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R. C. HOLMAN ET AL
ROCK DRILLING APPARATUS

2,738,769

Filed May 11, 1953

2 Sheets-Sheet 1

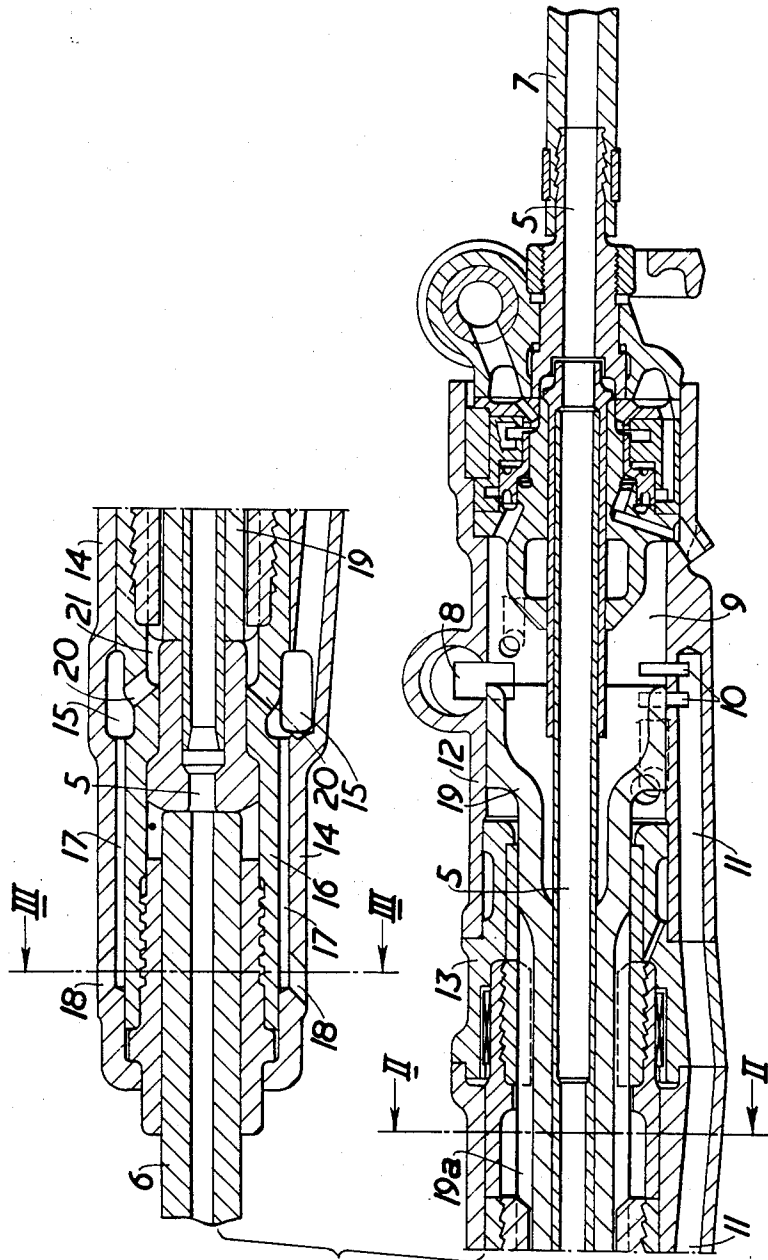


FIG. 1.

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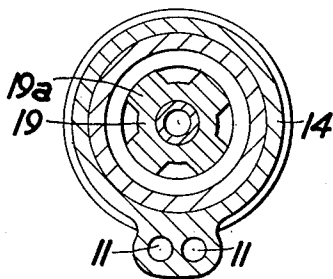


FIG. 2.

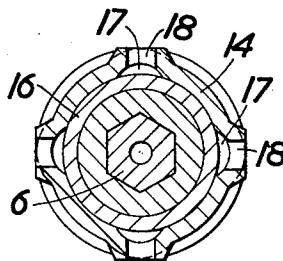


Fig. 3.

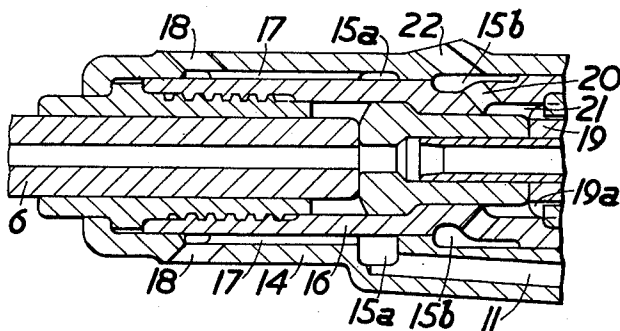


FIG. 4.

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ROCK DRILLING APPARATUS

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Application May 11, 1953, Serial No. 354,178

7 Claims. (Cl. 121—13)

As is now generally appreciated, it is highly undesirable to allow free dust particles created during rock drilling operations to escape into and pollute the atmosphere of the working place. The most usual method of preventing such escape of dust is to introduce water into the bore-hole during the drilling operation so that the dust particles are reduced to mud. However, this wet drilling method is neither completely satisfactory nor universally applicable and proposals have been made for drilling dry and removing the dust as it is formed by drawing a stream of air back through the hollow drill steel. It is to such air eduction, dry drilling apparatus that the present invention relates.

In the operation of such drilling machines, it is found that they tend to become very hot at the forward end, due partly to the lack of dissipation of the heat caused by the energy transfer to the drill shank and partly to the friction of the stream of cuttings and hot air passing back through the steel. In addition to causing discomfort to the operator, this heat has adverse effects on the lubrication.

A drilling machine in accordance with the present invention is pneumatically operated (as is the general practice), so that the rear part of the drill is kept cool by the expansion of the working fluid, and according to the invention, means are provided whereby some or all of the expanded and cooled exhaust air is caused to flow over the heated forward parts of the drill before it is allowed to escape to atmosphere.

By way of example the accompanying drawing shows the present invention applied in the manner described below to the particular form of dry drilling machine arranged for air eduction of the cuttings which is described and illustrated in the co-pending application of Arthur Trevena Holman et al., Serial No. 232,172, filed June 18, 1951, now abandoned. In this drawing Figure 1 shows a longitudinal section through the drill, Figures 2 and 3 shows cross sections taken respectively on the lines II—II and III—III of Figure 1, and Figure 4 is a longitudinal section of the forward end of the drill, showing a modification.

In general, the drill illustrated is similar in construction and mode of operation to that described and illustrated in the above mentioned application and it is deemed unnecessary to describe here the construction and function of many of the parts, with which the present invention is not directly concerned. It will be observed that the drill has a central passage 5 extending completely through the drill and adapted to communicate at its forward end with the bore of a hollow drill steel 6 and to be connected at its rear end to a suction hose 7, so that the dust produced by drilling can be withdrawn rearwardly through the drill in a stream of air. In addition to the main exhaust port 8 in the hammer cylinder 9, which communicates directly with atmosphere, there are provided on the opposite side of the cylinder two auxiliary ports 10, which communicate with a pair of conduits 11, running forward side by side within the thickness of the wall of the cylinder casing 12, the cylinder washer 13, and the front cover 14, which three parts together form the body or outer casing of the machine. In the construction shown in Figures 1 to 3,

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the forward ends of these conduits open into an annular chamber 15, formed midway along the length of the front cover 14 by a recess on the inner surface thereof and the outer surface of the chuck driver 16, which fits within the outer cover. From this chamber four passages 17, defined by channels or grooves on the inner surface of the front cover 14 and the outer surface of the chuck driver 16, lead forward to atmosphere vents 18 adjacent to the forward end of the machine.

The auxiliary exhaust ports 10, may have a slight lead over the main exhaust port, so that they are uncovered by the piston 19, earlier than the main exhaust port 8, to ensure that a reasonable proportion of the used air from the cylinder 9 will pass through the twin ports 10, to cool the forward end of the machine as it flows over the chuck driver 16, before escaping to atmosphere through the vents.

The flow of cooling air also serves to carry to the working parts at the forward end of the machine an adequate proportion of the lubricating oil which (in known manner) is introduced into the compressed air supplies to the machine. The ports and passages provided for the cooling air thus perform additionally the function of the lubricating ports, reservoir and passages which form the subject of prior British Patent No. 481,537. The cooling air passages of the present invention may be (and as shown are) formed by enlarging the known lubricating passages and providing outlets to atmosphere at their forward ends so as to cause a through flow of air.

In the construction of Figures 1 to 3, the annular chamber 15, which forms part of the passage for cooling air, communicates through ports 20, in the chuck driver 16 with the anvil chamber 21 of the drill. Any air which may leak forwardly over the splines 19a of the piston 19 into the anvil chamber will thus go forwardly with the air discharged through passages 17, to the atmospheric vents 18. However, if the air supply to the drill contains a large amount of entrained moisture, there is a tendency with the construction described above for some part of the moisture in the stream of cooling air to penetrate back through the ports 20, into the anvil chamber 21, and thence to reach the central dust passage 5, where it could cause the dust to aggregate and block the tube.

Figure 4, shows a modified construction designed to avoid the above mentioned danger. The construction is similar to that already described except that the annular chamber 15, is replaced by two separate annular chambers 15a and 15b. The former serves to connect the conduits 11 to the passages 17, while the latter is open to the ports 20, for leakage air and has its own atmospheric vent 22.

The means described above for introducing cool exhaust air to the forward end of the drill may obviously be varied in many ways. For example, the number of auxiliary exhaust ports provided and the position at which they are located in the cylinder may be varied, or the whole, instead of only a part, of the exhaust air may be used for cooling purposes.

We claim:

1. A pneumatically operated rock drill comprising a casing, a chuck supported in the forward portion of the casing, a piston in the casing for effectively importing hammer blows to a drill steel supported in the chuck, heat exchange means utilizing expanded and cooled exhaust air from the casing as a cooling medium for cooling the heated forward portion of the casing, chuck and a drill steel supported therein, said heat exchange means comprising a port in the casing controlled by the piston, an annular chamber in the forward portion of the casing, conduit means connecting said port and said annular chamber, and a plurality of passages defined by the outer

surface of the chuck and channels on the inner surface of the casing, said passages each communicating with said annular chamber and extending forwardly therefrom opening to atmosphere adjacent the forward end of the drill, said passages being circumferentially spaced about the periphery of the chuck for equal distribution of a cooling medium thereabout.

2. A pneumatically operated rock drill comprising a casing, a chuck supported in the forward portion of the casing, a piston in the casing for effectively importing hammer blows to a drill steel supported in the chuck, heat exchange means utilizing expanded and cooled exhaust air from the casing as a cooling medium for cooling the heated forward portion of the casing, chuck and a drill steel supported therein, said heat exchange means comprising a main exhaust port in the casing communicating with atmosphere, at least one auxiliary port in the casing controlled by the piston, an annular chamber in the forward portion of the casing, conduit means connecting said auxiliary ports and said annular chamber, and a plurality of passages defined by the outer surface of the chuck and channels on the inner surface of the casing, said passages each communicating with said annular chamber and extending forwardly therefrom opening to atmosphere adjacent the forward end of the drill, said passages being circumferentially spaced about the periphery of the chuck for equal distribution of a cooling medium thereabout.

3. The structure defined in claim 2 wherein at least one of said auxiliary ports is disposed forward of said main exhaust port assuring that such forwardly disposed auxiliary port will be uncovered by the piston in advance of said main exhaust port.

4. A pneumatically operated rock drill comprising a casing, a chuck supported in the forward portion of the casing, a piston in the casing for effectively importing hammer blows to a drill steel supported in the chuck, heat exchange means utilizing expanded and cooled exhaust air from the casing as a cooling medium for cooling the heated forward portion of the casing, chuck and a drill steel supported therein, said heat exchange means comprising a main exhaust port in the casing communicating with atmosphere, a plurality of auxiliary ports in the casing controlled by the piston, an annular chamber in the forward portion of the casing, conduit means connecting said auxiliary ports and said annular chamber, and a plurality of passages defined by the outer surface of the chuck and channels on the inner surface of the casing, said passages each communicating with said annular chamber and extending forwardly therefrom terminating adjacent the forward end of the drill in radially outwardly extending vents open to atmosphere, said passages being circumferentially spaced about the axis of the chuck for equal distribution of a cooling medium thereabout.

5. A pneumatically operated rock drill comprising a casing, a chuck supported in the forward portion of the casing, an anvil chamber in the casing, a piston in the casing for effectively importing hammer blows to a drill steel supported in the chuck, heat exchange means utilizing expanded and cooled exhaust air from the casing as a cooling medium for cooling the heated forward portion of the casing, chuck and a drill steel supported therein, said heat exchange means comprising a port in the casing controlled by the piston, an annular chamber in the forward portion of the casing, conduit means connecting said port and said annular chamber, a plurality of passages defined by the outer surface of the chuck and channels on the inner surface of the casing, said passages each communicating with said annular chamber and extending forwardly therefrom opening to atmosphere adjacent the forward end of the drill, said passages being circumferentially spaced about the periphery of the chuck for equal distribution of a cooling medium thereabout, and venting means placing the anvil chamber in communication with

atmosphere whereby any air which may leak forwardly past the piston is vented to atmosphere, said venting means comprising ports in the chuck placing the anvil chamber in communication with said passages.

6. A pneumatically operated rock drill comprising a casing, a chuck supported in the forward portion of the casing, an anvil chamber in the casing, a piston in the casing for effectively importing hammer blows to a drill steel supported in the chuck, heat exchange means utilizing expanded and cooled exhaust air from the casing as a cooling medium for cooling the heated forward portion of the casing, chuck and a drill steel supported therein, said heat exchange means comprising a port in the casing controlled by the piston, an annular chamber in the forward portion of the casing, conduit means connecting said port and said annular chamber, a plurality of passages defined by the outer surface of the chuck and channels on the inner surface of the casing, said passages each communicating with said annular chamber and extending forwardly therefrom opening to atmosphere adjacent the forward end of the drill, said passages being circumferentially spaced about the periphery of the chuck for equal distribution of a cooling medium thereabout and venting means placing the anvil chamber in communication with atmosphere whereby any air which may leak forwardly past the piston is vented to atmosphere, said venting means comprising a second annular chamber in the casing directly vented to atmosphere and ports in the chuck placing the anvil chamber in communication with said second annular chamber.

7. A pneumatically operated rock drill comprising a cylindrical casing, a front cover carried by the casing, a chuck supported in the front cover, a hammer cylinder in the casing, an anvil chamber in the front cover, a piston in the hammer cylinder for effectively importing hammer blows to a drill steel supported in the chuck, heat exchange means utilizing expanded and cooled exhaust air from the hammer cylinder as a cooling medium for cooling the heated forward portion of the front cover, chuck and a drill steel supported therein, said heat exchange means comprising a main exhaust port in the hammer cylinder in direct communication with atmosphere, a plurality of auxiliary ports in the hammer cylinder controlled by the piston, at least one of said auxiliary exhaust ports being disposed forward of said main exhaust port assuring that such forwardly disposed auxiliary ports will be uncovered by the piston in advance of said main exhaust port, an annular chamber in the forward portion of the drill defined by the outer surface of the chuck and a recess on the inner surface of the front cover, conduit means connecting said auxiliary ports and said annular chamber, a plurality of longitudinally extending passages in the forward portion of the drill defined by the outer surface of the chuck and channels on the inner surface of the front cover, said passages each communicating with said annular chamber and extending forwardly therefrom terminating adjacent the forward end of the drill in radially outwardly extending vents open to atmosphere, said channels being equally circumferentially spaced about the axis of the chuck adjacent the periphery thereof for equal distribution of a cooling medium thereabout, and venting means comprising at least one port in said chuck placing the anvil chamber in communication with atmosphere whereby any air which may leak forwardly past the piston is vented to atmosphere.

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