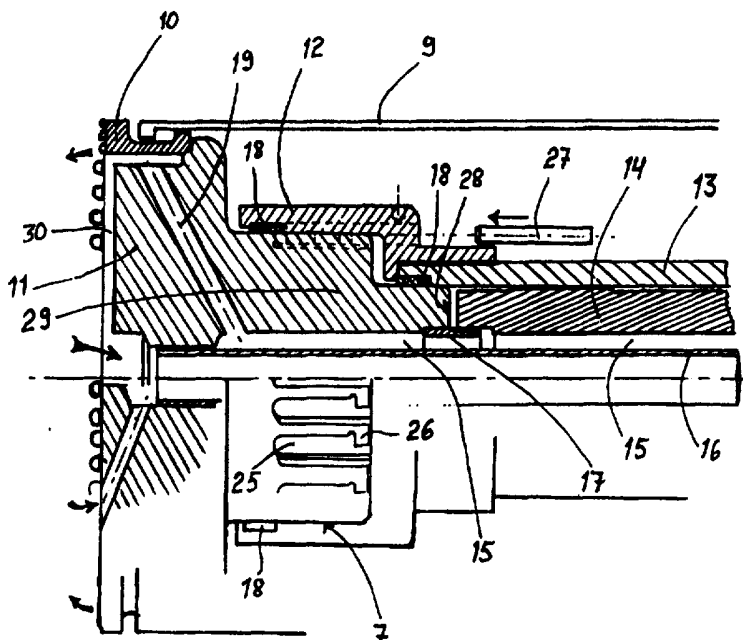




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(54) Title: A DRILLING APPARATUS BIT ASSEMBLY AND METHOD TO REMOVE DRILL WASTE



(57) Abstract

A bit assembly of a device boring a tunnel or hole in the soil comprising a cylindric inner bit (11) that can be pulled out from the bit assembly and a ring bit (10) mounted substantially outside the said bit to drill the outer hole portion and through which bit assembly drill waste is transported backward by means of pressure medium, s.c. flushing medium. The flushing medium channels (19) are in spindle (29) to discharge from there to the front side of the bit assembly, substantially from the outer bit circle, for instance the space between ring bit (10) and inner bit (11), and that the flushing medium is conveyed from the front of bits (10, 11) backward through bit spindle (29).

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A DRILLING APPARATUS BIT ASSEMBLY AND METHOD
TO REMOVE DRILL WASTE

This invention relates to a method according to the introduction part of patent claim 1 and to a bit assembly according to the introduction part of patent claim 4.

Previously known is conveyance of flushing medium transporting drill waste to the bit front side as a design in accordance with figure 1, where pressure air mostly from piston 4 is conveyed through a spindle 5 to the bit front side. From the bit front side the blast containing drill waste travels through channels in the bit outer edges along the bore hole to the rear. Both cylindrical and chisel bits are known, where the major portion of the bit cross-section is a hole.

The disadvantage of a solution as per figure 1 is that due to the inner hole the spindle becomes thin and weak and breaks by stress from impacts applied on a large size bit. On the other hand, on conveying flushing medium in the manner shown in the figure, more or less drill waste will remain in chamber 8 when drilling is stopped. Waste accumulates in chamber 8 by horizontal drilling and especially drilling vertically downward.

The thin neck of the spindle is a disadvantage by operation with all types of bits, particularly when the bit diameter is many times larger than the spindle diameter. When the bit edge hits rock, the spindle neck breaks easily.

The direction of flushing medium as per figure 1 is a disadvantage, especially with a double bit, since on stopping drilling, it is not possible to pull out the inner bit and the hammer from the bore hole due to drill waste accumulated in space 8, which wedges itself against outer tube 9.

By means of a bit assembly according to this invention the above introduced disadvantages are eliminated and the invention is

introduced disadvantages are eliminated and the invention is characterized in what is presented in the patent claims.

The advantage of this invention is that with a double bit assembly, which has an outer bit ring not possible to pull out from the bore hole and a cylindric bit meant to be pulled out from the bore hole, the hammer surroundings can be kept free from drill waste by reversed flow of the flushing medium. Flushing medium flows free only on the front side of the bits, elsewhere its travel is channelled. On stopping drilling, hardly any drill waste remains in the bore hole, since even from the apparatus, which is to be pulled out, no waste is dropping into the hole.

On reaching the front side of the bits from the outer hole portion, possibly as an annular stream, the delivery speed of the flushing medium is clearly lower than the speed of the blast in previous designs, when it turns backward through some holes from a corresponding spot in the bit. Accordingly, the edge portions of a hole in soft soil are attacked to a lesser degree by the flush-ing air in a solution as per this invention than in previous solutions. Particularly, when the flushing air is mere air. In previous designs even drill waste was conveyd along with the air.

In the following the invention is disclosed with reference to the enclosed drawing, where

Fig. 1 shows a known prior art.

Fig. 2 shows a bit assembly according to the invention.

Figure 1 illustrates a single bit 6, from the centre of which flushing air is blasted out and back to the rear through channels in the bit outer edge. Spindle 5 is secured to the drilling machine body by a nut 2 using a two-piece locking ring 3. Drill waste accumulates in chamber 8 due to retardation of the blast speed.

Figure 2 illustrates a double bit assembly as per the invention,

hand, a novelty is that the flushing air is conveyed along channel 19 in spindle 29 to the outer edge of the inner bit and is most favourably admitted to discharge from the angular space between bits 11,10. From that space there can be channels 30 direct to the bit 11 centre. There can also be channels from elsewhere of the bit 11 front face to the centre, from where a channel 16 leads backward. From this channel the flushing air returns taking drill waste along with it. The flushing air arrives coaxially along channel 15 through spindle 29 to the spindle and between the bits. There are many channels 19, all of them need not reach to the joint between the bits, but especially in large-diameter bits a portion of the flushing air can discharge already from the inner bit surface.

Flushing air can be conveyed from the space between the bits even further through the joint to ring bit 10, from where it can discharge along a channel (not shown) to the bit 10 front side.

By means of a construction shown in figure 2 the spindle 29 is made sturdy and does not break by drillings of even wider channels. The sturdiness is produced by an expansion of the spindle at support bushing 12. In the support bushing the spindle slides a distance as long as needed by hammering. The spindle is put into rotation from the hammer and the rotative motion is transferred by the said support bushing to the spindle by means of the spindle grooves 26 and their counter-pieces in bushing 12. The joint must also be opened. However, in the double bit assembly the actual joint, which can be opened, is the joint between bits 10,11.

Favourable for the double bit assembly is the presented reversed way of flushing, because clean flushing air keeps the joint clean that can be opened between bits 10 and 11, so that after drilling, for instance deep in the soil, the joint can be opened and the valuable inner bit and the hammer pulled out from the bore hole. Left behind would remain the bore hole sheltered in the protection tube 9 and the ring bit 10, which must always be

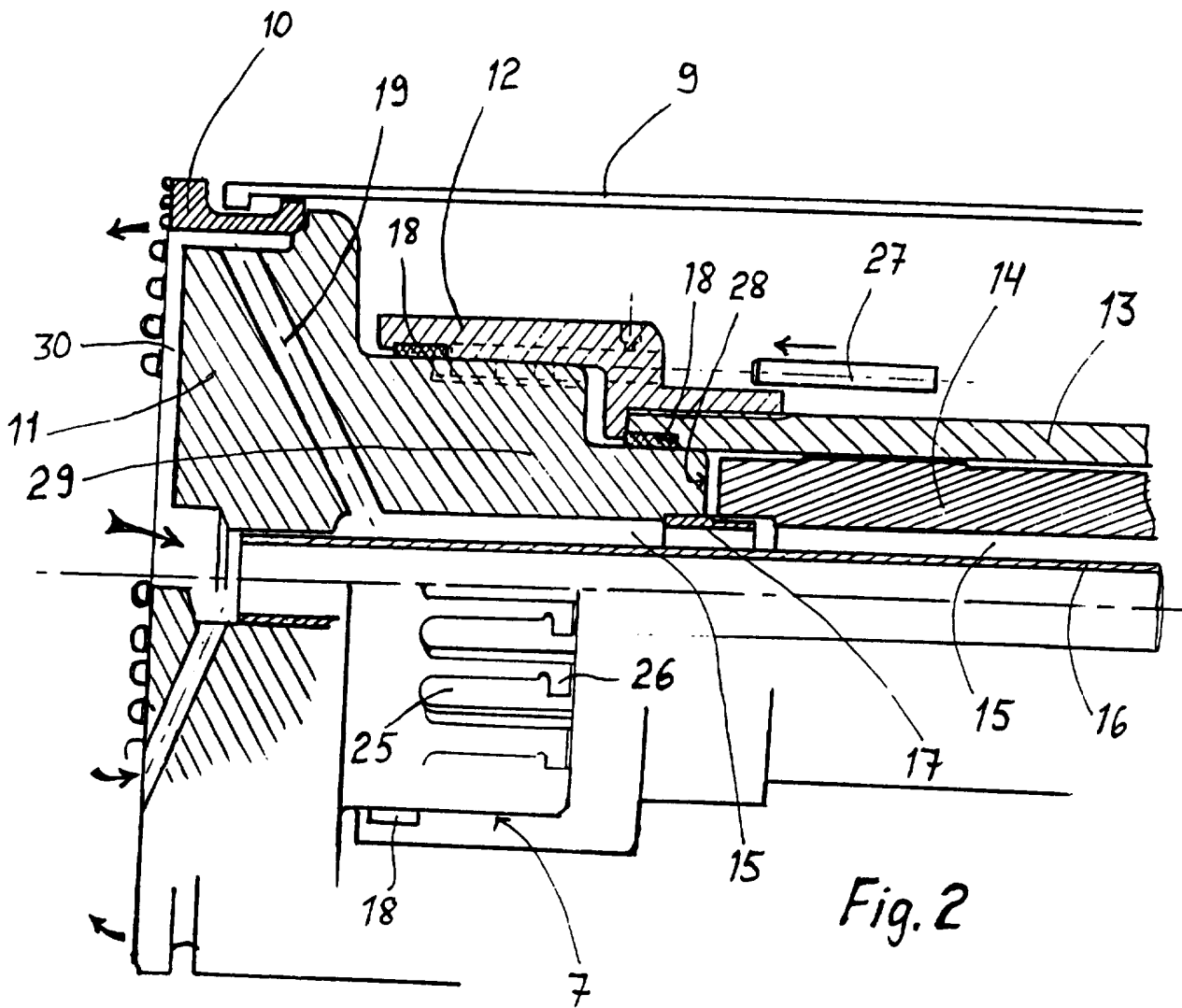
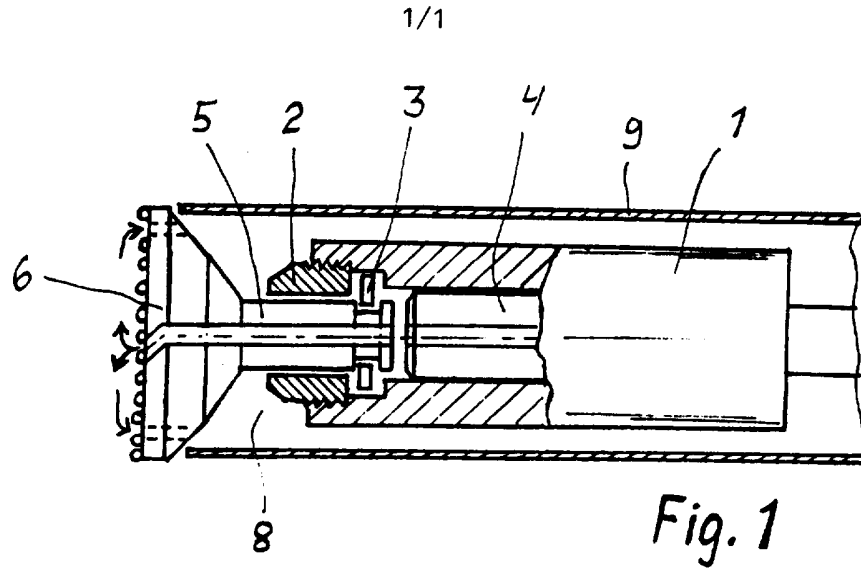
sacrificed to the closed space. The reversed flushing keeps also the hammer outer space clean from drill waste and thus pulling out the hammer and inner bit from the hole is secured.

PATENT CLAIMS

1. A method to remove the drill waste in a drilling apparatus of a device boring a tunnel or hole, which apparatus has a cylindric inner bit (11) that can be pulled out from the bit assembly, which has also a ring bit (10) drilling the outer hole portion characterized in that a portion of the flushing medium transporting drill waste is conveyed from the spindle (29) of the inner bit radially in the spindle at least into the space between bits (10, 11) and discharged from that space further to the front side of the bits and that the flushing medium is removed backward through the inner bit (11) and the said spindle.
2. A method according to patent claim 1 characterized in that flushing medium is conveyed to the front side of ring bit along a channel formed in the ring bit (10).
3. A method according to patent claims 1 and 2 characterized in that a portion of flushing medium is conveyed through holes in the inner bit to the front side of the inner bit.
4. A bit assembly of a device boring a tunnel or hole in the soil, the assembly comprised of a cylindric inner bit (11) that can be pulled out from the bit assembly and a ring bit (10) mounted substantially outside the former bit to drill the outer portion of the hole and through which bit assembly drill waste is transported backward by means of pressure medium, s.c. flushing medium, characterized in that in the bit spindle (29) there are channels (19) conveying flushing medium to the front side of bits (10,11) and reaching radially at least in level with the joint between ring bit (10) and inner bit (11) and that there is a discharge channel to the rear through the inner bit (10) and spindle (29) for the flushing medium reversing from the bit front.
5. A bit assembly according to patent claim 4 characterized in that spindle (29) is secured to the hammer by a guide bushing

(12) with an inner diameter substantially greater than the diameter of hammering face (28) of spindle (29) for direct extension of the spindle diameter at surfaces (18) supporting the spindle and for spindle reinforcement if a larger inner hole in the spindle is needed.

6. A bit assembly according to patent claims 4 and 5 characterized in that the inlet (15) and outlet (16) channels run through spindle (29).



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 95/00631

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E21B 10/38, E21B 7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: E21B, E21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EDOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 9015220 A1 (LISTER, WILLIAM), 13 December 1990 (13.12.90), page 2, line 35 - page 3, line 18 --	1-6
Y	DE 4225701 C1 (RUBAK, PETER), 23 December 1993 (23.12.93), page 4, line 51 - line 61 --	1-6
Y	Derwent's abstract, No 93- 51819/06, week 9306, ABSTRACT OF SU, 1719633 (KYSHTYM MACH WKS), 15 March 1992 (15.03.92), Fig 2, detail 14 -- -----	5

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INTERNATIONAL SEARCH REPORT
Information on patent family members

05/02/96

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9015220	13/12/90	NONE	
DE-C1- 4225701	23/12/93	NONE	