June 13, 1944. C. P. COLLINS 2,350,986

DEFLECTING DRILL BIT

Filed May 3, 1943

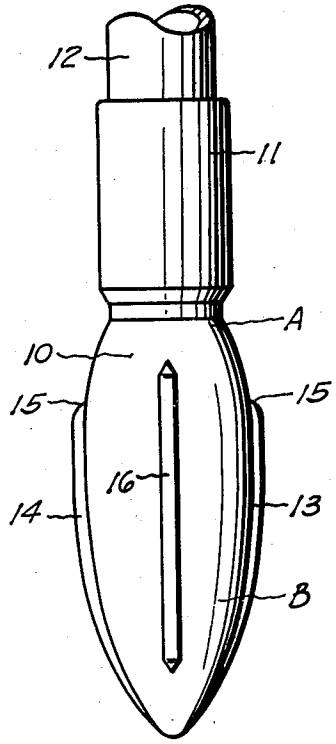

Fig. 1

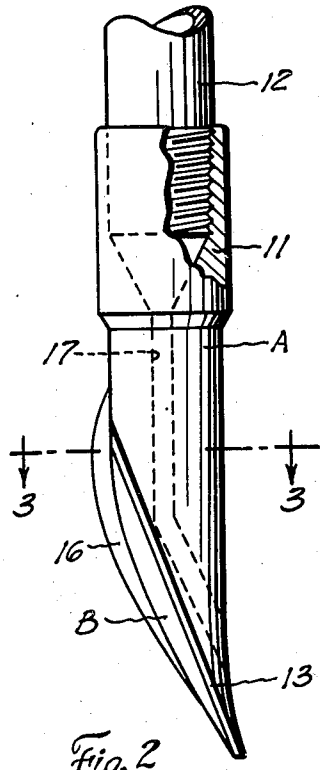

Fig. 2

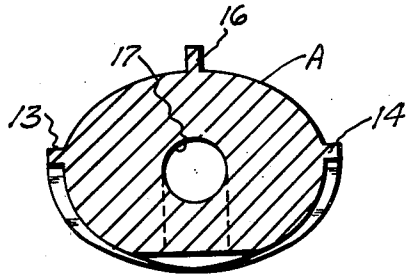

Fig. 3

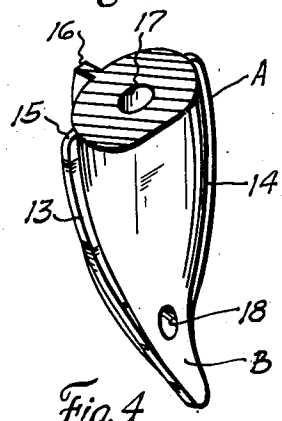

Fig. 4

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Patented June 13, 1944 2,350,986

UNITED STATES PATENT OFFICE

2,350,986

DEFLECTING DRILL BIT

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Application May 3, 1943, Serial No. 485,435

5 Claims. (Cl. 255—61)

This invention relates to new and useful improvements in deflecting drill bits.

In performing directional or controlled drilling, it has been the practice to employ "spudding" bits for starting the new bore which of course angles off from the drill bore. These spudding bits are operated by imparting a reciprocating or hammering action thereto to drive the bit into the formation and thereby begin the new bore at the desired angle. The usual type of spudder bit has no provision for cutting the formation with a rotary action with the result that after the bit has been driven into the formation as far as possible, it must be removed from the well and a rotary bit substituted therefor.

It is one object of the present invention to provide an improved deflecting or directional drill bit which is so constructed that it may be utilized as a spudding bit and driven downwardly into the formation and may also be employed as a rotary bit by rotating the same to perform a drilling or cutting action.

An important object of the invention is to provide an improved deflecting bit which includes a bit body having its lower portion offset and reduced so as to facilitate entry of the bit into the formation when said bit is spudded or forced downwardly; said body also having inclined cutting blades which are so disposed as to carry out a cutting or drilling action when the bit is rotated, the shape of the bit body, together with the cutting blades mounted thereon, forming a combination spudding and rotary deflecting tool.

Still another object of the invention is to provide an improved deflecting bit, of the character described, wherein the bit body is gradually reduced toward its lower end and also wherein such lower end is curved or offset from the longitudinal axis of said body, whereby a downward spudding of the bit forces the lower end thereof into the formation at an angle from the well bore, the shape of said body causing the thrust or force occasioned by the spudding operation to be taken by the entire bit body; said bit body also having relatively narrow cutting blades thereon which blades gradually merge into the body at its lower reduced end so that said blades do not materially interfere with the entry of the body into the formation during the spudding action.

A further object of the invention is to provide an improved bit, of the character described, wherein the cutting blades extend an angle to the axis of the curved or offset portion of the bit and also wherein said blades terminate in the same plane or above the lower end of the bit body, whereby the blades do not obstruct entry of the bit body into the formation during spudding and yet perform an efficient cutting action when the body is rotated.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specifications and by reference to the accompanying drawing, wherein:

Figure 1 is an elevation of a deflecting bit, constructed in accordance with the invention.

Figure 2 is also an elevation of the bit and viewed at a right angle to the device as shown in Figure 1.

Figure 3 is an enlarged horizontal, cross-sectional view taken on the line 3—3 of Figure 2, and

Figure 4 is a partial isometric view of the bit body.

In the drawing the numeral 10 designates a bit body which has an internally screw threaded box 11 preferably made integral with its upper end. The lower end of the usual drill pipe 12 is adapted to be connected in the box whereby the bit body is supported by the drill pipe and may be lowered and raised within the well bore by means of said pipe.

Immediately below the box 11 the bit body has a vertical portion A which is substantially elliptical in cross-section (Figure 3) and the longitudinal axis of said vertical portion A is in alinement with the longitudinal axis of the drill pipe 12. From the vertical portion A the bit body is gradually reduced or tapered and terminates in a pointed or sharpened end. The reduced or tapered portion B is curved or offset to one side, that is, the longitudinal axis of the portion B extends at an inclination with respect to the longitudinal axis of the portion A. It will be obvious that when a downward force is exerted upon the bit body the reduced offset portion is urged or directed into the formation at an angle from the well bore. The curvature or offsetting of the lower portion of the bit body will of course control the particular angle at which the bit enters the formation and by varying this curvature the new bore formed by the bit body may be at any desired angle relative to the axis of the well bore.

A pair of elongate side cutting blades 13 and 14 are secured to the exterior surface of the curved portion B of the bit body. The blades

13 and 14 are disposed diametrically opposite each other on the body and as is clearly shown in Figure 2, are inclined with respect to the axis of the elliptical upper end A of said body. The blades project radially outwardly and have their upper ends rounded or curved as indicated at 15. Each blade is gradually reduced in area to decrease its radial projection toward its lower end and the extreme lower end of said blade merges into the outer surface of the bit body adjacent the pointed lower end of said body.

In addition to the side cutting blades 13 and 14, a combined cutting and guide blade 16 is secured to the exterior surface of the body along the rear or trailing side of said body. The blade 16 projects radially outwardly and extends vertically of the body 10 and the outer edge thereof is curved with the lower portion of the blade being gradually reduced so as to merge into the lower end of the bit body. The blade 16 is located substantially midway between the side blades 13 and 14.

In order to permit circulation of a suitable drilling fluid through the tool, the body 10 is provided with a vertically extending bore 17, the upper end of which communicates with the interior of the box 11. The lower end of the bore 17 is offset or angled outwardly so that its outlet 18 is disposed near the lower end of the bit body between the side cutting blades 13 and 14. Obviously fluid passing downwardly through the drill pipe 12 may enter the passage or bore 17 and then escape through the outlet 18 so as to circulate around the lower portion of the cutting blades.

In using the deflecting bit, said bit is connected to the lower end of the drill pipe and is lowered through the well bore. Ordinarily in deflecting operations the well bore is plugged with cement and the deflecting bit is lowered until it contacts the cement plug. A downward force or spudding action is then imparted to the drill stem to force the bit downwardly within the well bore. Due to the curved or offset lower portion B of the bit body, such spudding causes the lower or pointed end of the bit to enter the formation at an angle to the well bore. It is noted that the side cutting blades 13 and 14 as well as the rear cutting blade 16 terminate in a plane above the extreme lower end of the bit body and this, together with the fact that the blades gradually merge into the body permits the body to enter the formation without substantially any resistance being offered to such entry by the blades. Thus, the body itself carries the entire load of the spudding action and said body is sufficiently rugged to withstand said load whereby efficient spudding may be accomplished.

As the bit is spudded into the formation, a new bore is formed at an angle to the well bore and the spudding action is continued until such new bore is well started. The drill pipe 12 is then rotated to impart a rotation to the bit body 10 and such rotation will cause the blades 13, 14 and 16 to drill out the new bore. During such drilling a suitable drilling fluid is circulated downwardly through the drill pipe, said fluid being ejected outwardly through the passage 17 and then upwardly around the exterior of the body and around said cutting blades. Manifestly, the bit can be spudded or driven into the formation only a certain distance and the provision of the blades and cutting elements makes it possible to increase the distance penetrated by the bit. This is an important feature of the invention for it is apparent that when the bit is rotated the new bore may be made of an increased depth by means of such bit. After the bit has penetrated the formation as far as desired through both the spudding and rotary action, said bit is removed and the usual type of rotary bit is substituted therefor to continue drilling of the new bore.

From the above, it will be seen that a simple and efficient directional or deflecting bit is provided. The provision of the cutting blades makes it possible to supplement the spudding action with a rotary action thereby assuring that sufficient formation is removed to start the new bore and guide the usual drilling bit which will be subsequently lowered into said bore. The particular shape of the bit body and the manner in which the cutting blades are disposed thereon cause the entire body to take the full thrust or load which is imposed during the spudding operation. The body itself has sufficient strength and is substantial enough to withstand the jar or shock occasioned by spudding and the blades are not subjected to any stress or strain during such spudding. After the spudding is completed the blades perform a cutting action upon rotation of the bit.

What I claim and desire to secure by Letters Patent is:

1. A deflecting bit including, a bit body adapted to be connected to the lower end of a drill pipe, the upper portion of the body being substantially elliptical in cross-section and having its longitudinal axis alined with the axis of the drill pipe, the lower portion of said body being curved or offset from the upper portion and being gradually reduced to a point at its extreme lower end, a pair of side cutting blades on the exterior of the body and located diametrically opposite each other, each cutting blade being gradually reduced in size toward its lower end so as to merge into the outer surface of the body at a point adjacent the extreme lower end of the body, and a rear cutting element extending vertically on the trailing side of the body and having its lower portion gradually reduced so as to merge into the exterior surface of said body.

2. A deflecting bit as set forth in claim 1, wherein the side cutting blades are disposed at an inclination with respect to the longitudinal axis of the curved lower end of the bit body.

3. A deflecting bit as set forth in claim 1, together with a longitudinal fluid passage extending through the bit body and having its lower end disposed at the lower end of said body between the side cutting blades.

4. A deflecting bit including, a bit body having its upper portion disposed along a vertical axis with its lower portion curved and offset with respect to said upper portion, the curved lower portion being gradually reduced and terminating in a substantially pointed end, and a pair of side cutting elements disposed on the exterior of the body and located diametrically opposite each other, each cutting blade being gradually reduced in size toward its lower end so as to merge into the outer surface of the body at a point adjacent the extreme lower end of the body, and a vertically extending cutting element on the trailing side of said bit body, said cutting element having its outer edge curved with its lower portion gradually reduced and merging into the outer surface of the bit body at a point adjacent the lower end thereof.

5. A deflecting bit including, a bit body having its upper portion disposed along a vertical axis

with its lower portion curved and offset with respect to said upper portion, the curved lower portion being gradually reduced and terminating in a substantially pointed end, and a pair of side cutting elements disposed on the exterior of the body and located diametrically opposite each other, each cutting blade being gradually reduced in size toward its lower end so as to merge into the outer surface of the body at a point adjacent the extreme lower end of the body, each side cutting element extending at an angle with respect to the longitudinal axis of the curved or offset lower portion of the bit body, and a rear cutting and guide blade extending vertically on the trailing side of the bit body and having its lower end gradually reduced so as to merge into the outer surface of the body at a point adjacent the lower end thereof.

CHARLES P. COLLINS.