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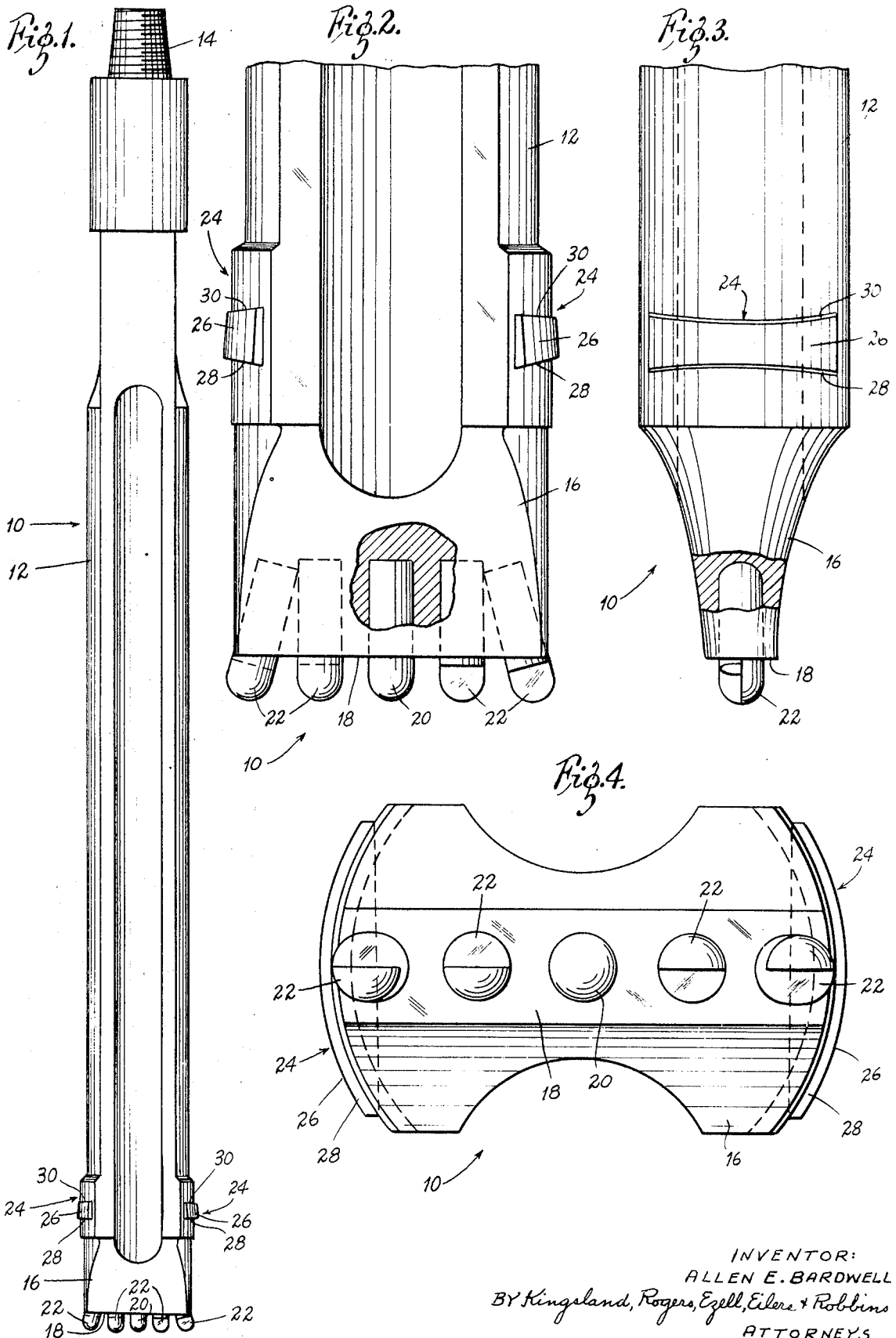
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EXPANDABLE DRILL BIT AND REAMER CONSTRUCTION

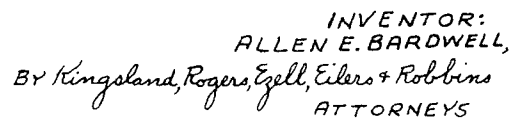
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EXPANDABLE DRILL BIT AND REAMER CONSTRUCTION

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9 Claims

ABSTRACT OF THE DISCLOSURE

Drilling bit and reamer units comprising a shaft or body having a reduced lower end. In one preferred embodiment, a row of elongated chisel bit elements or fingers of carbide or other suitable material is mounted in and extends downwardly from said lower end, the center finger being of bullet-nose shape and the others of one-half bullet-nose form, the flat surface facing in the spin direction. In a second preferred embodiment, two spaced block-like teeth extend down from cavities in the lower end, each tooth being of solid steel or having a cutter insert of carbide or other suitable material, said teeth being drawn by a heavy bolt towards a partition separating the cavities, and shims for insertion between each tooth and the partition to compensate for wash or wear of the exposed outer surface of the teeth. Affixed to the shaft above the cutting elements or to the teeth are spaced reamers formed for effective reaming and minimum withdrawal sticking.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates generally to percussion drilling, and more particularly to novel churn cable percussion drilling bit and reamer units adapted for advantageous use with conventional and multiple blow drilling structures.

Description of the prior art

There has long existed the need for churn drill bit and reamer units which are streamlined and reduce to a minimum the recrushing of rock material previously cut, maintain a straight hole even against boulders, expandable with the use of simple tools to maintain size, substantially eliminate resharpening particularly in the field, do not stick when properly employed, materially increase the inches per hour drilled thereby over standard equipment, are long lasting, and in which the reamer is located and formed for effective action.

Hence, an object of the present invention is to provide a novel streamlined percussion drilling bit and reamer unit which satisfies the foregoing needs.

SUMMARY OF THE INVENTION

Broadly, in one preferred embodiment, the present novel churn percussion drilling bit and reamer unit comprises a streamlined shaft or body having a reduced lower end. Mounted in and extending downwardly from the lower end is a row of elongated chisel bit elements or fingers. The center one may be of bullet-nose shape and the others of half bullet-nose form, each group flanking

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the center element facing in a predetermined direction for spinning cutting or scraping, or all may be bullet-shaped. Affixed to the shaft above the said cutting elements and separated therefrom, a novel arrangement, are spaced reamers formed for effective reaming and minimum withdrawal sticking.

In another preferred embodiment, the bit is expandable. Two spaced block-like teeth extend down from cavities in the lower end of the streamlined shaft, each of which includes an elongated cutter insert of carbide or other suitable material, although for some uses, the teeth may be of tool steel. A downwardly extending partition wall separates the teeth, a heavy bolt extending through the teeth and wall securing the teeth in place. Shims are provided for disposition between said teeth and wall to maintain the teeth in the desired expended positions which are readily insertible on removal of the bolt.

Other objects are to provide novel cable percussion drilling bit and reamer units which find particular adaptation to a multiple blow drilling structure, but are useful otherwise as well, which are highly efficient and effective, which reduce to a minimum recrushing of cut rock, which maintain a substantially straight hole, which reduce resharpening of the cutting elements to a minimum, which are expandable to maintain cutting size by use of simple tools, which substantially increase inches per hour drilled, which are very durable, which effectively ream and reduce sticking in upward movement to a minimum, in which a tooth or teeth may be readily replaced at low cost, and which otherwise fulfill the objects and advantages sought therefor.

The foregoing and other objects and advantages are apparent from the following description, taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of one preferred drill bit and reamer unit incorporating the teachings of the present invention;

FIG. 2 is an enlarged fragmentary view of the lower end thereof, a portion being in cross section for illustration of details;

FIG. 3 is a view similar to FIG. 2 rotated through ninety degrees, a portion being in cross section for illustration of details;

FIG. 4 is a further enlarged bottom plan view of FIG. 2;

FIG. 5 is a side elevational view of another preferred drill bit and reamer incorporating the teachings of the present invention;

FIG. 6 is an enlarged fragmentary view of the lower end of the bit of FIG. 5;

FIG. 7 is a view similar to FIG. 6 rotated through ninety degrees;

FIG. 8 is a bottom plan view of FIG. 6;

FIG. 9 is an enlarged horizontal cross-sectional view on substantially the line 9—9 of FIG. 5;

FIG. 10 is a horizontal cross-sectional view on substantially the line 10—10 of FIG. 6;

FIG. 11 is a vertical cross-sectional view on substantially the line 11—11 of FIG. 7; and

FIG. 12 is a view similar to FIG. 10 illustrating three teeth.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings more particularly by ref-

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erence numerals and with specific reference to FIGS. 1-4, 10 indicates generally a cable percussion drilling bit and reamer unit constructed to include the principles of the present invention. The unit 10 includes a shaft 12 having a threaded reduced upper portion 14 and a reduced lower portion 16 of the form clearly shown in FIGS. 2-4, terminating in a flat, narrow bottom surface 18 which reduces rock recrushing effects. An elongated bullet-nose carbide steel chisel element 20 is mounted in and centrally of the bottom surface 18, being secured in position by any desirable means, as by press fit, silver solder, screw threads, or the like. To each side of the element 20 are elongated half or full bullet-nose carbide steel chisel elements 22, two being illustrated in each group. Each element 22 is mounted so the cutting edge provided by cutting away one-half of the free nose faces in the normal direction of spin of the unit 10 as it drops. The chisel elements 20, 22 may extend well below the bottom surface 18, which reduces recrushing of cut or shattered rock or they may just protrude. No sticking occurs when the unit 10 is used with a multiblow drill structure. The elements 20 and 22 may take other specific forms, all having a high unit load in drilling.

For churn drilling, the present structure provides a new method of rock stressing. The points of contact of the elements 20, 22 cause radial stress lines to overlap, which does not occur with standard bits. Hence, there is greater drilling effect, more rock being drilled.

Above the chisel elements 20, 22 and integral with the shaft 12 are reamers 24 spaced diametrically, each of which includes a carbide steel scraper 26 having a lower cutting edge 28 about $\frac{1}{32}$ " outwardly of an upper reaming edge 30 for maximum reaming with minimum sticking on the withdrawal of the unit 10, as clearly shown in the drawings.

The elements 20, 22 and the reamer scrapers 26 may be of other suitable material, as tungsten carbide.

In FIGS. 5-11 is shown another preferred embodiment of the present invention, the unit being indicated generally by the reference numeral 30. The unit 30 includes a shaft 32 having a threaded reduced upper end 34 and a lower end 36 having two cavities or chambers 38 open at the ends and bottom and separated by a depending partition or wall 40.

A tooth 42 of block forming including a round hole 44 with an enlarged leading portion 46 and having an insert 48 of carbide or other suitable material and of the configuration shown in the drawings is mounted in one cavity 38. A second tooth 50 is like tooth 42, except for a threaded hole 52 instead of the hole 44. The teeth 42 and 50 may be solid good steel. A heavy bolt 54 with a head 56 extends through the hole 44, a hole 58 in the partition 40, and threadably engages the hole 52 to maintain the teeth 42 and 50 in operative positions. The hole 58 is a little larger than the diameter of the bolt 54 to prevent undue impact on or contact with the bolt 54 in drilling to prevent stressing or binding of the bolt 54. It is understood that variations may be made in the securing means, as a nut and bolt for the bolt 54, which would not require threads in the hole 52, but would need a space for a nut. Further, a single bolt 54 may be used to secure each of teeth 42 and 50, such bolts being anchored in the partition 40.

A shim 60 of metal or other suitable material is shown between each of the teeth 42 and 50 and the partition 40 to maintain the proper drilling positions of the teeth 42 and 50. It will be understood that more shims will be added as the teeth wear in drilling. This can be readily accomplished in the field by removal and replacement of the bolt 54 with simple tools. The teeth 42 and 50 are of good tool steel or other suitable material.

A button 62 of carbide and the like may be secured in the bottom of the partition 40 to break up center "crowns" and the like.

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Reamers similar to the reamers 24 may be used with the unit 30, or inserted on the lower end 36, as the reamers 64 above teeth 42 and 50, or as integral part of the teeth 42 and 50 above the carbide inserts 48 indicated 66 in the dotted lines in FIG. 7 only. However, the unit 30 will drill effectively without reamers.

In FIG. 12 is illustrated a modification of the expandable unit 30 designated 70 in which a center post 72 replaces the partitions 40. Three teeth 74 are shown, each secured in position by a bolt 76, the holes through the teeth 74 being a little large to prevent shock and to allow tooth movement without binding. More teeth could be used. In one comparative test, a standard drop drilling stem with standard field forged bit drilled a segment of six inch holes at a rate of 8"-9" per hour in green granite in Connecticut. A chatter hammer with a standard field forged bit under the same conditions drill 18"-24" per hour. A chatter hammer with the bit unit 30 above described under the same conditions drilled 36"-48" per hour. Other comparative tests have demonstrated the same outstanding improvement.

Shimming of the teeth 42 and 50 increases the cutting life of the unit 30 several fold. Tests in Connecticut green granite demonstrated approximately $\frac{1}{32}$ " of overall gage lost per 30 feet of drilling with the unit 30. By use of shims 60, nearly 1000 feet may be drilled with one set of teeth 42, 50 as against 300'-350' obtained from comparable fixed bits. It is to be understood that the wear referred to decreases the size of the bit so that it becomes too small for the hole size being drilled.

It is apparent that there has been provided units which fulfill the objects and advantages sought therefor.

It is to be understood that the foregoing description and the accompanying drawings have been given by way of illustration and example. It is also to be understood that changes in form of the elements, rearrangement of parts, and substitution of equivalent elements, which will be obvious to those skilled in the art, are contemplated as within the scope of the present invention which is limited only by the claims which follow.

What is claimed is:

1. In combination, a drilling unit for churn drills and the like, comprising a body including a lower end, drill teeth mounted in the lower end for drilling, and means for moving the drill teeth generally radially of the body as needed for the required drilling width of the drilling unit.
2. The combination of claim 1 including a crushing member secured to the bottom of the lower end.
3. The combination of claim 1 and including a reamer secured to each tooth.
4. The combination of claim 1 and including means for receiving and holding shim means in effective relation to said teeth to provide required drilling width.
5. The combination of claim 1 in which two cavities are formed in the lower end of the body, a partition wall separating the cavities, a tooth in each cavity, and bolt means securing the teeth against the partition wall.
6. The combination of claim 5 in which at least one shim is disposed between each tooth and the partition wall.
7. The combination of claim 6 in which the bolt extends through a hole in the partition wall, said hole being of sufficient larger diameter than the bolt to substantially eliminate destructive pounding on the bolt in drop drilling.
8. The combination of claim 1 in which multiple cavities are formed in the lower end of the body about a central post, a tooth in each cavity, and means securing the teeth in the cavities.
9. The combination of claim 8 in which at least one shim is disposed between at least one tooth and the post.

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