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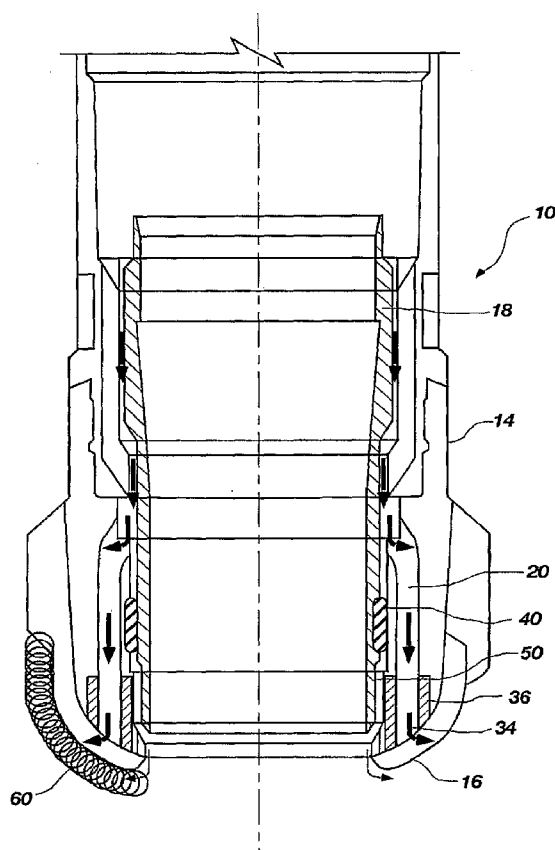
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[Continued on next page]

(54) Title: CORE DRILL ASSEMBLY WITH ADJUSTABLE TOTAL FLOW AREA AND RESTRICTED FLOW BETWEEN OUTER AND INNER BARREL ASSEMBLIES



(57) Abstract: A core drill assembly with replaceable cutting fluid nozzles permitting effective total flow area adjustment (TFA), substantial optimization of hydraulic force at the cutting face to improve rate of penetration (ROP) and core quality. At least one seal assembly to restrict drilling fluid flow while permitting mutual rotation between the core head ID and the lower shoe is disposed in an annulus defined therebetween.



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AMENDED CLAIMS

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1. A core drill assembly (10) configured for downward flow of drilling fluid
5 within an interior thereof and upward flow about an exterior thereof, the core drilling
assembly (10) comprising:
a core head (14) including an inside diameter, a face (16), and at least one fluid course
having an outlet on the face (16);
a lower shoe (18) disposed within a portion of the inside diameter of the core head (14);
10 the core drill assembly (10) characterized by:
at least one replaceable nozzle (36) disposed in the at least one fluid course (20) proximate
the outlet; and
at least one seal structure (40), disposed between the inside diameter of the core head (14)
and an exterior side surface of the lower shoe (18), the at least one seal structure
15 (40) configured to prevent substantial downward flow of drilling fluid between an
exterior side surface of the lower shoe (18) and the inside diameter of the core
head (14) and to permit rotation of the core head (14) about the lower shoe (18).
2. The assembly of claim 1, wherein the at least one replaceable nozzle (36)
20 is replaceable with another replaceable nozzle (36) having a different inner diameter (34).
3. The assembly of claim 1, wherein the at least one seal structure (40)
comprises a seal assembly (40) and includes at least one groove (46) formed on at least
one of the inside diameter of the core head (14) and the exterior side surface of the lower
25 shoe (18).
4. The assembly of claim 3, wherein the seal assembly (40) includes at least
one seal element (42, 44) carried in the at least one groove (46).
- 30 5. The assembly of claim 4, wherein the at least one seal element (42, 44) is
at least one of an o-ring seal, a wiper seal, a split-ring seal, a chevron seal or a packer cup.

6. The assembly of claim 4, wherein the at least one seal element (42, 44) is made of at least one of a nylon, a Teflon®, a polyethylene, a rubber or a neoprene material.

5 7. The assembly of claim 1, wherein the at least one seal structure (40) comprises a labyrinth seal (48).

8. The assembly of claim 1, wherein the at least one seal structure comprises a restrictor sleeve (60) disposed within the core head (14) laterally adjacent an exterior
10 side surface of the lower shoe (18).

9. The assembly of claim 8, wherein the restrictor sleeve (60) rests on an annular shoulder (62) on the inside diameter of the core head (14).

15 10. The assembly of claim 8, wherein an inside diameter of the restrictor sleeve (60) and the laterally adjacent exterior side surface of the lower shoe (18) are mutually spaced by about 1 mm.

11. A method for substantially controlling the total flow area (TFA) of a core
20 drill assembly (10) comprising:
providing a core drill assembly (10) configured for downward flow of drilling fluid within an interior thereof to a core head (14) at a lower end of the core drill assembly (10) and subsequent upward flow about an exterior of the core drill assembly (10), the core head (14) including at least one fluid course (20) having an outlet on the face (16) thereof;
25 the method characterized by:
installing a replaceable nozzle (36) having a selected inner diameter (34) in the at least one fluid course (20) proximate the outlet;
disposing a lower shoe (18) at least partially within the core head (14); and
rotating the core head (14) about the lower shoe (18) while flowing drilling fluid
30 downwardly within the core drill assembly (10), substantially preventing a downward flow of the drilling fluid between the core head (14) and the lower shoe (18) using a seal structure (40) disposed between an inside diameter of the core head (14) and an exterior side surface of the lower shoe (18) and directing

drilling fluid flow through the at least one replaceable nozzle (36) to a face (16) of the core head (14) and upwardly about an exterior of the core drill assembly (10).

12. The method of claim 11, further including replacing the at least one
5 replaceable nozzle (36) with another replaceable nozzle (36) having a different inner diameter (34).

13. The method of claim 13, further comprising providing an absolute fluid
10 seal between the core head (14) and the lower shoe (18) with the seal structure (40).

STATEMENT

Applicant has amended claims 1, 3, 4, 8, 9, 10, 11 and 13. The amendments have no impact on the description and the drawings. The amendments to claim 1 recite, among other things, to further specify the configuration of the core drill assembly for conventional, downward flow and to place the claim in two-part form. The amendments to claim 3, 4, 8, 9 and 10 have been made to enhance antecedent basis in light of the amendments to claim 1 and to eliminate abbreviations from the claims. Claim 11 has been amended in a manner similar to claim 1. Claim 13 has been amended to specify that the recited absolute fluid seal is achieved with the seal structure recited in claim 11.