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DUST COLLECTING ROTARY ROCK DRILL

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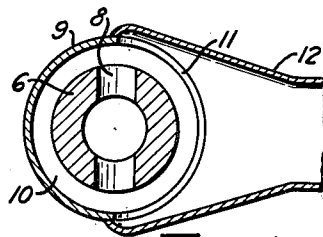
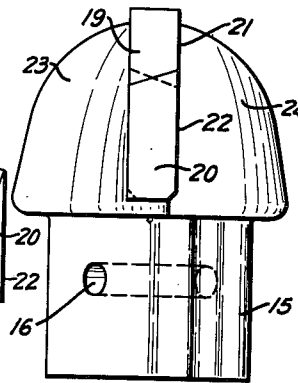
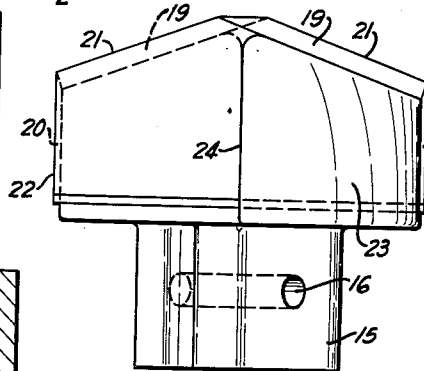
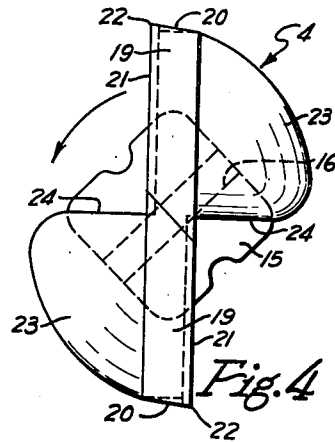
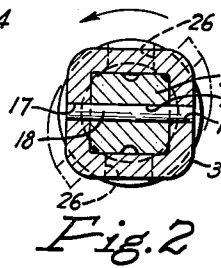
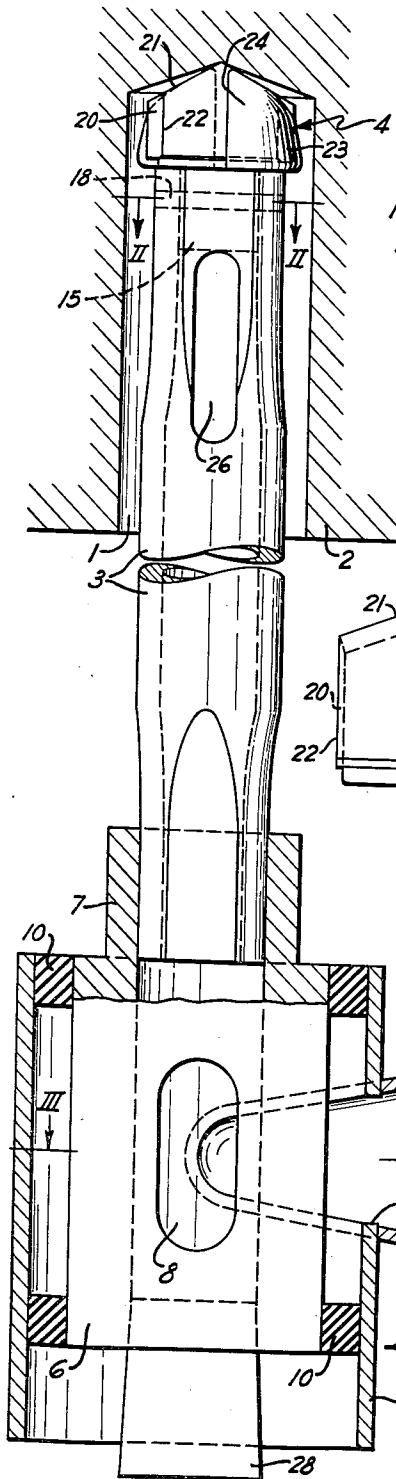


Fig. 1

Fig. 6

Fig. 3

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DUST COLLECTING ROTARY ROCK DRILL

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This invention relates to rock drills that are rotated only, as distinguished from percussive drills, and more particularly to those that use hollow drill stems for drawing rock dust and chips away from the drill bit.

In drilling holes in rock strata, such as for the reception of explosive charges or mine roof bolts, it is common practice to mount a dust collecting head on the rotary drill stem next to the surface being drilled. Suction is applied to the head to draw rock dust into it and to carry the dust away. An objection to such a collecting head is that it is always between the driller and the rock being drilled, thereby obstructing his view of the hole and requiring the drill stem to be pushed through the head as drilling progresses.

It is among the objects of this invention to provide a rotary rock drill which collects rock dust without the use of a collecting head at the rock face, which carries the dust away through the drill stem, and which permits substantially no dust to escape from the hole being drilled.

In accordance with this invention a drill bit has a base that fits in a polygonal opening in one end of a drill stem that is provided with circumferentially spaced flat side areas around that end. The opposite end of the stem is adapted to be connected with suction apparatus. Also, the stem is adapted to be rotated continuously in any suitable manner in order to rotate the bit in a predetermined direction. The bit is provided with a plurality of uniformly spaced cutting edges extending lengthwise of the stem. The stem has in its polygonal end portion uniformly spaced longitudinal slots, which correspond in number to the number of said cutting edges on the bit. Each of these slots is located in one of the flat areas of the stem and has an area at least as great as the internal cross section of the stem. It also has a width less than the inner diameter of the stem. Each of the longitudinal cutting edges of the bit is located slightly behind one of the slots relative to the direction of rotation of the stem.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

FIG. 1 is a side view of our rock drill, partly broken away and in section;

FIG. 2 is a cross section of the bit and stem taken on the line II-II of FIG. 1;

FIG. 3 is a reduced cross section taken on the line III-III of FIG. 1;

FIG. 4 is an enlarged end view of the bit;

FIG. 5 is an enlarged side view of the bit turned 45° from its position in FIG. 1; and

FIG. 6 is an enlarged side view of the bit turned 90° from its position in FIG. 5.

Referring to FIGS. 1 and 2 of the drawings, a rotary drill is shown drilling a hole 1 into rock strata 2. The drill may be operating more or less horizontally or vertically. For the purpose of this description it will be assumed that the roof of a mine is being drilled and that the drill therefore is vertical. The drill includes a round drill stem 3 that is tubular and on the upper end of which is mounted a rock bit 4. At the lower end of the stem there is a hollow cylindrical chuck 6 that has a closed lower end, and an open upper end that receives the lower end of the stem. The chuck and stem may be connected together in any suitable manner, preferably by deforming the lower end portion of the stem to make it square so

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that it will fit in a square opening in a hub 7 at the upper end of the chuck. The side of the chuck is provided with openings 8, each of which has an area at least as great as the cross sectional area of the passage through the hollow stem. The chuck is encircled by a suction housing that forms a closed dust collecting chamber around it. This housing can be formed from a metal cylinder 9 of considerably larger diameter than the chuck and having rigidly mounted in its opposite ends resilient sealing rings 10 that frictionally engage chuck 6. One side of the housing is provided with an outlet slot 11 that extends part way around it, and from which a tubular coupling 12 extends away from the housing. The outer end of the coupling is adapted to be connected by a hose (not shown) that leads to any suitable apparatus for creating a suction in the housing.

The upper end of the stem is formed with a polygonal shape, preferably square, thereby giving the opening in the upper end of the stem the same shape. Removably mounted in this opening is the base 15 of a drill bit, as shown in FIG. 2. The base has the same shape as the opening and fits it fairly snugly so that the bit will be turned by the stem. The base is provided with an opening 16 extending transversely through it, which aligns with openings 17 in two opposite sides of the drill stem, and a pin 18 is inserted in all of these openings to hold the bit and stem together.

Directly above the stem, the bit is enlarged to form a head that projects laterally beyond the stem. The top of the head has narrow flat areas 19 inclined outward and downward from its center to the upper ends of narrow flat areas 20 that extend substantially vertically down to approximately the bottom of the head. The head of the bit in front of each inclined area 19 is flat and vertical, thereby forming cutting edges 21 and 22. The portions 23 of the head behind the inclined areas are curved outward and downward, and they also have flat vertical surfaces 24 substantially perpendicular to inclined cutting edges 21 when there are only two cutting faces as shown. Each inclined area 19 is inclined downward away from its cutting edge as shown in FIGS. 5 and 6, and each vertical area 20 is inclined inward away from its cutting edge as shown in FIGS. 4 and 6.

When the bit is used with a stem having a square upper end, the bit is provided with an even number of cutting edges, such as two or four. For most purposes, two sets of cutting edges are sufficient and they are located substantially above two diagonally opposite corners of the square base of the bit, as shown in FIG. 4.

To carry away the dust and chips formed by the rotating drill bit, the square upper end of the drill stem is provided with a plurality of uniformly spaced slots 26 that extend lengthwise of the stem. In most cases, the slots correspond in number to the number of vertical cutting edges 22 on the bit, so that with two such cutting edges, two slots are used. These slots are located in two opposite sides of the stem, as close as possible to the bit. The slots are in the sides of the stem that are directly in front of the vertical cutting edges of the bit. In other words, each cutting edge 22 is located adjacent the trailing edge of a slotted side of the stem. This position also is defined herein as being between an adjacent pair of slots. The slots gather the dust and chips made by the cutting edges 20 and 21 during rotation of the drill. The square upper end portion of the drill stem increases the maximum width of the space between the flat sides and the wall of the hole, which aids in delivering loose material to the slots. Also, the rotating square portion creates turbulence in the loose material to help prevent it from packing around the stem.

The upper ends of the slots should not be more than five inches away from the head of the bit, for if they

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are any farther away the bit and stem is likely to bind in the rock because the rock particles loosened by the drill will pack tightly around the stem before it can be drawn into the slots. Also, when drilling is begun, too much dust would be thrown into the atmosphere before the lower ends of the slots would be elevated into the hole being drilled. The area of each slot should be at least as great as the internal cross section of the stem to take full advantage of the suction created in the stem. Also, the width of each slot should be less than the inner diameter of the stem to avoid weakening the stem unnecessarily. For a drill stem having an internal diameter of $\frac{3}{4}$ of an inch, it has been found that a slot $1\frac{1}{2}$ inches long and $\frac{3}{8}$ inch wide is the most practical. A wider and shorter slot would weaken the drill stem in torsional strength, and a longer and narrower slot would not collect dust as quickly at the start, since the drill would have to penetrate the rock more deeply before the slots would be completely surrounded by the wall of the hole to produce the full benefit of the suction through the stem.

The drill can be rotated continuously by any suitable means. For example the driving motor can be operatively connected by a socket (not shown) to a square plug 28 inserted in a square opening in the bottom of chuck 6. The driven plug will drive the drill.

It will be seen that the drilling apparatus described above satisfactorily disposes, in a very simple manner, of the dust produced by a rock drill in any position. The collecting head or chamber is remote from the bit, where it will not interfere with the operator's view of the portion of the drill entering the rock. Also, the dust collector can be moved forward with the drill, as it is not necessary to hold the collector in one place and slide the drill through it as it is fed forward. The drill stem itself forms part of the dust conduit, so there is no necessity for having another dust conduit close to the surface being drilled.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A dust collecting rotary rock drill for use with rotary drilling means comprising a rotary tubular drill stem having a circular body and having one end portion provided with circumferentially spaced flat side areas spaced inwardly from the projected outer surface of said body, the opposite end of the stem being formed for connection with suction apparatus and rotary driving means, and a rotary drill bit having a base rigidly mounted in said end portion of the stem for rotation thereby, the bit projecting laterally from the stem and being provided with a plurality of uniformly spaced cutting edges extending lengthwise of the stem, the stem having in said end portion uniformly spaced longitudinal slots corresponding in number to the number of said lengthwise cutting edges on the bit, each slot being located in one of said flat areas and being narrower than

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the inside of the stem but having an unobstructed area at least as great as the internal cross section of the stem, and each of said cutting edges of the bit being located along a line extending lengthwise of the stem between an adjacent pair of said slots.

2. A dust collecting rotary rock drill for use with rotary driving means comprising a rotary tubular round drill stem having a circular body provided with a square end portion, the transverse width of said portion being less than the diameter of the circular body the opposite end of the stem being formed for connection with suction apparatus, and rotary driving means and a rotary drill bit having a square base fitting in said end portion of the stem for rotation thereby, the bit projecting laterally from the stem and being provided with an even number of uniformly spaced cutting edges extending lengthwise of the stem, the stem having in the sides of said square portion uniformly spaced longitudinal slots corresponding in number to the number of said cutting edges on the bit, each slot having an unobstructed area at least as great as the internal cross section of the stem and a width less than the inner diameter of the stem, and each of said cutting edges of the bit being located at a corner of said square portion along a line extending lengthwise of the stem directly behind one of said slots relative to the direction of rotation of the stem.

3. A dust collecting rotary rock drill for use with rotary driving means comprising a rotary tubular drill stem having a circular body provided with a square end portion, the transverse width of said portion being less than the diameter of the circular body the opposite end of the stem being formed for connection with suction apparatus and rotary driving means, and a rotary drill bit having a square base fitting in said end portion of the stem for rotation thereby, the bit projecting laterally from the stem and being provided with a pair of oppositely disposed side cutting edges extending lengthwise of the stem, said edges being adjacent diagonally opposite corners of said base, the bit also being provided with a second pair of cutting edges extending from the outer ends of said side cutting edges inwardly toward the center of the bit, the stem having in opposite sides of said square portion a pair of longitudinal slots, each slot having an unobstructed area at least as great as the internal cross section of the stem and a width less than the inner diameter of the stem, and each of said side cutting edges of the bit being adjacent the corner of said square portion of the stem at the trailing edge of one of said slotted sides when the stem is rotated.

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