This invention relates to rock drilling bits of the type comprising a plurality of segmental elements (such as) which have rotary cutters mounted on projecting bearings and which enclose flushing liquid conduits delivering flushing liquid to the cutters.

In the drilling bits of the above type at present available, the conduits for the flushing liquid are contained in a tubular branched unit separate from the drill bit and housed in recesses or cavities in the cast or forged segmental elements of which the bit is composed.

An aim of the present invention is to simplify the construction and reduce the number of parts comprising the bit, eliminating the separate unit conveying flushing liquid.

A further aim of the invention is to improve the sturdiness of construction, including that part concerned with the mounting of the liquid outlet nozzle.

The invention broadly consists in a rock drill bit which possesses self-contained flushing liquid passages formed integrally in the bit segmental elements, such that the flow circulation directly contacts the metal of the bit segments.

According to the invention the circulating liquid is conveyed to the nozzles through passageways composed of a plurality of arcuate grooves which are formed in the bit segmental elements and which when mated together complete said passages. In the preferred form, each of three segmental elements has a coaxial arcuate groove, subtending an angle of 120°, in the shank of the element and dividing into two nozzle feeding branch grooves, and one of such pair of grooves terminates in a boss adapted to constitute an integral seating for the delivery nozzle.

A feature of the invention lies in the provision of a nozzle seating boss as above characterized, projecting laterally to overlap the opposing branch groove of the next adjacent segment and constitute a bridging bond welded to such segment.

In the accompanying drawings:

Figure 1 is a front elevation of one of the segmental elements for a bit according to the invention; the elevation presents the inward surfaces of such elements.

Figure 2 is a rear or outside elevation of the segmental element and

Figures 3 and 4 are respectively a right and left hand side elevation of the segmental element seen in Figure 1.

Figure 5 is a plan view according to Figure 3.

Figure 6 is a right hand side elevation (partly in section) of a segmental element, machined ready for assembly and welding.

Figure 7 is a plan according to Figure 6.

Figure 8 is a fragmental front elevation of a segmental element as seen in Figures 6 and 7.

Figure 9 is a fragmental sectional view of the nozzle mounting, taken on the line 9—9 of Figure 7.

Figure 10 is an outside elevation of a pair of segmental elements assembled together to illustrate the overlapping relation of the nozzle mounting boss with respect to the adjoining segmental element.

Figure 11 is a plan view of three segmental elements welded together to compose one form of the improved bit and illustrating the weld around the nozzle boss.

In carrying the invention into effect according to one mode described by way of example, dies are made for drop forging identical segmental elements of the shape and character described below. Each segmental element is forced integrally (subtending an angle of 120°) and comprises a shank portion 1, a body or head 2, neck projections 3 carrying cutter bearing bosses 3a on the head, and a nozzle mounting boss 4 projecting laterally from one side of the head portion of the segmental element, the boss being located in the region intended for the circulation outlet. In the present instance each drill bit consists of three segmental elements which are adapted to fit together to constitute a bit which externally (Figure 2) in rear view is similar in general appearance to drill bits of known type.

As the segmental elements are identical one with another, it will suffice to describe one such element in detail and the manner in which the several segmental element elements fit together and are assembled and welded to comprise an integral bit unit.

Each segmental element has right and left segmental faces 5a, 5b and these faces mate with corresponding faces of the segments on either side when assembled.

The shank 1 at the segmental angle is mutilated in the forging by an arcuate coaxial groove 6 adapted to constitute one third of the boundary wall of an axial fluid passage of circular cross section. At the region where the shank merges into the body or head 2, the arcuate groove 6 divides into a pair of branch arcuate grooves 6a, 6b inclined outwardly away from the bit axis. The branch grooves are separated at the upper portion of the head by a central body of metal terminating inwardly in fragmental segmental faces 5c and 5d which are spaced away from the longitudinally extending faces 5a and 5b respectively by the said branch grooves. The arcuate grooves 6a and 6b are completed into liquid distributing branch passages when the three like segmental elements are assembled together, the groove 6a being completed by the juxtaposition of the groove 6b of the circumferentially adjacent segmental element. The groove 6b is correspondingly completed by the juxtaposition of the groove 6a of the next segmental element.

The branch groove 6b opens inwardly into a recess 7 formed in the upper surface of the head, but the branch groove 6a is closed at its upper end by the transverse boss 4 which projects laterally beyond the face 5a such that it overlaps the end of the groove 6b of the next adjacent segmental element and is accommodated in the recess 7 thereof.

The boss is such that it can be machined and drilled as described hereinafter to provide seating sockets for outlet nozzle inserts for discharging the circulating liquid. Each boss, due to its overlapping relation with the next segmental element, constitutes a bonding bridge between adjacent elements.

The drop forging dies are designed to produce a forging which is slightly oversize in respect to those parts which require machining for producing a snug fit in the assembly of the segments.

After forging the segmental elements are machined as for the faces 5a, 5b, 5c and 5d to afford accurately mating surfaces when the elements are assembled together. In preparing three segmental elements for assembly and welding, the margins which represent the meeting of the groove 6 and the faces 5a, 5b of each segment and co-extensive with the shank part 1 are given a chamfer 1a.
Each boss 4 is drilled and reamed to form a seating 4c for a tungsten or other nozzle assembly 8. The conical projections 3a are machined to afford cutter bearings as seen in Figures 6 and 7. These bearings may have roller bearing races 3b and ball bearing races 3c. A transverse bore 3d may be provided extending from the outermost surface of the neck projection 3 to the ball bearing race 3c for inserting balls into such race after a cutter is in position around the bearing. This arrangement of races and passage for inserting balls into the ball race is conventional.

After assembly of the three segmental elements in a jig, welding is carried out at the parts indicated above and a weld may also be made around the nozzle inserts at 8a.

In order to ensure exact registration of the segmental elements one with another in the assembly, the faces 5a and 5b are provided with dowel holes 9 (Figures 6 and 8) and dowels in suitable positions. After the welding operation has united the three segmental elements into an integral bit unit, any circumferential or other machining including the formation of a tapered thread on the shank, as indicated at 1b (Figures 6 and 8) is effected.

The completed bit constitutes a very sturdy unit, the segmental elements of which are not only united by the longitudinal and transverse welds but are bonded by the bridging bosses welded in overlapping relation to the next adjacent segmental element.

This arrangement provides conducting passages with which the circulating legend directly contacts and eliminates the usual separate piping unit for the circulating liquid housed within cavities specially formed to receive it. In the improved bits the axial and branch grooves form passages integral with the metal of the segmental elements and terminate in nozzles directly seated in the metal of the bridging bosses.

I claim:

1. In a rock drill bit, a bit head comprising a plurality of segments secured together and cutters attached to the lower end of the head, each of the segments having longitudinally extending parting faces respectively in abutment with the corresponding parting face of an adjacent segment, each segment having an annular upper cross section so that the segments together provide a fluid passage opening at the upper end of the bit head, pairs of mating branch grooves respectively in the adjacent parting faces of each segment and extending downwardly from said passage toward the lower end of the bit head, said nozzle pads bridging between adjacent segments and extending laterally across the parting faces of such adjacent segments and respectively lying across the lower ends of the pair of branch grooves in each adjacent segment, said pairs of matching grooves extending to and terminating at the respective nozzle pads, each pad having a bore therethrough communicating with the pair of grooves across which it extends.

2. The bit of claim 1 wherein each of said pads is integral with one segment and is welded to an adjacent segment.

3. The bit of claim 2 wherein said adjacent segment has a recess into which the pad on said one segment extends.

4. The bit of claim 1 wherein a nozzle of wearresistant material is secured in the bore of each pad.

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