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Reynolds

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[54] **ROCK SAMPLING TOOL**

[75] Inventor: **John Windley Reynolds,** Kimberley, B. C., Canada

[73] Assignee: **Cominco, Ltd.,** Vancouver, British Columbia, Canada

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **299/18,** 73/425.2, 125/13, 173/30, 173/60, 175/58, 175/206, 299/64

[51] **Int. Cl.** **E21c 37/22**

[58] **Field of Search** 125/13; 73/425, 425.2; 299/18, 64, 67, 89; 173/30, 60; 175/58, 60, 66, 206

[56] **References Cited**

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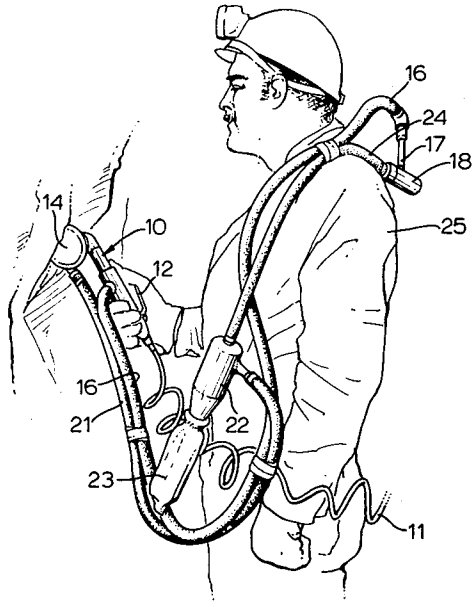
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Primary Examiner—Ernest R. Purser

[57] **ABSTRACT**

In the sampling of a rock surface, dust that is formed by action of a compressed air driven rock cutting wheel is entrained in an air stream that is drawn into a shroud that surrounds all but a minor part of the cutting edge of the wheel and thence to a cyclone where it separates into a sample collector. High velocity exhaust air from the wheel-driving mechanism passes through an air ejector to provide a vacuum that causes the air stream to flow through the sample collecting system.

7 Claims, 2 Drawing Figures



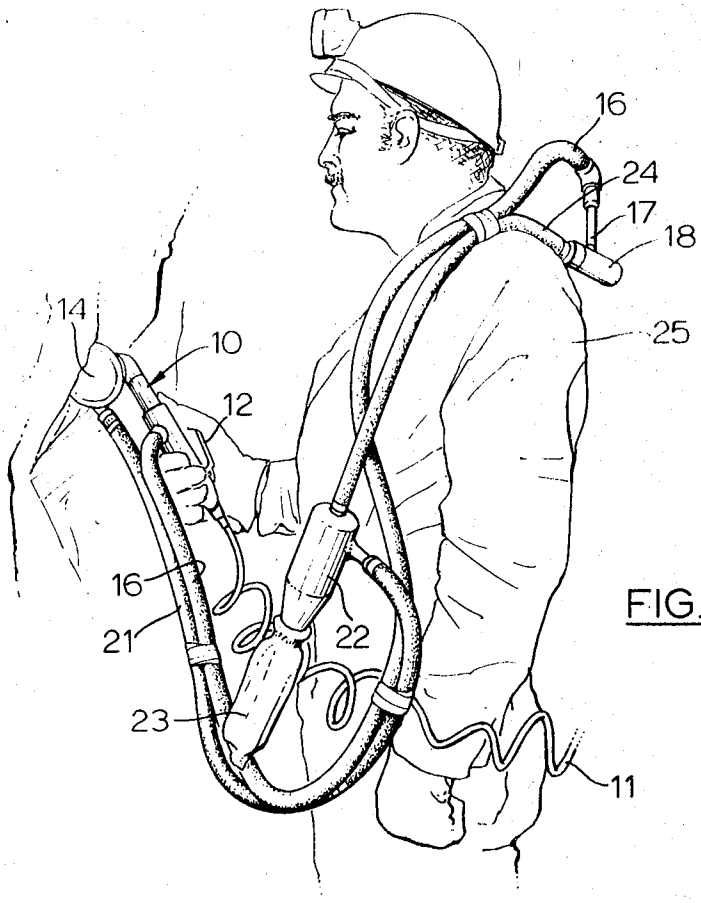

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FIG. 1

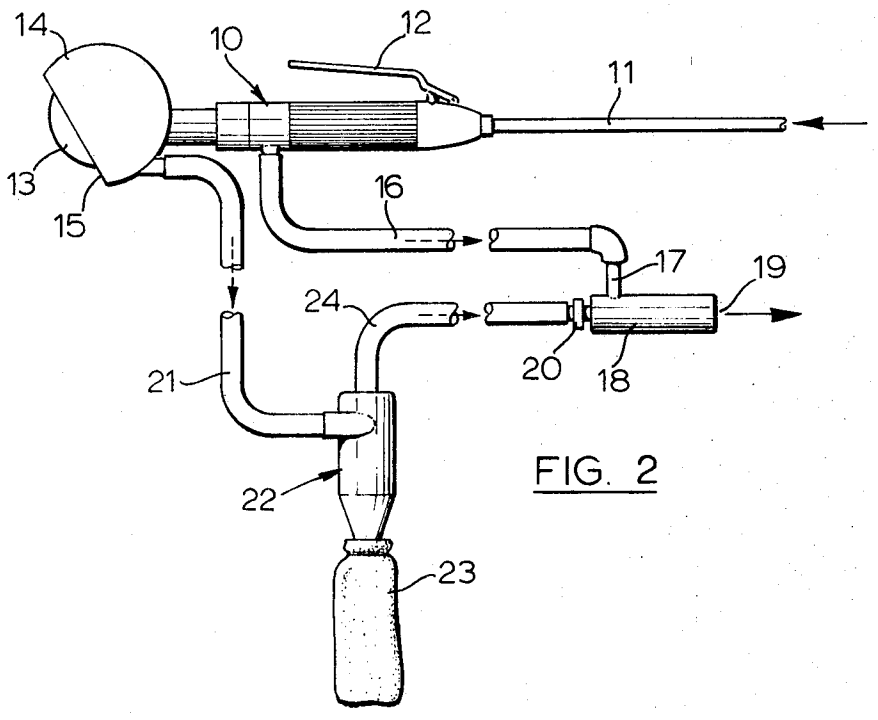

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FIG. 2

ROCK SAMPLING TOOL

BACKGROUND OF THE INVENTION

This invention relates to a rock sampling tool and is particularly directed to a rock sampling tool used primarily in geological exploration to take samples of exposed rock surfaces. It provides easy means of getting good samples of such rock surfaces or rock faces and can be sufficiently small and compact to be conveniently carried and operated by one man.

In the most commonly used method of rock face sampling, the geologist spreads a blanket below the surface to be sampled. He knocks chips off the surface with hammer and chisel and collects the chips on the blanket. It is also known to drill a number of holes into the face of the rock and to collect sludge that is so formed. With chip sampling of heterogeneous surfaces, the proportion of soft rock material collected tends to be too high, and thus the samples collected are not representative of the face sampled. With drill sampling, means must be provided for collecting the sludge in a manner that avoids mixing of successive samples. In addition, frequent washing of equipment is essential.

SUMMARY OF THE INVENTION

I have found that the foregoing disadvantages of conventional rock sampling techniques and apparatus can be substantially overcome by the sampling tool of the present invention by which shallow grooves are cut in a rock face by a rotating rock cutting wheel and dust formed thereby is carried by an air stream into a shroud that encases all but a minor portion of the cutting edge of the wheel. The air and entrained dust then flow to a cyclone where the dust separates into a sample collector. The driving mechanism for the cutting wheel or saw is operated by compressed air, the high velocity discharge stream of which provides suction to pull air and entrained rock dust through the sampling system. Improved sampling of a rock face is easily obtained by making patterned, shallow saw cuts in the area to be sampled. Dust from the saw cuts is drawn into the cyclone and is separated into the sample collector. A short period of operation without cutting or with reverse flow of air discharged from the saw driving mechanism through the open cyclone between samples purges the collection system, thereby providing clean separation of successive samples. The sample collector is supported in the open position on a framework attached to the base of the cyclone. A rubber band conveniently seals a plastic sample bag to the cyclone. Such a collector is very easily changed between samples.

It is a principal object of the present invention to provide a rock sampling tool that is readily portable and operable by one man and which permits easy sampling of rock faces and the like rock surfaces.

It is another object of the present invention to provide a rock sampling tool which obtains representative samples of heterogeneous rock surfaces for direct deposit into sample bags with clean separation of successive samples.

BRIEF DESCRIPTION OF THE DRAWING

A fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

FIG. 1 is an illustration of the sampling tool of the invention in its operative position; and

FIG. 2 is a schematic view of the sampling tool showing more clearly the relationship of component parts.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing, sampling tool driving mechanism **10,** shown as a 90° angle drill, is operated by high pressure air that enters through hose **11** and is controlled by throttle **12** to rotate wheel **13** of a rock cutting saw. Shroud **14** encases the wheel except for a small segment of the cutting edge projecting from the shroud. Parallel edges **15** of shroud **14,** disposed on either side of wheel **13,** serve as a depth gauge for the saw cuts.

Exhaust air from drill **10** flows through hose **16** to inlet **17** of ejector **18** from which it is released through outlet **19.** Rapid flow of this air stream through ejector **18,** which operates as an aspirator, provides a low pressure zone or vacuum to draw air from the sampling system through a nozzle attached to opening **20.** The sampling system comprises shroud **14** which substantially envelops wheel **13,** shroud off-take hose **21,** cyclone **22,** sample collector **23** and cyclone off-take hose **24.**

Rock dust that is formed during operation of cutting wheel **13** on a rock face is carried in an air stream passing into shroud **14** through hose **21** tangentially into cyclone **22** where it separates under centrifugal forces from the air and descends through the cyclone cone into collector **23.** After separation of the dust, the air leaves cyclone **22** through a vortex outlet by way of hose **24** to opening **20** of ejector **18** where it joins the exhaust air from drill **10.**

The casing of saw driving mechanism **10** serves as a handle for convenient use by operator **25.** It is also convenient to suspend the ejector over the operator's shoulder, as shown, so that the cyclone and collector are positioned in front of him. With flexible hose connections, the drill and saw can be rotated to cause edges **15** to move horizontally, vertically or diagonally over irregular rock faces. A unit with a small diameter wheel is capable of sampling quite irregular rock faces.

A rock sampling tool of the present invention was driven by a conventional air powered 90° angle drill that was 9 ½ inches long, weighed 2.2 pounds and rotated at 2,000 rpm with an air flow of 12 cfm at 100 psi. The compressed air may be provided by a portable air bottle, a scuba type of which will operate the saw for about 8 minutes. Air entered the drill through a length of self-coiling plastic air supply hose and its flow was controlled manually by depressing a throttle that was attached to the drill casing. Exhaust air from the drill passed through a ⅜ inch ejector and was vented behind the operator. The nozzle of the ejector was adjusted to apply effective vacuum to the sampling system for ingress of air into the shroud for entrainment of the dust formed by the cutting wheel and for its effective separation from the air flowing through the cyclone. A 3 ¾ inch diameter by ¾ inch shroud encased a 3 inch diameter cutting wheel to leave a small segment of the wheel, about ½ inch along a diameter, protruding beyond the straight edges of the shroud to limit the depth of a saw cut. The rim of the wheel was set with diamonds in a sintered matrix. This sampler cut a

groove about ¼ inch by ¼ inch at a rate of 3 to 4 feet per minute. Air drawn into the shroud carried dust from the cutting zone to the cyclone through hose that was attached to a tangentially mounted dust off-take on the shroud periphery. A 2 inch diameter cyclone was used. A thimble-shaped wire supporting frame, about 6 inches long and 1 ¾ inches in diameter was attached to the base of the cyclone. A plastic sample bag was sealed to the cyclone base with a rubber band. The sampling tool operated effectively on dry and on wet rock faces. A clean cyclone before each sample was taken was assured by removal of the sample bag and momentarily closing the ejector exit. Exhaust air from the drill then blew out the open cyclone. Analyses for lead, zinc and iron in rock face samples obtained with this tool compared favorably with those of samples obtained by the chipping method.

What we claim as new and desire to protect by letters patent of the United States is:

1. A rock sampling tool comprising, in combination, a compressed air operated driving mechanism, a rock cutting wheel operatively connected to said driving mechanism, a shroud substantially enveloping said rock cutting wheel excepting a segment of said cutting wheel projecting therefrom, a cyclone having a vortex outlet and a conical base with a dust sample collector removably attached to said conical base, an air ejector, connecting means to carry exhaust air from said driving mechanism to said air ejector for creating a low pressure zone therein, connecting means between the interior of the shroud and the cyclone and connecting means between the cyclone vortex and the air ejector low pressure zone whereby rock dust formed during operation of said cutting wheel is carried into said collector.

2. A rock sampling tool as claimed in claim **1**, in which said air ejector is an aspirator whereby air exhausting from said compressed air operated driving mechanism creates a low pressure therein which induces an airflow from the shroud to the cyclone to the air ejector through the connecting means for collecting cut rock in the cyclone for discharge therefrom.

3. A rock sampling tool as claimed in claim **1**, in which said air ejector is an aspirator whereby air exhausting from said compressed air operated driving mechanism creates a low pressure therein which induces an airflow from the shroud to the cyclone to the air ejector through the connecting means for collecting cut rock in the cyclone for discharge therefrom.

4. A rock sampling tool as claimed in claim **1**, in which said driving mechanism is a 90° angle drill.

5. A rock sampling tool as claimed in claim **4**, in which said air ejector is an aspirator whereby air exhausting from said compressed air operated driving mechanism creates a low pressure therein which induces an airflow from the shroud to the cyclone to the air ejector through the connecting means for collecting cut rock in the cyclone for discharge therefrom.

6. A method of sampling a rock face which comprises supplying air under pressure to a driving mechanism having a cutting wheel with an enveloping shroud operatively connected thereto, feeding exhaust air from said driving mechanism to an air ejector to create a low pressure zone therein, said shroud being connected to a cyclone having a vortex outlet and a dust collector attached to the base thereof and said vortex outlet being connected to said air ejector low pressure zone, thereby causing an air stream to flow from said shroud to the cyclone and thence to the low pressure zone of said air ejector whereby rock dust formed by operation of the cutting wheel is entrained by the flowing air and is carried through the shroud and thence to the cyclone where it is separated from the air and from which it is passed into said collector.

7. A rock sampling tool comprising, in combination, a compressed air operated driving mechanism, a rock cutting wheel operatively connected to said driving mechanism, an air ejector operated by exhaust air from the driving mechanism to provide a low pressure zone therein, a shroud which substantially envelops said rock cutting wheel excepting a segment of said cutting wheel projecting therefrom, a shroud off-take hose, a cyclone, a sample collector sealed to the base of said cyclone, and a cyclone off-take hose, said shroud off-take hose being adapted to carry air and entrained dust from said shroud to said cyclone, and said cyclone off-take hose being adapted to carry air from the vortex outlet of the cyclone to the low pressure zone of said air ejector.

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