March 4, 1969 T. A. WHITE 3,430,719

WELL DRILLING BIT

Filed Nov. 20, 1967

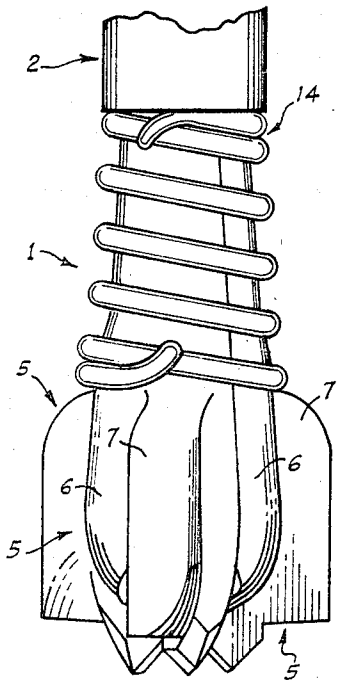

FIG. 1

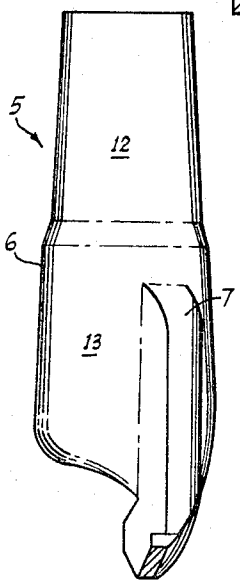

FIG. 3

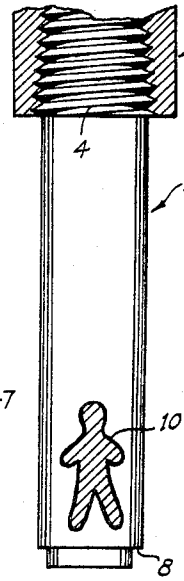

FIG. 2

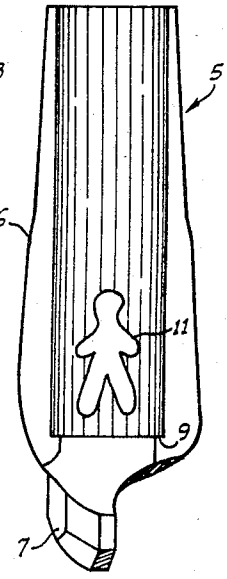

FIG. 4

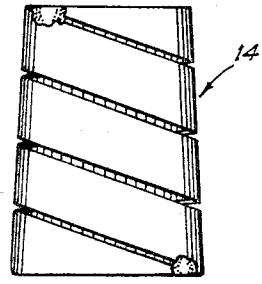

FIG. 6

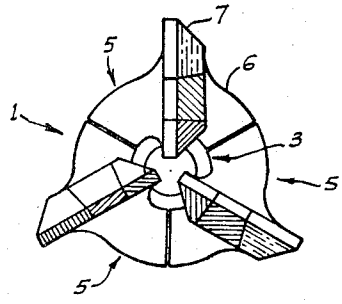

FIG. 5

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WELL DRILLING BIT

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U.S. Cl. 175—412 5 Claims
Int. Cl. E21c 13/02

ABSTRACT OF THE DISCLOSURE

Certain specific improvements in a bit as hereinafter described which has heretofore been employed for drilling comparatively shallow, small diameter holes such as shot holes, water wells and the like.

The invention is applicable to a bit as described having a plurality of three circumferentially spaced removable blade elements each having an arcuate web portion embracing a corresponding portion of the peripheral surface of a tubular blade holder, beginning at the lower end of said holder and extending upwardly therefrom, and having a blade portion positioned near the lower end of said web portion and extending radially outwardly and downwardly therefrom, said holder having an externally threaded shank portion, beginning at its upper end, extending upwardly above the web portions of said blade elements for engagement with the lower end of a drill pipe. The external peripheral surfaces of the web portions of said blade elements are tapered downwardly and radially outwardly for use as hereinafter described.

According to this invention the holder, and the opposing surfaces of the web portions of the respective blade elements, are straight, and a tapered compression spring, which in its applied position encircles the upper ends of the web portions of said blade elements, has its upper end, which is of relatively smaller diameter, secured in abutting engagement with the lower end of the drill pipe whereby said blade elements are positively secured to said holder, between said holder and said spring.

An important feature of the invention is that the tapered compression spring is seated initially on the above mentioned blade portions of said blade elements, which extend radially outwardly and downwardly from the web portions as described, in the lowermost position of said spring, and extends upwardly a short distance above said web portions for abutting engagement with the drill pipe whereby the spring is compressed upon advancing the holder relative to the drill pipe.

Upon compressing the spring, as the holder is advanced relative to the drill pipe, the several convolutions of the spring are caused to grip the opposing web portions whereby the blade elements are positively clamped to the holder, between the holder and said spring. Upon releasing the spring it is immediately disengaged from the blade elements due to its inherent spring tension.

The invention contemplates an arrangement as described which includes mutually engaging means on the blade holder and the blade elements, respectively, whereby the blade elements are clamped securely to the holder, as the holder is advanced relative to the drill pipe, the blade elements are positively secured against displacement in any direction relative to the holder, and the structure is additionally reinforced so that the bit is characterized by its ruggedness and dependability as well as its efficiency.

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 blade elements each having an arcuate web portion embracing a corresponding portion of the peripheral surface of a tubular blade holder, beginning at the lower end of said holder and extending upwardly therefrom, and having a blade portion positioned near the lower end of said web portion and extending radially outwardly and downwardly therefrom, said holder having an externally threaded shank portion, beginning at its upper end, extending upwardly above the web portions of said blade elements for engagement with the lower end of a drill pipe. The external peripheral surfaces of the web portions of said blade elements are tapered downwardly and radially outwardly for use as hereinafter described.

In one form of bit as described, as illustrated in applicant's Patent No. 2,656,153, the external peripheral surface of said holder is tapered downwardly and radially outwardly, beginning at its lowest end, for frictional engagement with the opposing surfaces of the web portions of said blade elements, which are correspondingly tapered. A tapered collar, which is in its applied position encircles the upper ends of the web portions of said blade elements, has an internal taper corresponding to the external taper of said web portions, for frictional clamping engagement therewith. The top of the collar, which is of relatively smaller diameter, is secured in abutting engagement with the lower end of the drill pipe whereby said blade elements are positively secured to said holder, between said holder and said collar.

According to this invention the holder is straight throughout its length, the web portions of the respective blade elements are not internally tapered, and a tapered compression spring, which has the same relative position as the tapered collar above mentioned, has a novel action wholly dissimilar thereto as hereinafter described.

The tapered compression spring of the invention is not wedged in place on the web portions of the respective blade elements, but is seated initially on the above mentioned blade portions of said blade elements, which extend radially outwardly and downwardly from the web portions as described, in the lowermost position of said spring, and extends upwardly a short distance above said web portions.

Upon compressing the spring, as the holder is advanced relative to the drill pipe, the several convolutions of the spring are caused to grip the opposing web portions whereby the blade elements are positively clamped to the holder, between the holder and said spring. Upon releasing the spring it is immediately disengaged from the blade elements due to its inherent spring tension.

The invention contemplates an arrangement as described which includes mutually engaging means on the blade holder and the blade elements, respectively, whereby the blade elements are clamped securely to the holder, as the holder is advanced relative to the drill pipe, the blade elements are positively secured against displacement in any direction relative to the holder, and the structure is additionally reinforced so that the bit is characterized by its ruggedness and dependability as well as its efficiency.

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, showing fragmentarily the lower end of a string of drill pipe to which the bit is connected, and showing the several blade elements and the compression spring in place on the blade holder;

FIG. 2 is a side elevational view, partly broken away,

showing the blade holder connected to the drill pipe but with the blade elements and the compression spring removed;

FIG. 3 is a side elevational view showing one of the blade elements in a detached position thereof, showing the side of the blade element which faces radially outwardly;

FIG. 4 is a view similar to FIG. 3 showing the opposite side of the blade element, which faces radially inwardly;

FIG. 5 is a bottom plan view of the bit; and

FIG. 6 shows separately an alternative form of compression spring.

Referring to 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 tubular blade holder **3** which as shown is generally cylindrical and has straight, concentric inner and outer peripheral surfaces.

The blade holder **3** has an externally threaded shank portion **4**, beginning at its upper end, for engagement with the lower end of the drill pipe **2** whereby the bit is rigidly and removably connected thereto.

The bit **1** further includes a plurality of three circumferentially spaced removable blade elements **5** each having an arcuate web portion **6** embracing a corresponding portion of the peripheral surface of the blade holder **3**, beginning at the lower end of the holder **3** and extending upwardly therefrom, and having a blade portion **7** positioned near the lower end of the web portion **6** and extending radially outwardly and downwardly therefrom.

The blade holder **3** has a downwardly facing external shoulder **8** thereon, near its lower end, in abutting engagement with upwardly facing internal shoulders **9** on the inner peripheral surfaces of the web portions **6** of the respective blade elements **5**.

The blade holder **3** has a plurality of three circumferentially spaced shaped depressions **10** in its outer peripheral surface, above the downwardly facing external shoulder **8**.

Each of the depressions **10** has received therein, and provides a closely fitting socket for, a correspondingly shaped internal projection **11** which extends radially inwardly from the inner peripheral surface of the web portion **6** of one of the blade elements **5**.

As shown, the depressions **10** and the projections **11**, which with the shoulders **8** and **9** comprise mutually engaging means which, in association with other means as hereinafter described, positively secure the blade elements **5** against displacement in any direction relative to the blade holder **3**, are generally elongated and have the configuration of a man in standing position with arms and legs extended downwardly and laterally outwardly.

The external peripheral surfaces of the web portions **6** of the blade elements **5** are tapered downwardly and radially outwardly, by steps, as at **12**, **13**, for use as hereinafter described. The tapered areas **12**, **13** are inclined at different angles relative to the longitudinal axis of the blade holder **3**, the inclination of the lowermost area **13** being relatively greater.

A tapered compression spring **14** encircles the web portions **6** of the blade elements **5**, above the blade portions **7**, with its smaller end positioned uppermost for abutting engagement with the lower end of the drill pipe **2**, whereby the blade elements **5** are positively secured to the blade holder **3**, between the blade holder **3** and the compression spring **14**, upon tightening the threads whereby the blade holder **3** is connected to the drill pipe **2**.

The ends of the compression spring **14** are secured, as by tying, as illustrated in FIG. 1, or by welding, as shown in FIG. 6.

The compression spring **14** is seated initially on the blade portions **7** of the blade elements **5**, in the lowermost position of the spring **14**, and extends upwardly a short distance above the web portions **6** for abutting engagement with the drill pipe **2**.

In its initial position the compression spring **14** loosely encircles the externally tapered areas **12**, **13** of the web portions **6** of the blade elements **5**, and is not wedged thereon.

As the spring **14** is compressed, upon tightening the threads whereby the blade holder **3** is connected to the drill pipe **2**, the several convolutions of the spring **14** are caused to grip the opposing web portions **6** whereby the blade elements **5** are securely clamped to the blade holder **3**, between the blade holder **3** and the compression spring **14**.

Upon loosening the threads whereby the blade holder **3** is connected to the drill pipe **2**, the pressure on the spring **14** is released and the spring **14** is immediately disengaged from the blade elements **5** due to its inherent spring tension.

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 tubular blade holder 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, a plurality of circumferentially spaced removable blade elements each having an arcuate web portion embracing a corresponding portion of the peripheral surface of the blade holder, below said shank portion, and having a blade portion positioned near the lower end of the web portion and extending radially outwardly and downwardly therefrom, mutually engaging means on the blade holder and the blade elements including a plurality of circumferentially spaced shaped depressions in the outer peripheral surface of the blade holder, above its lower end, and correspondingly shaped projections each extending radially inwardly from the web portion of one of the blade elements and received in one of said depressions, the external peripheral surfaces of the web portions of the blade elements being tapered downwardly and radially outwardly, and a tapered compression spring encircling the web portions of the blade elements, above the blade portions thereof, with its smaller end positioned uppermost for abutting engagement with the lower end of the drill pipe, whereby the blade elements are positively secured to the blade holder, between the blade holder and the compression spring, upon tightening the threads whereby the blade holder is connected to the drill pipe.

2. The structure of claim **1**, the blade holder being generally cylindrical and having straight, concentric inner and outer peripheral surfaces, the external peripheral surfaces of the web portions of the blade elements being tapered downwardly and radially outwardly, by steps, and having two adjoining tapered areas positioned one above the other, said tapered areas being inclined at different angles relative to the longitudinal axis of the blade holder, and the inclination of the lowermost area being relatively greater.

3. The structure of claim **1**, said compression spring being seated initially on the blade portions of the blade elements, in the lowermost position of the spring, and extending upwardly a short distance above the web portions for abutting engagement with the drill pipe, whereby the compression spring, in its initial position, loosely encircles the web portions of the blade elements, above the blade portions, and is not thereafter wedged thereon.

4. The structure of claim **3**, the arrangement being such that as the spring is compressed, upon tightening the threads whereby the blade holder is connected to the drill pipe, the several convolutions of the spring are caused to grip the opposing web portions whereby the blade elements are securely clamped to the blade holder, between the blade holder and the compression spring,

and upon loosening the threads whereby the blade holder is connected to the drill pipe, the pressure on the spring is released and the spring is immediately disengaged from the blade elements due to its inherent spring tension.

5. The structure of claim 1, said depressions and projections being generally elongated and having the configuration of a man in standing position with arms and legs extended downwardly and laterally outwardly.

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