

June 20, 1967

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3,326,308

WELL DRILLING BIT

Filed July 22, 1965

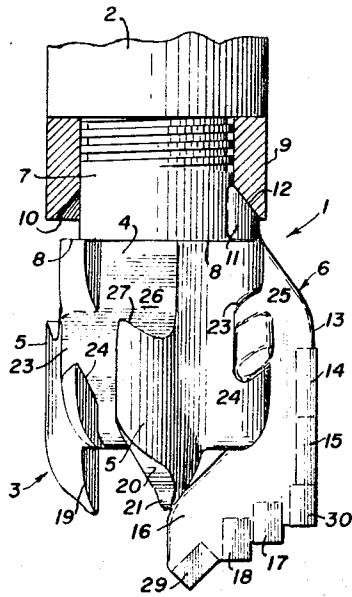


FIG. 1.

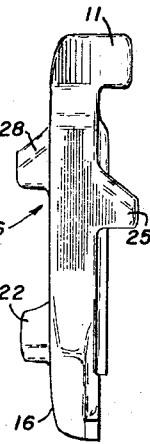


FIG. 3.

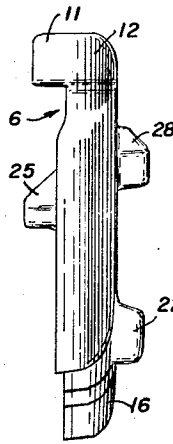


FIG. 4.

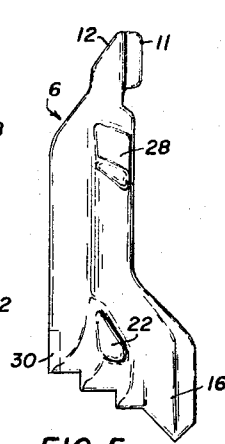


FIG. 5.

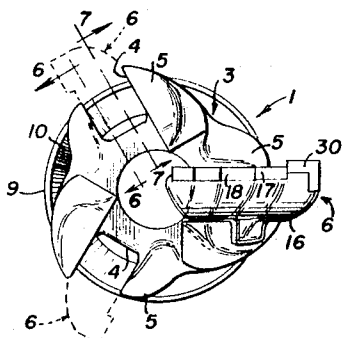


FIG. 2.

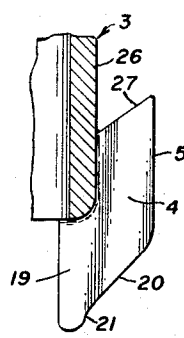


FIG. 6.

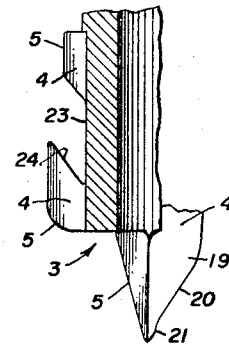


FIG. 7.

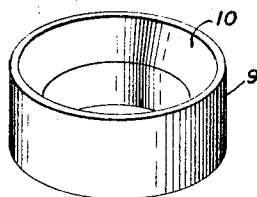


FIG. 8.

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3,326,308

WELL DRILLING BIT

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Filed July 22, 1965, Ser. No. 474,098
6 Claims. (Cl. 175—413)

This invention relates to a well drilling bit, and it concerns more particularly certain specific improvements in a bit as hereinafter described which has heretofore been employed for drilling comparatively shallow, small diameter holes, commonly referred to as shot holes, for use in geophysical exploration operations in which explosive charges are placed in such holes and detonated from the surface, and the resulting earth vibrations are recorded by seismograph.

The invention is applicable to a bit as described having a plurality of three circumferentially spaced removable blades which are received in longitudinal slots therefor in thickened peripheral portions of a tubular blade holder having an externally threaded shank portion for engagement with the lower end of a drill pipe. Each of the blades has a short circumferentially extending portion extending laterally outwardly from at least one side thereof, adjacent the upper end of the blade, which fits around the threaded shank portion of the blade holder and overlies a discontinuous upwardly facing external shoulder on the blade holder communicating with the upper ends of the longitudinal slots therein. Said upper end portion of the blade is externally beveled for clamping engagement by a ring loosely surrounding the shank portion of the blade holder, in opposing relation to the lower end of the drill pipe and said shoulder, said ring being internally beveled on its under side, whereby a downward thrust is applied to the blades relative to the blade holder as the blade holder is advanced relative to the drill pipe, upon tightening the threads thereof, and the blades are rigidly and removably clamped to the blade holder by abutting engagement of their mutually opposing surfaces.

The invention contemplates certain improvements and refinements of the mutually opposing surfaces on the blade holder and the blades, respectively, whereby the blades are clamped to the blade holder, between the blade holder and said ring, whereby the blades are positively secured against displacement in any direction relative to the blade holder and the structure is additionally reinforced so that the bit is characterized by its ruggedness and dependability in use as well as more efficient. The strength of the bit is comparable to that of the drill pipe to which it is connected, and breakage of parts, as well as costly fishing jobs to recover parts lost in the hole, are substantially avoided by use of the invention.

The invention also contemplates certain improvements in the cutting surfaces of the blades whereby the blades are less subject to wear and their useful life is increased, while at the same time the rate at which the bit penetrates a formation being drilled is increased.

The invention will be readily understood by referring to the following description and the accompanying drawing, in which:

FIG. 1 is a side elevational view of a well drilling bit embodying the invention having two of its three blades removed to show details of construction, showing one of the blades in place as seen from the leading side thereof relative to the direction of rotation of the bit, showing the heavy duty tubular blade holder having the longitudinal slots formed in thickened peripheral portions thereof for engagement by the blades, showing the blade holder connected by its threaded shank portion to an adjoining section of drill pipe, shown fragmentarily, and showing

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in longitudinal section the ring surrounding said threaded shank portion of the blade holder, in opposing relation to the lower end of the drill pipe and a discontinuous upwardly facing external shoulder on the blade holder, and having in internally beveled surface on its under side for clamping engagement with the externally beveled, arcuate upper end portions of the several blades, which extend circumferentially between said ring and said shoulder, whereby a downward thrust is imparted to the blades relative to the blade holder as the blade holder is advanced relative to the drill pipe, upon tightening the threads thereof, and the blades are rigidly and removably connected to the blade holder, and are secured against displacement in any direction relative thereto, by abutting engagement of their mutually opposing surfaces as hereinafter more fully described;

FIG. 2 is a bottom plan view of the bit as illustrated in FIG. 1;

FIG. 3 is an elevational view showing one of the blades in its detached position as seen from the inner longitudinal edge thereof, facing radially outwardly relative to the assembled position of the blade;

FIG. 4 is an elevational view showing one of the blades in its detached position as seen from the outer longitudinal edge thereof, facing radially inwardly relative to the assembled position of the blade;

FIG. 5 is an elevational view showing one of the blades in its detached position as seen from the trailing side thereof relative to the direction of rotation of the bit, in the assembled position of the blade;

FIG. 6 is a fragmentary sectional elevational view on an enlarged scale taken on the line 6—6 of FIG. 2;

FIG. 7 is a fragmentary sectional elevational view on an enlarged scale taken on the line 7—7 of FIG. 2; and

FIG. 8 is an inverted perspective view showing the ring illustrated in FIG. 1 as seen from the bottom and one side thereof.

Referring to FIGS. 1 and 2 of the drawing, the numeral 1 designates generally a well drilling bit having the invention incorporated therein, and the numeral 2 indicates the lower end portion of a drill pipe, shown fragmentarily, having the bit 1 connected thereto.

The bit 1 includes a heavy duty tubular blade holder 3 which as shown has a plurality of three longitudinal channels 4 formed in thickened peripheral portions 5 thereof for engagement, respectively, by a like number of blades 6, and has an upwardly extending externally threaded shank portion 7 whereby the blade holder 3 is connected to the drill pipe 2.

The blade holder 3 has a discontinuous upwardly facing external shoulder 8 communicating with the upper ends of the channels 4. A ring 9, which loosely surrounds the threaded shank portion 7 of the blade holder 3, in opposing relation to the lower end of the drill pipe 2 and the shoulder 8, is internally beveled on its under side, as at 10, for clamping engagement with the upper end portions 11 of the several blades 6, which are externally beveled, as at 12, and extend circumferentially between the ring 9 and the shoulder 8.

A downward thrust is imparted to the blades 6 relative to the blade holder 3 by the action of the ring 9 as the blade holder 3 is advanced relative to the drill pipe 2, upon tightening the threads thereof, and the blades 6 are rigidly and removably clamped to the blade holder 3, between the blade holder 3 and the ring 9, by abutting engagement of their mutually opposing surfaces including the upwardly facing shoulder 8 of the blade holder 3 and the opposing surfaces of the upper end portions 11 of the blades 6.

The blades 6 are secured in engagement with the channels 4 by abutting engagement of the internally beveled

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surface 10 on the under side of the ring 9 with the externally beveled surfaces 12 on the upper end portions 11 of the blades 6.

The blades 6 are generally planar and the outer longitudinal edges thereof are straight for a major portion of their lengths, as at 13. Hard metal inserts, two of which are indicated by the numerals 14, 15, are applied to the leading sides of the blades 6, relative to the direction of rotation of the bit 1, adjacent the outer longitudinal edges 13 thereof.

The lower end portions of the several blades 6, indicated by the numerals 16, extend downwardly and radially inwardly toward each other below the body of the blade holder 3, whereby they substantially meet, and the width of the blades 6 is progressively reduced by steps immediately adjacent the lower ends 16 thereof. Hard metal inserts, two of which are indicated by the numerals 17, 18, are applied to the leading sides of the blades 6, relative to the direction of rotation of the bit 1, adjacent the lower ends 16 thereof.

The structure above described is conventional and is not claimed herein. This invention resides in the specific improvements hereinafter described:

(1) The side walls of the channels 4 on the trailing sides of the blades 6, relative to the direction of rotation of the bit 1, are extended downwardly below the body of the blade holder 3, as at 19, FIG. 6, in juxtaposed relation to the lower end portions 16 of the blades 6, which likewise extend downwardly below the body of the blade holder 3 as above described, and in close proximity to the leading edges of the blades 6 relative to the direction of movement of the bit 1 in a downward direction, whereby the lower end portions 16 of the blades 6 are reinforced against the torque to which they are subjected upon rotative movement of the bit 1.

(2) The portions 19 of the side walls of the channels 4 on the trailing sides of the blades 6, relative to the direction of rotation of the bit 1, which extend downwardly below the body of the blade holder 3 as above described, have downwardly and radially inwardly inclined abutments 20 immediately above their lower ends terminating in downwardly extending, radially outwardly facing vertical abutments 21 immediately adjacent their lower ends, and the blades 6 have correspondingly shaped lugs 22 on the trailing sides thereof, in opposing relation to the abutments 20, 21, whereby the lower end portions 16 of the blades 6 are reinforced against forces acting on them to squeeze them together.

(3) The side walls of the channels 4 on the leading sides of the blades 6, relative to the direction of rotation of the bit 1, have cut out portions intermediate the ends of the channels 4 terminating in upwardly and radially outwardly inclined abutments 24 spaced above the lower end of the body of the blade holder 3, and the blades 6 have correspondingly shaped lugs 25 on the leading sides thereof, in opposing relation to the abutments 24, whereby the lower end portions 16 of the blades 6 are reinforced against forces acting on them to spread them apart.

(4) The side walls of the channels 4 on the trailing sides of the blades 6, relative to the direction of rotation of the bit 1, have cut away portions 26 beginning at their upper ends terminating in upwardly and radially outwardly inclined abutments 27 spaced below the shoulder 8, and the blades 6 have correspondingly shaped lugs 28 on the trailing sides thereof, in opposing relation to the abutments 27, whereby the blades 6 are secured against accidental displacement from the channels 4 upon loosening the threads whereby the blade holder 3 is connected to the drill pipe 2, to thereby disengage the ring 9 from its clamping engagement with the upper end portions 11 of the blades 6, upon changing the blades 6.

(5) The extreme lower ends of the blades 6 are pointed and terminate in oppositely inclined, radially extending intersecting edges, and rectangular, substantially diamond shaped hard metal inserts 29, which correspond to the

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inserts 17, 18, are applied to the leading sides of the blades 6, relative to the direction of rotation of the bit 1, adjacent the extreme lower ends of the blades 6, whereby the blades 6 are more efficient from the standpoint of their rates of earth penetration.

(6) Right angular hard metal inserts 30, which correspond to the inserts 14, 15, are applied to the leading sides of the blades 6, relative to the direction of rotation of the bit 1, and to the outer longitudinal edges 13 thereof, at the junctures of said outer longitudinal edges 13 with the lower edges of the blades 6, whereby the blades 6 are characterized by their resistance to wear.

The invention may be modified in various ways without departing from the spirit and scope thereof.

I claim:

1. In a well drilling bit having replaceable blades, the combination of a blade holder having a tubular body and having a plurality of circumferentially spaced longitudinal channels formed in thickened peripheral portions thereof, and having an upwardly extending externally threaded shank portion for engagement with a drill pipe whereby the blade holder is adapted to be connected to said pipe, the blade holder having a discontinuous upwardly facing external shoulder traversing the upper ends of said channels, below said shank portion, a plurality of blades each received in one of said channels, said blades being substantially planar and extending radially outwardly beyond said channels, the outer longitudinal edges of said blades being straight for a major portion of their lengths, the blades extending above and below said channels and the lower end portions of the blades extending downwardly and radially inwardly toward each other below the body of the blade holder, whereby they substantially meet, the widths of the blades being progressively reduced in the direction of their opposite end portions, respectively, and the upper end portions of the blades being arcuate and extending laterally, circumferentially of the blade holder, above said upwardly facing shoulder, and being externally beveled, and a ring loosely surrounding said shank portion, for abutting engagement with the adjacent end of said pipe, said ring being internally beveled on its under side for abutting engagement with the externally beveled, arcuate upper end portions of the blades whereby the blades are adapted to be clamped between the blade holder and said ring upon tightening the threads whereby the blade holder is connected to said pipe, the side walls of said channels on the trailing sides of the blades, relative to the direction of rotation of the bit, extending downwardly below the body of the blade holder, in juxtaposed relation to the lower end portions of the blades, and in close proximity to the leading edges of the blades, relative to the direction of movement of the bit in a downward direction, whereby the lower end portions of the blades are reinforced against the torque to which they are subjected upon rotative movement of the bit.

2. The structure of claim 1, the lower end portions of the side walls of the channels on the trailing sides of the blades, relative to the direction of rotation of the bit, having downwardly and radially inwardly inclined abutments immediately above their lower ends terminating in downwardly extending, radially outwardly facing vertical abutments adjacent their extreme lower ends, and the blades having correspondingly shaped lugs on the trailing sides thereof, in opposing relation to said abutments, whereby the lower end portions of the blades are reinforced against forces acting on them to squeeze them together.

3. The structure of claim 1, the side walls of said channels on the leading sides of the blades, relative to the direction of rotation of the bit, having cut out portions intermediate the ends of said channels terminating in upwardly and radially outwardly inclined abutments spaced above the lower end of said body, and the blades having correspondingly shaped lugs on the leading sides thereof, in opposing relation to said abutments, whereby the

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lower end portions of the blades are reinforced against forces acting on them to spread them apart.

4. The structure of claim 1, the side walls of said channels on the trailing sides of the blades, relative to the direction of rotation of the bit, having cut away portions beginning at their upper ends terminating in upwardly and radially outwardly inclined abutments spaced below said shoulder, and the blades having correspondingly shaped lugs on the trailing sides thereof, in opposing relation to said last mentioned abutments, whereby the blades are secured against accidental displacement from said channels upon loosening the threads whereby the blade holder is adapted to be connected to said pipe, to thereby disengage said ring from its clamping engagement with the blades, upon changing the blades.

5. The structure of claim 1, the extreme lower ends of the blades being pointed and terminating in oppositely inclined, radially extending intersecting edges, and the blades having rectangular, substantially diamond shaped hard metal inserts applied to the leading sides thereof, relative to the direction of rotation of the bit, adjacent their extreme lower ends, whereby the blades are characterized by their efficiency from the standpoint of their rates of earth penetration.

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6. The structure of claim 1, the blades having right angular hard metal inserts applied to the leading sides thereof, relative to the direction of rotation of the bit, and to their outer longitudinal edges, at the junctures of said outer longitudinal edges with their lower edges, whereby the blades are characterized by their increased resistance to wear in areas which normally are subject to relatively greater wear than other portions thereof.

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