

- [54] **ROTARY DRILL BIT AND METHOD OF FORMING BORE HOLE**
- [76] Inventor: **Donald P. Arbuckle**, 1203 18th St., Golden, Colo. 80401
- [21] Appl. No.: **834,656**
- [22] Filed: **Sep. 19, 1977**
- [51] Int. Cl.² **E21B 7/18**
- [52] U.S. Cl. **175/67; 175/340; 175/393; 175/422; 299/17**
- [58] Field of Search **175/67, 339, 340, 393, 175/422; 299/17**

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,901,223	8/1959	Scott	175/340
3,417,829	12/1968	Acheson et al.	175/67
3,542,142	11/1970	Hasiba	175/422 X
3,865,202	2/1975	Takahashi et al.	175/67 X
3,923,109	12/1975	Williams, Jr.	175/340
3,923,109	12/1975	Williams, Jr.	175/340

FOREIGN PATENT DOCUMENTS

39860	7/1957	Poland	175/340
-------	--------	--------	---------

Primary Examiner—Stephen J. Novosad
Assistant Examiner—Nick A. Nichols, Jr.
Attorney, Agent, or Firm—Crandell & Polumbus

[57] **ABSTRACT**

Means for emitting high-pressure jets of fluid such as

water, and mechanical rock breaking wheels, are positioned on a rotary drill bit for cooperatively cutting an axially extending bore hole through earth material. A center core opening is cut into the drill face material of the bore hole by a jet of fluid crossing the axis of the bore hole at an acute angle. The material of the drill face annularly surrounding the center core opening is removed by cutting concentric slots in the material and by applying radially inward directed force for breaking each ring defined by the slots cut. At any given axial position or level, the slots are cut and the rings are broken in sequence from the radially innermost position to the radially outermost position of the bore hole. Removal of the drill face material occurs simultaneously at different axial positions or levels in the bore hole; the center core opening is first opened by the center jet cutting at the most axially advanced position, an inner annular segment of drill face material surrounding the center core is simultaneously removed at intermediate axial positions, and an outer annular segment of drill face material surrounding the inner annular segment is simultaneously removed at the least axially advanced positions. The fluid jet emitting means cut slots in the inner and outer annular segments. Breaker wheels break the rings of material by applying a bending movement on the rings. The jet emitting means are positioned radially adjacent the breaker wheels.

82 Claims, 12 Drawing Figures

