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(54) **PERCUSSION ROCK DRILLING BIT WITH
MORE EFFICIENT FLUSHING**

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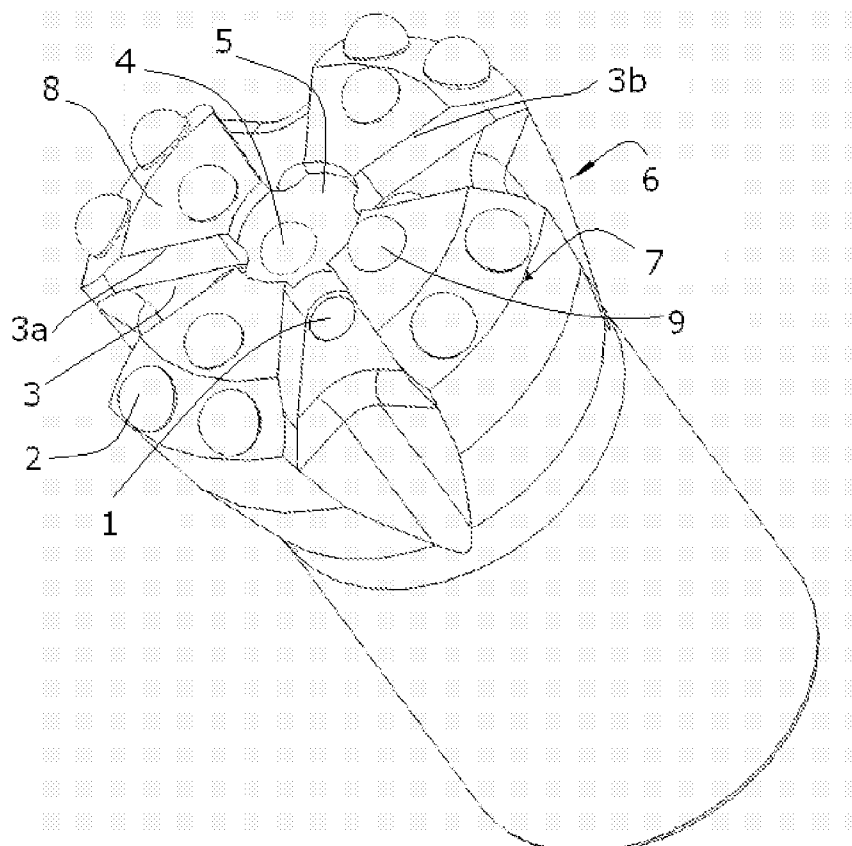
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ABSTRACT

A design of crown of drill bit for percussive rock drilling with big "V" shape front flushing grooves, small central "dead" area will reduce the repeatedly crushing of broken rock cuttings. It will not only improve the rate of penetration, but also decrease the hole deviation, as well as the erosion to the outer surface of drive sub and case tube of DTH hammer.

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an example of bit crown with big front flushing grooves in 3-D view

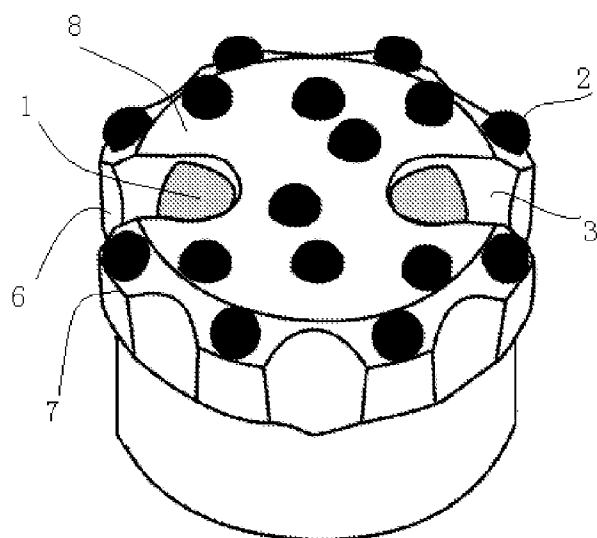


Figure 1, an example of conventional bit crown design

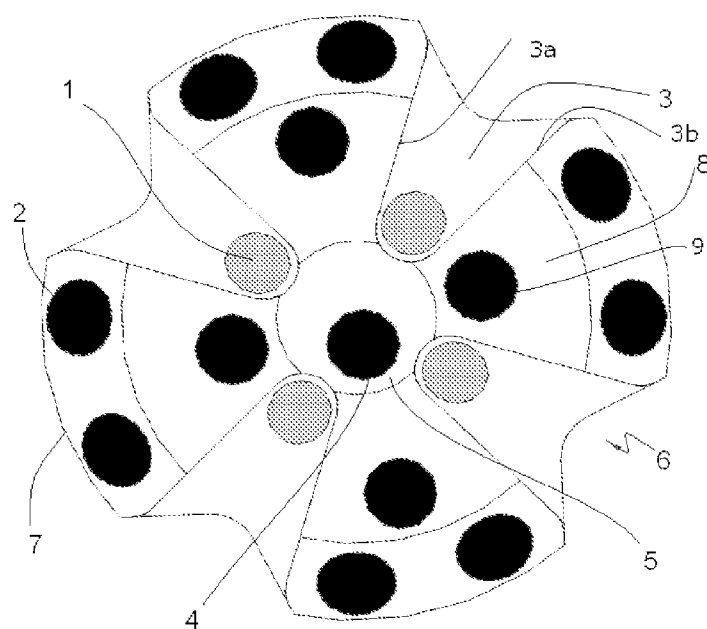


Figure 2, an example of bit crown with big front flushing grooves

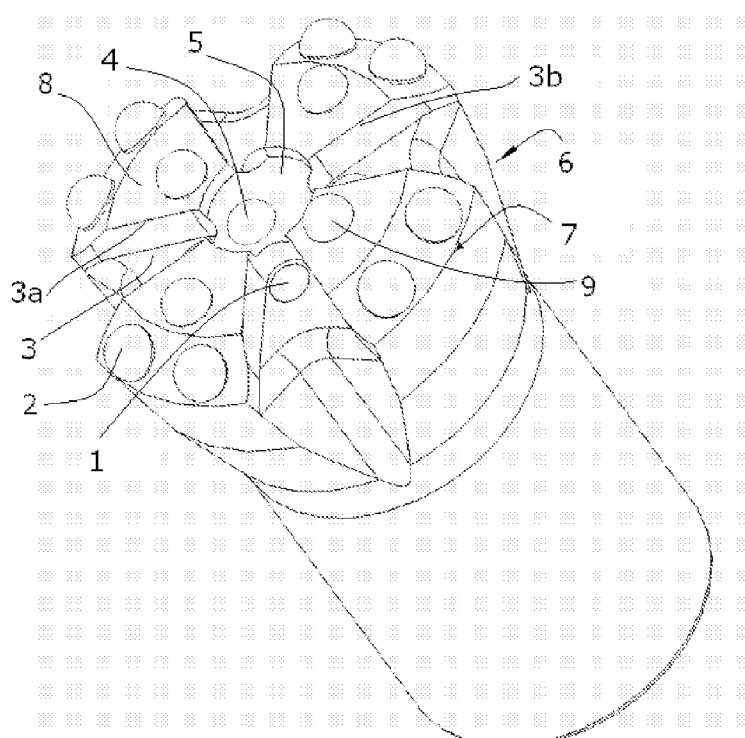


Figure 3, an example of bit crown with big front flushing grooves in 3-D view

PERCUSSION ROCK DRILLING BIT WITH MORE EFFICIENT FLUSHING

THE APPLICATION AREA

[0001] The present disclosure relates to bore holes drilling of an earth formation by top hammer hydraulic drilling and down-the-hole (DTH) drilling with a hammer that is driven by pressurized air or other fluids.

THE BACKGROUND

[0002] The button bit technology was mainly focused on increasing the rate of penetration, deviation improvement, better materials and bit skirt design since their first introduction. There are not significant changes in the designs to improve the flushing efficiency.

[0003] However, the actual rate of penetration is determined by the efficiency of both impacting and flushing. The broken rock debris should be removed via flushing medium immediately so buttons will hit fresh solid rock surface with each impact. Otherwise, a portion of the impact energy will be consumed by crushing the broken debris, eventually slow down the penetration.

[0004] An example of prior art of design is shown in FIG. 1, the flushing holes located at the distance about half of the bit front head radius to the center. They are connected via grooves 3 in the front face to the side grooves 6 of bit head respectively. The front head grooves 3 have straight parallel edges and the width of them is about the same as the diameter of flushing hole.

[0005] From fluid dynamics, the majority of flushing medium at the bottom of a hole will flow through the grooves 3 in the front face of bit, which are bigger passages therefore have less restriction to flushing medium. Broken rock chips within the areas will be blow away by the flushing medium immediately. The blowing out force of flushing medium is not as high in the areas without flushing grooves because of the restriction and/or resistance of inserts and bit body steel. Furthermore, the big rock chips are very likely clamped and/or blocked by the bit front face, inserts and rock surface. They will also block smaller chips. Therefore, the majority of broken rock debris could not be blown away on time. They get crushed repeatedly, and then are blown out by flushing medium when meet the flushing grooves as the bit rotating.

[0006] Moreover, the central area of bit front head is a "dead area", the area within the inner edge of the flushing holes/grooves. There is theoretically no flushing force to blow rock debris out from the area. They get crushed repeatedly.

[0007] All of the left over rock cuttings act as a cushion between the bit and solid rock surface. The "cuttings cushion" prevents the inserts from penetrating the solid rock. Therefore, large portion of impact energy is consumed by crushing the cuttings and the rate of penetration is slowed down; the body steel of bits front face gets worn away fast.

[0008] The "cutting cushion" also prevents the buttons of bit from grasping the solid rock, keeping the drill bit in a

floating state. Therefore, bit tends to move sideways if it encounter side force, causing the holes' deviation.

[0009] With the prior art of design, the width of the front grooves 3 is small on the edge of bit head. So the velocity of the flushing medium and the cuttings is very high when moving out of the grooves 3, especially for DTH air hammer. Severe erosion will be created on the behind outer surface of drive sub and hammer case tube.

THE DESCRIPTION OF THE INVENTION

[0010] As is shown in FIG. 2 and 3, there is only one insert 4 in the central area 5 of the front head of the bit, so that the flushing holes 1 can be close to the center as much as possible to minimize the central dead area 5.

[0011] The width of front flushing grooves 3 becomes wider towards the edge 7 of bit crown forming "V" shape front flushing areas as viewed in the direction perpendicular to the front face 8. Each of the front grooves 3 connects to a side groove 6 respectively, which is in the surface of the cylinder and/or cone of bit crown. The rock debris in the areas can be blown away by flushing medium immediately. The inserts 2 moving into this area will hit the fresh solid rock surface.

[0012] The opening size of groove 3 along edge 7 should be as wide as possible so the total area of the grooves 3 is much bigger than that of the conventional straight grooves, which means much less re-crushing of the rock debris under the bit front face 8. Therefore, more impact energy will be used to break solid rock surface. Also the wider openings will significantly reduce the velocity of the out moving flushing medium and the cuttings, which results in much less erosion on the outer surface of drive sub and hammer tube.

What is claimed in the invention are:

1. A crown of rock drill bit for percussion rock drilling, comprising at least three fluid passages or flushing holes 1 which emerge in the vicinity of the front face 8 of the crown; each flushing hole connecting to a radially extending front groove 3 formed in the front face; the outer end of each front groove connecting to a side groove 6 which extend axially rearward; wherein each land formed between the grooves carries at least one gauge insert 2 and one front insert 9.

2. The bit crown, according to claim 1 has only one button in the central area 5, the area within the inner edge of the flushing holes/grooves of the front head.

3. According to claim 1, the shape of each front groove 3, when looking at the bit front face, is "V" shape, the width of the front grooves, when measuring across the center of the flushing hole, is bigger than its diameter, getting wider outwards, to minimum 1.3 times wider towards the outer edge 7 of bit front head.

4. According to claim 3, the sides 3a and 3b of front grooves 3, when looking at the bit front face 8, can be straight and/or curved; the opening width of side grooves 6 is the same or bigger than that of front grooves 3.

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