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COMBINATION EARTH AUGER WITH ROCK DRILLING POINT

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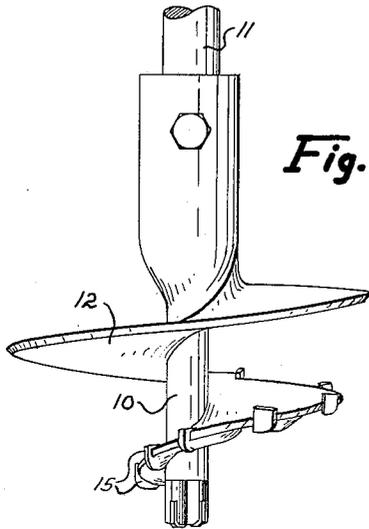


Fig. 1

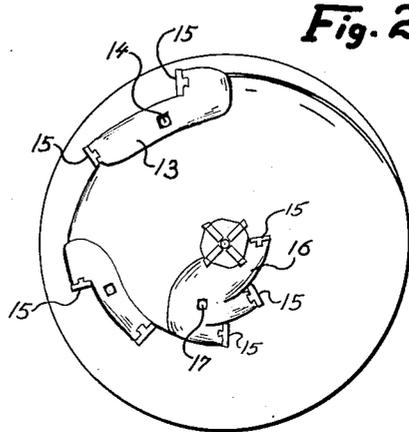


Fig. 2

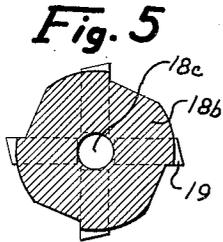


Fig. 5

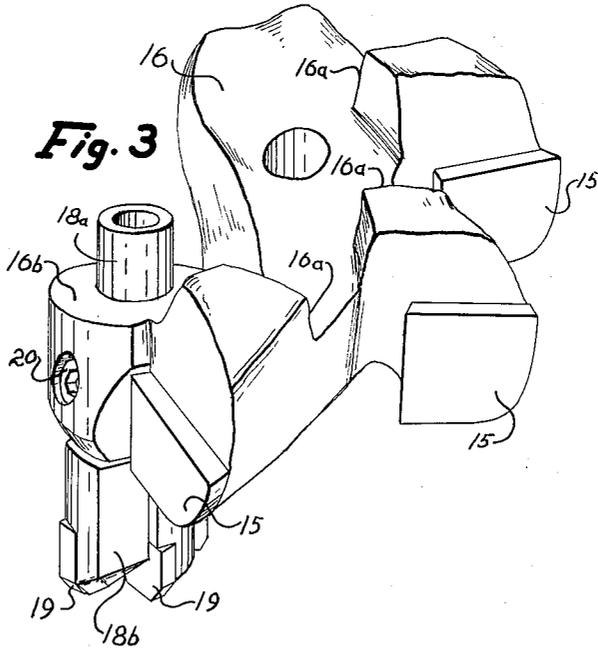


Fig. 3

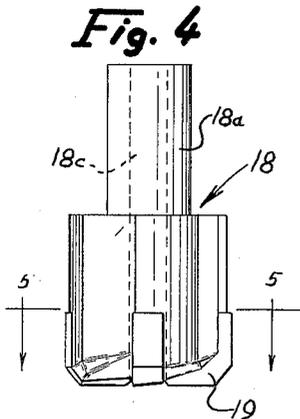


Fig. 4

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COMBINATION EARTH AUGER WITH ROCK DRILLING POINT

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4 Claims. (Cl. 255-69)

This invention relates to an earth drilling tool particularly adapted for drilling through rock and other extremely hard material.

While my earth drilling tool disclosed in my co-pending patent application, Serial No. 70,777, entitled Earth Auger With Spirally Arranged Removal Cutting Bits, filed January 13, 1949, now Patent No. 2,594,261, has operated extremely satisfactorily in drilling in hard ground, my present invention is designed particularly to facilitate drilling through layers of solid rock, if necessary.

It is an object of my present invention to provide an earth drilling auger working in close cooperation with a cutting tip or bit adapted to initially cut a relatively small center hole even in extremely hard rock to permit spirally arranged cutting bits of progressively increasing diameter to enlarge said hole and ultimately produce a bore of relatively large diameter through said rock layer.

More specifically, it is an object to provide an axially mounted cutting tip having a plurality of substantially radially disposed cutting edges extending outwardly from the center thereof and having their outer edges disposed a slight distance outwardly from the main body portion thereof to cut with a grinding type of action into the hard rock surface and produce an axially disposed central bore of relatively small diameter which is subsequently enlarged during the drilling operation by the progressively outwardly disposed cutting bits mounted on the material-carrying body of the drilling auger.

Still more specifically, it is an object to provide a cutting tip particularly designed for use with a downwardly tapered spiral body having a plurality of progressively outwardly disposed cutting bits mounted thereon to initially drill a central hole even in relatively hard, solid rock and thus permit the other cutting bits mounted on said spiral body to enlarge the same and ultimately produce a relatively large bore through said rock, the tip having a plurality of radially disposed cutters extending outwardly from a central axially disposed passage forming a hollow cutting tip adapted to permit finely divided material to pass upwardly therethrough and facilitate cooling of the cutting tip during the drilling operation by reducing the heat-retaining material thereof.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views and in which:

Fig. 1 is a side elevational view of an earth drilling auger embodying my invention;

Fig. 2 is a bottom plan view thereof;

Fig. 3 is a perspective view of the drilling tip and mounting member therefor;

Fig. 4 is a side elevational view of the drilling tip per se; and

Fig. 5 is a horizontal sectional view thereof taken substantially along the line 5-5 of Fig. 4.

As illustrated in the accompanying drawings, I pro-

vide a spiral auger having an elongated axially disposed hub 10 with the upper portion thereof being constructed to receive a rotary drive shaft 11 in any conventional manner. A spiral body 12 is fixed around the hub 10 in the form shown and tapers downwardly toward the bottom thereof.

The marginal portion of said spiral body 12 has a plurality of steps formed therein, which steps form abutment shoulders to interfit with stepped bit mounting members 13 in a manner similar to that described in my previously identified co-pending application. The bit mounting members 13 have underlying attachment portions through which an attachment element, such as the bolt 14, extends forming a positive interconnection with the adjacent overlying attachment portion of the marginal periphery of the spiral body 12 through which said bolt also extends. Each of the bit mounting members 13 carries a plurality of bits 15 which are interconnected therewith as by a tapered dove-tail cooperative interconnecting structure. Each bit, in the form shown, is backed by a stepped portion of the bit mounting member in order to eliminate transfer of any stress to the bit mounting member itself and to permit the cutting stress exerted by the bits to be transferred directly to the marginal edge portions of the spiral body adjacent the respective cutting bits.

The mounting member for the drilling tip is best shown in Figs. 2 and 3 and is designated by the numeral 16. This mounting member underlies the lower portion of the spiral body and said mounting member has a plurality of interlocking steps 16a formed behind each of the cutting bits 15 mounted thereon. These steps 16a form abutment shoulders which interfit with the cooperative steps formed on the lower marginal edge portion of the spiral body. A substantial attachment portion of the tip mounting member underlies the lower marginal portion of said body and the entire mounting member is positively attached thereto by a single attachment element such as the bolt 17. The lower end of the mounting member 16 has a tip mounting boss 16b integrally formed therewith and said boss is hollow to receive the hollow upstanding shank portion 18a of a cutting tip 18, best shown in Fig. 4. The lower portion of the cutting tip 18 is in the form shown divided into a plurality of spaced mounting elements 18b which form a generally enlarged lower portion with an abutment shoulder at the top thereof. The lower radially disposed extremities of said elements 18b have cutters 19 made from extremely hard material mounted in fixed relation thereon and said cutters extend downwardly a slight distance therebelow. The outer edge portions of said cutters extend upwardly a slight distance from the lower ends of the respective mounting elements and the cutting edges thereof are disposed outwardly from the outer edges of said mounting elements, as best shown in Figs. 2, 3 and 4. The inner ends of the radially disposed cutters 19 are spaced apart by a centrally disposed passage 18c extending upwardly through the entire cutting tip 18. This passage 18c facilitates cooling of the tip portion and materially increases the cutting efficiency thereof. The cutting tip is secured to the boss 16b as by the socket head set screw 20, best shown in Fig. 3.

When the auger and cutting tip are rotated by the drilling apparatus (not shown) which drives shaft 11, the downwardly exerted pressure on shaft 11 causes the cutters 19 of the drilling tip 18 to cut away with a grinding action the hard rock surface engaged thereby and form a relatively small axially disposed hole in said rock. This initial penetration by the cutting tip 18 is extremely important since this is one of the most difficult parts of drilling through hard rock layers. When the cutting tip 18 has penetrated the length thereof, the first cutting

bit 15 will engage the rock surface adjacent the initial hole and increase the radius thereof as will the successive cutting bits 15 disposed upwardly around the auger body 12. These cutting bits 15 are of course, as are the cutting bits in my previously identified co-pending application, disposed at progressively increasing radii from the center hub 10 to cut annular zones of progressively increasing radii.

It will be seen that I have provided a highly efficient earth-drilling tool having a rock cutting tip working in close cooperation with the tapered spiral auger body to produce a relatively large hole even through hard rock layers. The radially disposed cutters of the tip 18 work in close cooperation with the cutting bits 15 to initially drill out a small hole which said bits subsequently enlarge to the desired diameter.

It should be noted that the side wall portions of the drilling or cutting tip 18 are recessed adjacent the upstanding portions of the cutters 19 to permit the comminuted material produced by said cutters to pass upwardly and to be delivered to the spiral body 12.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of my invention which, generally stated, consists in the matter shown and described herein and set forth in the appended claims.

What I claim is:

1. An earth drilling tool particularly constructed for drilling through rock and comprising an elongated upstanding axial hub member, a downwardly tapered spiral material-conveying body fixed to said hub with the lower end thereof having substantially the same radius as said hub and gradually increasing in radius toward the top, a rock drilling tip axially fixed at the lower end of said hub and extending downwardly from the lower extremity of said tapered body, a plurality of substantially radially disposed cutters fixed to the bottom end of said tip and extending outwardly in peripherally spaced relation one from the other, a plurality of side cutters extending upwardly from the outer ends of the respective bottom cutters and delivering material to the lower end of said material-conveying body, a plurality of peripherally spaced cutting bits mounted on the marginal portion of said spiral body in spaced relation therearound with the lowermost bit disposed adjacent the outer periphery of the cutting tip, and the other bits positioned to cut adjacent annular zones of progressively increasing diameter to enlarge the initial hole formed by said tip.

2. The structure set forth in claim 1, and said cutting tip having a plurality of upstanding recesses formed in the side portions thereof adjacent the leading edges of the upstanding cutters to permit ground material produced by said cutters to pass upwardly to said spiral body.

3. An earth drilling tool particularly constructed for drilling through rock and comprising an upstanding axial hub member having an upwardly extending recess formed

in the lower end thereof, a removable mounting member having a lower tip receiving portion with an aperture therethrough, a rock drilling tip having an upstanding shank portion fixed thereto and extending upwardly through the aperture in the lower portion of said mounting member and extending a substantial distance thereabove to be received in the recess at the lower end of said hub, an upwardly inclined material-conveying body fixed to said hub and having radially extending portions, means removably mounting said mounting member on a radially extended portion of said material-conveying body, a number of cutting bits mounted on said mounting member and successively disposed at increasing radii from the axis of the hub with the innermost bit being disposed adjacent the outer periphery of the rock drilling tip to cut annular zones of progressively increasing diameter to enlarge the initial hole formed by said cutting tip, releasable locking means for securing the upstanding shank portion of said tip to said mounting member with the upwardly extending portion of said shank being received in the recess formed in the bottom of said hub, and means securely anchoring said mounting member to said inclined material-conveying body.

4. An earth drilling tool particularly constructed for drilling through rock and comprising an upstanding axial hub member, a rock drilling tip mounted at the lower end of said hub and including a plurality of generally radially disposed cutters extending outwardly in circumferentially spaced relation along the bottom of said tip to engage the surface being drilled with a grinding action, an upwardly inclined material conveying body of progressively increasing radius mounted on said hub and having portions adjacent said hub positioned to receive ground material produced by said cutting tip, and a plurality of cutting bits mounted on said inclined body, the innermost bit being positioned adjacent the periphery of said tip above said cutters and projecting radially outwardly thereof to cut an annular zone above said cutter tip of greater diameter than the hole cut by the tip, and the other bits being disposed successively above and outwardly therefrom to cut successive annular zones of progressively increasing diameter.

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