the member for admitting a fluid under pressure alternately to the ends of the cylinder, means controlled by the movable member for exhausting the fluid at a point adjacent one end of the cylinder, a hollow steel positioned to directly receive the exhaust from said adjacent point and means for continuously delivering fluid under initial pressure to the exhaust.

7. In a valveless pneumatic hammer, the combination comprising a cylinder, a piston, a striking head thereon, a hollow drill steel, means for delivering a fluid under pressure to the cylinder, and means carried by the piston for delivering part of the exhaust fluid and fluid continuously under substantially initial pressure to the steel.

8. In a valveless pneumatic hammer, the combination comprising a cylinder, a piston, a striking head thereon, a hollow drill steel, means for delivering a fluid under pressure to the cylinder, means carried by the piston for delivering part of the exhaust fluid and fluid under substantially initial pressure to the steel, and means controlled by movement of the piston for controlling the flow of the rest of the exhaust fluid to the steel.

9. In a pneumatic hammer, the combination comprising a cylinder, and a single movable member associated therewith and distributing operating fluid alternately to opposite ends of the cylinder, said cylinder being provided at one end thereof with a chamber adapted to communicate with a hollow drill steel and said member controlling the exhaust of fluid to said chamber from both ends of the cylinder.

10. In a pneumatic hammer, the combination comprising a cylinder and a single movable member associated therewith and distributing operating fluid alternately to opposite ends of the cylinder, said cylinder being provided at one end thereof with a chamber adapted to communicate with a hollow drill steel, and said member controlling the exhaust of fluid to said chamber from both ends of the cylinder, and having provision for continuously supplying live fluid to said chamber.

11. In a pneumatic hammer, a cylinder, a tube connected with a pressure fluid supply projecting inwardly from one end thereof, a piston in said cylinder having a passage therein receiving said tube, ports in said piston adapted to deliver pressure fluid from said passage to the ends of said cylinder, an exhaust port in the other end of said cylinder controlled by said piston, and passages in said piston to conduct exhaust fluid from said first mentioned end to said second mentioned end.

12. In a pneumatic hammer, a cylinder, a fluid pressure supply tube projecting inward from one end thereof, a hollow piston in said cylinder cooperating with said tube to distribute working fluid, port means in the periphery of said tube spaced from the end thereof, and passage means in said piston cooperating with said port means to convey exhaust fluid to atmosphere at the opposite end of said cylinder.

13. In combination with a hollow drill, a pneumatic hammer comprising a cylinder, a piston therein movable to supply pressure fluid to both ends of the cylinder, and passages in said piston to conduct exhaust from one end of said cylinder and live fluid simultaneously to the drill.

In testimony whereof I affix my signature.

HENRY H. MERCER.