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(54) **Rock Drills.**

(57) The invention relates to rock drills generally known as down the hole drills. During the use of down the hole drills it is inevitable that chippings and other debris collect in the bottom of the hole and unless such chipping and debris are removed the drilling operation will be impeded. In addition it is a frequent requirement that chippings and debris are brought to the surface for analysis. The object of the present invention is to provide a rock drill facilitating the efficient removal of chippings and debris from the bottom of a hole which objective is met by a construction in which pressure air for the purposes of driving the piston within the rock drill is exhausted through an annular passageway between the end of the wear tube and the drill bit and whereby exhaust air passes entirely around the periphery of the drill bit and to the bottom of the hole from where it enters a centre bore through the drill bit and is exhausted through the centre tube of the drill carrying with it all chippings and debris gathered in the bottom of the hole.

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ROCK DRILLS

This invention relates to rock drills, and is particularly concerned with rock drills for producing a bore and as are frequently referred to as down-the-hole drills.

Down-the-hole drills are known and in which a compressed air supply is supplied to the drill and which, via an air diverter and suitable porting, causes a piston within the drill to reciprocate at high frequency and on its down-stroke to strike the end of a drill bit. Naturally, during operation of such drills, chippings and other debris collect in the bottom of the hole and can impede the drilling operation. Consequently, it is important that such chippings and debris is removed efficiently. Equally importantly, it is frequently so that the nature of the rock or the like through which the bore is being produced needs to be analysed and when again there is a need for a means of bringing such chippings and debris as are created during drilling to the surface for analysis.

It has therefore been previously proposed to form a down-the-hole drill with a central longitudinal outlet bore for

compressed air, and for appropriate porting to be provided such that air directed below the piston to generate its return stroke and after the return stroke has been commenced is directed to the bottom of the hole to be exhausted through the central longitudinal bore with the intention that the exhaust air should carry with it chippings and debris collecting at the bottom of the hole. The prior art proposal has involved the provision of transverse passageways leading to the centre bore and positioned above the drill bit and longitudinal passageways through the drill bit emerging at its cutting face. The difficulty here is that those longitudinal passageways emerging at the cutting face can become blocked, and when the drill is reliant on a suction effect created by air passing through the lateral passageways and up the centre bore to lift chippings and debris from the bottom of the hole, and whilst some clearing of the bottom of the hole will be effected, it cannot be guaranteed.

The object of the present invention is to provide a rock drill generally of the type referred to above and where clearing of

chippings and debris from the bottom of a hole can be substantially guaranteed.

According to the present invention, a rock drill comprises an outer wear tube, an inner centre tube, a drill bit mounted on the end of the centre tube, a reciprocal piston slidably mounted on the centre tube, an air diverter located within the drill at a position between a compressed air inlet to the drill and the piston, and porting means for the selective direction of compressed air to one side or the other of the piston to cause its reciprocation at high frequency, the arrangement being such that the piston, at the end of its down-stroke, strikes the inner end of the drill bit, and there being porting means closed by the piston during its down-stroke and opened on commencement of its return stroke to direct exhaust air to an annular passageway between the end of the wear tube and the drill bit and whereby air is exhausted in its entirety around the periphery of the drill bit to the bottom of the hole, from where it enters a central bore through the drill bit and is exhausted through the centre tube carrying with it all chippings and

debris gathered in the bottom of the hole. Whilst the annular passageway can be formed between the end of the wear tube and the drill bit, it is preferred to provide a short extension tube connected to the end of the wear tube, the annular passageway being formed between the extension tube and the drill bit.

To assist in the smooth flow of exhaust air past the drill bit to the bottom of the hole, it is desirable to provide a number of relatively shallow longitudinally disposed, external grooves around the periphery of the drill bit.

An inevitable result of producing a bore is the creation of a narrow annular gap between the outer face of the wear tube and the wall of the hole, and up which exhaust air can pass. It is therefore usual to seal the upper end of the bore at the surface, but this can have the possiby harmful effect of a gradual build-up of pressure in the annular gap. It is therefore a further advantageous feature of the invention that seal means are provided between the outer wear tube and the hole wall to limit the length of the annular gap and over which pressurisation can occur.

Thus, a sealing ring may be secured to the wear tube of a material that combines the two required properties of reasonable flexibility and wear resistance, and which will therefore not impede the passage of the drill down the hole or its withdrawal.

In a circumstance where the drill of the invention is passing through relatively soft material there can be the possible risk of a core of material being formed in the longitudinal bore through the drill bit. To ensure that this does not occur, it is a further feature of the present invention that the longitudinal bore through the drill bit towards its cutting face is set at an acute angle to the longitudinal axis of the drill bit, this offsetting of the end of the longitudinal bore ensuring that a core of material is not produced, irrespective as to the nature of the material through which the drill is passing.

The invention therefore provides a means of cleaning the bottom of a hole and bringing chippings and other debris to the surface for subsequent analysis that can substantially be guaranteed to function

efficiently no matter what drilling conditions are encountered.

One embodiment of the invention will now be described with reference to the accompanying drawing, which is a sectional side-elevation of a rock drill according to the invention.

In the drawing, a down-the hole rock drill as an outer wear sleeve 1 secured at one end to a back head 2 and at the opposite end to a chuck 3. Located within the wear tube at the end towards the back head is a check valve 4 in sealing engagement with an air diverter 5, an inner cylinder 6 being mounted on the air diverter, and extending to a bearing 7 located within the wear tube at the end towards the chuck 3, the outer diameter of the inner cylinder and the inner diameter of the wear tube being such as to provide an annular gap 8.

The air diverter 5 has a through bore in which is fitted a centre tube 9, a drill bit 10 being mounted on the opposite end of the centre tube through an interposed bearing 11. The outer surface of the drill bit and the inner surface of the chuck are

correspondingly splined as indicated at 12, the splines being so dimensioned as to provide a number of gas passageways 13 around the drill bit 10. Lying within the wear seeve 1 between the chuck 3 and the bearing 7 is a split spacer 14 on which is provided a bit retainer 15.

Within the cylinder 6 and surrounding the centre tube 9 is a piston 16 having an enlarged bore 17 at one end for sliding engagement over a stem 18 on the air diverter 5 and there being an annular gap 19 between the through bore of the piston and the centre tube 9. The piston 16 has two inlet ports 20, 21 from which, respectively, extend gas passage-ways 22, 23, the inlet ports 20, 21 respectively selectively co-operating with ports 24, 25 through the wall of the cylinder 6.

At the back-head end, a dual pipe joint 26 is provided, locating a centre tube 27 co-axially with a bore through the check valve 4 leading to the centre tube 9, and an outer tube 28 to provide an annular gas passageway 29 for incoming pressure air. The drill bit 10 has a centre bore 30 in

contiuation of the centre tube 9, and at its front end, the drill bit is provided with an angled gas passageway 31.

Thus, at the commencement of operations, and with the piston 16 at its position of rest as is indicated by the upper part of the section through the piston, the piston extends through the bearing 7 and is in contact with the end of the drill bit. Here, the piston, the bearing 7 and the cylinder 6 define a chamber 32 into which the passageway 22 in the piston emerges, and the port 20 in the piston is in register with the port 24 through the cylinder wall. On the admission of pressure air through the annular passageway 29, air passes through the check valve 4 and air diverter 5 into the annular gap 8, from where it passes through the ports 20, 24 and down the passageway 22 to pressurise the chamber 32 and apply an upward force on the piston sufficient to carry the piston to the position indicated by the lower part of the section through the piston, where the piston has, at one end, cleared the bearing 7, and at the other end engaged the stem 18 on the diverter, the piston, the stem 18 and the

cylinder forming a chamber 33 into which the passageway 23 in the piston emerges. At the commencement of the up or return stroke of the piston the instant the piston leaves the end of the dril bit, the chamber 33 is communicated with the passageways 13 around the drill bit to exhaust any pressure air, and as the piston clears the bearing 7, pressure air in the chamber 32 is also exhausted through the passageways 13. At the end of the up or return stroke of the piston, the port 21 in the piston is in register with the port 25 in the cylinder, to direct pressure air to the chamber 33, to apply a downward force on the piston to drive it into contact with the end of the drill bit.

Thus, for so long as pressure air is provided the piston is caused to reciprocate at high speed, with pressure air in the chambers 32 and 33 being alternately exhausted through the passageways 13 around the exterior of the drill bit. Consequently, all of the exhausted air passes around the exterior of the drill bit and into the bottom of the hole being drilled from where it escapes through the angled passageway 31 in the bit and up

through the centre of the drill, carrying with it dirt and debris congregating in the bottom of the hole. The angled disposition of the gas passageway through the drill bit has the effect of avoiding that passageway becoming blocked as drilling of a hole progresses.

CLAIMS

1. A rock drill comprising an outer wear tube, an inner centre tube, a drill bit mounted on the end of the centre tube, a reciprocal piston slidably mounted on the centre tube, an air diverter located within the drill at a position between a compressed air inlet to the drill and the piston, and porting means for the selective direction of compressed air to one side or the other of the piston to cause its reciprocation at high frequency, the arrangement being such that the piston, at the end of its down-stroke, strikes the inner end of the drill bit, characterised in that there are porting means (13, 22, 24) closed by the piston (16) during its down-stroke and opened on commencement of its return stroke to direct exhaust air to an annular passageway (13) between the end of the wear tube (1) and the drill bit (10) and whereby air is exhausted in its entirety around the periphery of the drill bit (10) to the bottom of the hole, from where it enters a central bore (30) through the drill bit (10) and is exhausted through the centre tube (9) carrying with it all chippings and debris

gathered in the bottom of the hole.

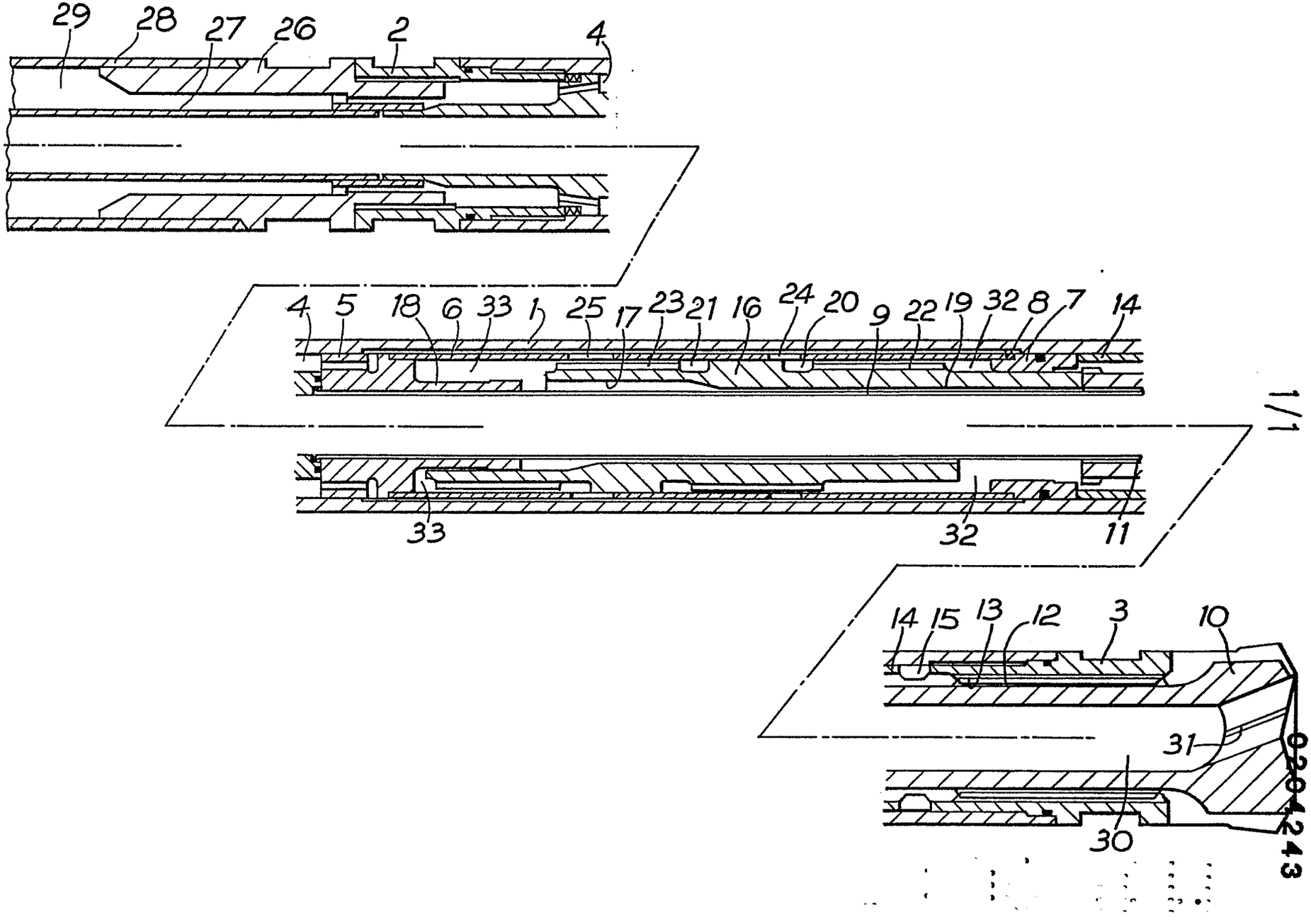
2. A rock drill as in Claim 1, wherein the annular passageway (13) is formed between the end of the wear tube (1) and the drill bit (10).

3. A rock drill as in Claim 1, wherein the annular passageway (13) is formed between a short exension tube connected to the end of the wear tube (1) and the drill bit (10).

4. A rock drill as in any of Claims 1 to 3, wherein a number of relatively shallow longitudinally disposed external grooves (12) are provided around the periphery of the drill bit (10).

5. A rock drill as in any of Claims 1 to 4, wherein externally of the wear tube (1) and part way along its length annular seal means are provided to seal against the wall of the hole being cut.

6. A rock drill as in any of Claims 1 to 5, wherein the gas inlet (31) to the longitudinal bore (30) through the drill bit (10) is set at an acute angle to the longitudinal axis of the drill bit (10).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