May 23, 1967 JAMES E. WEBB 3,321,034
ADMINISTRATOR OF THE NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
SAMPLE COLLECTING IMPACT BIT
Filed Jan. 19, 1965

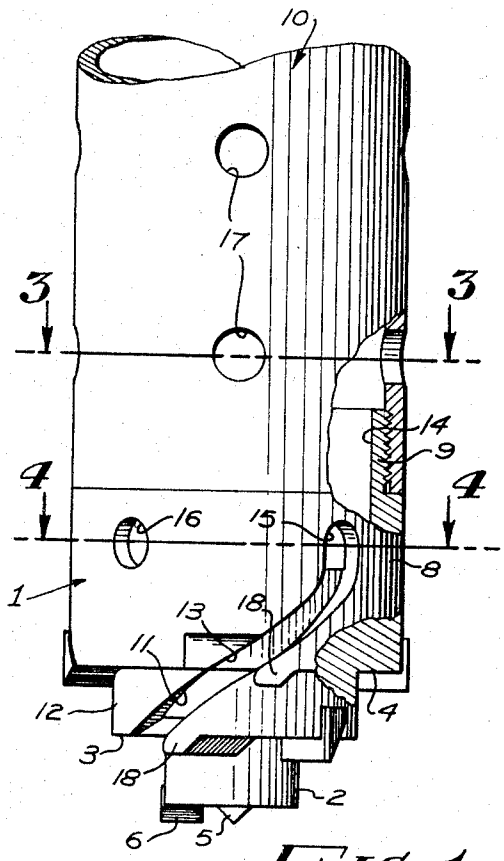

FIG. 1

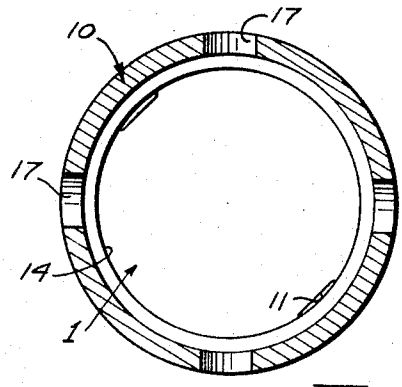

FIG. 3

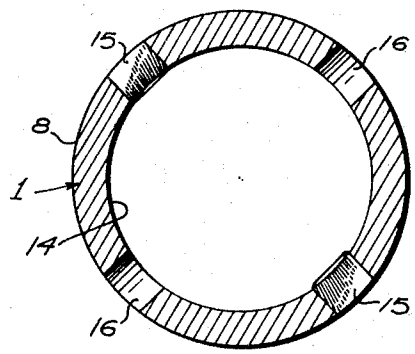

FIG. 4

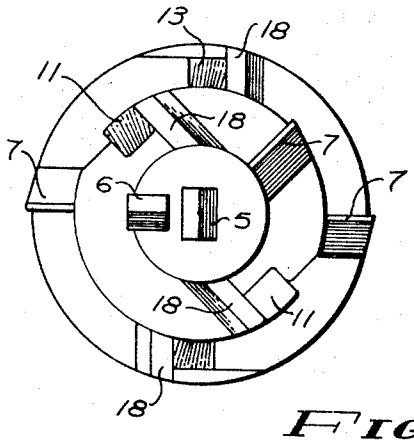

FIG. 2

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3,321,034

SAMPLE COLLECTING IMPACT BIT

James E. Webb, Administrator of the National Aeronautics and Space Administration, with respect to an invention of Victor A. Peckham, Jr., Manhattan Beach, Calif.

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5 Claims. (Cl. 175—310)

The invention described herein was made in the performance of work under a NASA contract and is subject to the provisions of Section 305 of the National Aeronautics and Space Act of 1958, Public Law 85–568 (72 Stat. 435; 42 U.S.C. 2457).

This invention relates to sample collecting impact bits and included in the objects of this invention are:

First, to provide a sample collecting bit having a novel means of collecting and storing cuttings produced by operation of the bit, the collecting and storing means including a cylindrical chamber above the bit and confronting the surrounding walls of the bore formed by the bit, the chamber having holes through which cuttings or powder produced by the bit work into the chamber and are not only collected but also, by being collected, minimize rotational friction.

Second, to provide a sample collecting impact bit which is operable without the use of air, water or other flushing mediums and which is particularly suitable, but not limited to use in an essentially atmosphere free environment such as the surface of the moon.

Third, to provide a sample collecting impact bit wherein the teeth are mounted on a series of terraces or annular ledges of increasing diameter, and wherein grooves are provided to guide cutting produced by the teeth in an upward direction for collection.

These and other objects of the invention are achieved by providing a sample collecting impact bit which includes a tubular sample collecting chamber, closed at one end by a cutting head. The head defines a plurality of terraces or lands, each with at least one cutting tooth. The lands and the chamber define helical grooves, through which cuttings are directed from the bottom of the bore to the interior of the chamber.

Deflecting teeth are mounted near the ends of the grooves at the lands or terraces, so that the cuttings are forced into the grooves and therefrom into the chamber. Cuttings which happen to work upwardly between the chamber and the bore walls, enter the chamber through holes machined in the chamber walls. Consequently, the danger of the bit being jammed in the bore or the need for lubricating fluids to prevent such jamming is eliminated or greatly minimized.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawings, in which:

FIGURE 1 is a fragmentary side view of the sample collecting impact bit;

FIGURE 2 is an end view thereof;

FIGURE 3 is a transverse sectional view taken through 3—3 of FIGURE 1;

FIGURE 4 is a transverse sectional view taken through 4—4 of FIGURE 1.

The sample collecting impact bit includes a bit head 1 having a small circular end face 2 protruding from an annular ledge or land 3 of larger diameter which in turn extends from a second annular ledge or land 4 of still larger diameter. The annular land 4 may be omitted or, if desired, additional lands of increasing diameter may be provided.

The end face 2 is provided with a centrally located cutting tooth 5 formed of hard material such as tungsten

carbide which is embedded and welded or brazed in place. The bit head is formed of steel or the like. Also embedded in the end face is one or more radially disposed cutting teeth 6.

Similarly, each of the ledges is provided with one or more cutting teeth 7. All of the cutting teeth are formed of hard material and permanently secured in the bit head. The cutting teeth 6 and 7 protrude radially beyond the end face 2 or the lands 3 or 4 in which they are mounted so as to bore holes slightly larger than the diameters of the end face and lands.

The bit head 1 includes a cylindrical portion 8 continuing axially from the annular land 4 and is provided with a reduced upper extremity having screw threads 9. The bit head is joined by the screw threads 9 to the internally screw threaded end of a tubular collector 10 shown fragmentarily in FIGURE 1. The upper end, not shown, of the collector is joined to the suitable means for reciprocating and rotating the bit head.

The annular land 3 is intersected by one or more helical grooves 11 which extend upwardly in the cylindrical side wall 12 which separates the land 3 from the land 4. The annular land 4 is similarly provided with helical grooves 13 which spiral upwardly in the cylindrical portion 8. The upper end of the cylindrical portion 8 is provided with a recess 14 which is intersected by the upper extremity of the helical grooves 13 to form apertures 15. Other apertures 16 which communicate with the recess 14 may be provided in the cylindrical portion 8. In addition, the tubular collector 10 may be provided with side openings 17.

The helical grooves 11 and 13 are intended to guide the cuttings upwardly into the recess 14 by reason of the fact that the helical groove 13 is disposed radially outward with respect to the helical groove 11. The annular land 4 is provided with deflector teeth 18 disposed at the appropriate side of the entrance end of the helical groove 13. The deflector teeth 18 are preferably formed of softer material than the digging teeth and are of tougher material such as steel so that they may wear away but do not chip or break.

Operation of the sample collecting impact bit is as follows:

The impact bit is caused to reciprocate so as to apply a striking force to the underlying material. The bit is also rotated so as to change the point of impact. The cuttings are guided between the ledges formed in the underlying formation and the lands until they enter the grooves 11 and 13. On entering the grooves, the cuttings are guided and worked upwardly into the recess 14.

Not all of the cuttings are carried by the grooves 11 and 13. The remaining cuttings work upwardly between the impact bit and the surrounding formation and into the various openings or apertures 16 and 17.

It is intended that the impact bit be operated dry, that is, without the use of water or other fluid. Normally under these conditions the cuttings might tend to pack between the bit and the surrounding formation. However, by reason of the helical grooves 11 and 13 and the apertures or openings 15, 16 and 17, the cuttings work their way into the collector 10 relieving the tendency of the cuttings to pack. This is especially true in regard to the cuttings which move upwardly between the cylindrical collector and the surrounding walls of the bore. As the cuttings work into the collector, pressure is relieved in the annular space surrounding the collector and friction due to rotation is materially reduced.

When the sampling operation has been completed, the impact bit and collector are removed. Some material will fall from the holes and apertures, but the cuttings will tend to bridge so that a large percentage of the cuttings are retrieved.

While a particular embodiment of this invention has been shown and described, it is not intended to limit the same to the details of the construction set forth, but instead, the invention embraces such changes, modifications and equivalents of the various parts and their relationships as come within the purview of the appended claims.

I claim:

1. A sample collecting impact bit adapted to form a bore in rock formation, said bit comprising:

(a) a tubbular sample collecting member having a plurality of openings confronting the walls of said bore thereby to receive cuttings which may work upwardly between said collecting member and said bore;

(b) and a cutting head closing the lower end of said collecting member and including at least one annular land, an axially directed impact cutting tooth in said land for producing cuttings and a guide channel having one end communicating with said land and another end communicating with said collecting member for conveying cuttings thereto.

2. A sample collecting impact bit adapted to form a bore in rock formation, said bit comprising:

(a) a tubular sample collecting member having a plurality of openings confronting the walls of said bore thereby to receive cuttings which may work upwardly between said collecting member and said bore;

(b) a cutting head closing the lower end of said collecting member, said cutting head including a series of annular lands of increasing diameter and at least one upwardly spiraling guide channel communicating at its upper end with the interior of said collecting member;

(c) and a plurality of impact teeth fixed in said lands.

3. A sample collecting impact bit adapted to form a bore in rock formation, said bit comprising:

(a) a tubular sample collecting member having a plurality of openings confronting the walls of said bore thereby to receive cuttings which may work upwardly between said collecting member and said bore;

(b) a cutting head closing the lower end of said collecting member, said cutting head including a series of annular lands of increasing diameter, and a series of helical channels communicating between said lands and with the interior of said collecting member;

(c) and impact teeth fixed in said lands.

4. A sample collecting impact bit adapted to form a bore in rock formation, said bit comprising:

(a) a tubular sample collecting member having a plurality of openings confronting the walls of said bore thereby to receive cuttings which may work upwardly between said collecting member and said bore;

(b) a cutting head closing the lower end of said collecting member, said cutting head including a series of annular lands of increasing diameter, and a series of helical channels communicating between said lands and with the interior of said collecting member;

(c) impact teeth fixed in said lands;

(d) and deflecting means at each land to direct cuttings into said guide channels.

5. A sample collecting impact bit adapted to form a bore in rock formation, said bit comprising:

(a) a tubular sample collecting member having a plurality of openings confronting the walls of said bore thereby to receive cuttings which may work upwardly between said collecting member and said bore;

(b) and a cutting head closing the lower end of said collecting chamber for producing said cuttings, said member defining at least one helical channel having ends communicating with said head and the interior of said chamber to direct cuttings from said head into the interior of said chamber.

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