Nov. 11, 1958 H. J. HAWTHORNE 2,859,942

DETACHABLE BLADE BIT

Original Filed Dec. 29, 1947

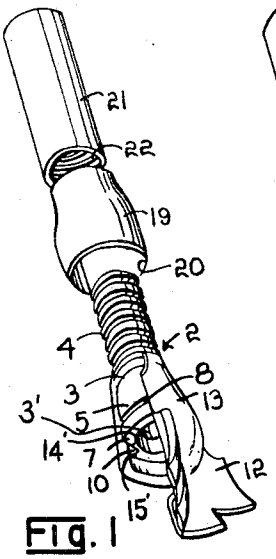

Fig. 1

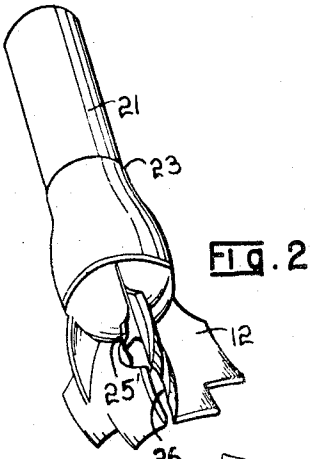

Fig. 2

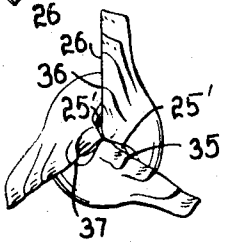

Fig. 5

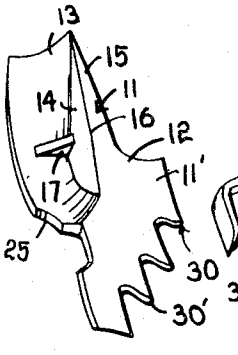

Fig. 3

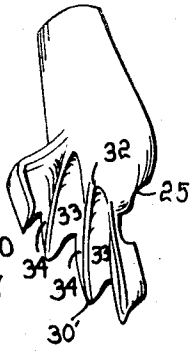

Fig. 4

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DETACHABLE BLADE BIT

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Continuation of Serial No. 332,060, January 19, 1953, which is a division of application Serial No. 794,239, December 29, 1947, now Patent No. 2,666,622, dated January 19, 1954. This application May 15, 1957, Serial No. 659,423

1 Claim. (Cl. 255—61)

This invention pertains to drilling bits for drilling earth formations.

This application is a continuation of my copending application Serial No. 332,060, filed January 19, 1953 for Detachable Blade Bit and now abandoned. Serial No. 332,060 is a division of my earlier filed application Serial No. 794,239, filed December 29, 1947, now Patent 2,666,622. Accordingly, the present application is entitled to the aforesaid filing date of December 29, 1947.

Detachable blade bits of the type herein described are generally referred to in the well drilling art as drag bits since the cutting action against the formation by the bit is accomplished by rotating the bit so that the blades drag against the formation so as to cut into the formation as the bit rotates.

Heretofore, a great deal of difficulty has been encountered in attempting to keep the blades of the bit firmly secured in position on the body. This is due to the fact that a weight is usually placed immediately above the drill bit so that the bit will be pushed downwardly against the formation as it is rotated. Techniques for overcoming these difficulties are described and claimed in the above-mentioned applications.

The invention described and claimed herein is of utility regardless of particular means for attaching blades to a bit body.

An object of the invention is to provide a drag bit having a plurality of blades of claw-like construction which are constructed so as to dig into the formation being drilled as the bit is rotated.

Other and further objects and advantages of the invention will become more readily apparent when the following description is considered in connection with the accompanying drawing wherein:

Fig. 1 is a partially exploded view of a form of a bit in which the invention is embodied;

Fig. 2 is an elevational view showing the bit of Figure 1 assembled;

Fig. 3 is a rear elevational view showing a modification of the blade construction;

Fig. 4 is a front elevational view of the blade shown in Fig. 3;

Fig. 5 is a bottom plan view looking up at the bottom of a bit constructed in accordance with the present invention and having a blade construction in accordance with that shown in Figs. 3 and 4.

In Fig. 1 a bit is shown generally at **2** and comprises a body **3** with the threaded shank **4** and a tapered body portion **5** thereon. A passage **3'** extends through the body **3** for pumping of flushing fluid therethrough. Spaced from the end **7** of the body portion **5** is a groove **8** on the outer periphery of the body **3**. A plurality of notches **10** are cut in the end **7** and extend up to the groove **8** of the body **3** to receive the formed portion **11** of the blades **12** to support the blades and the body, as will be more fully described. While there may be any number of notches in the body so as to accommodate a like number of blades, as a practical matter, it has been found

that the number of blades used will not exceed 3 or 4. If 3 blades are used, a body **3** is used which has three notches **10** which are 120° apart on the end **7** of the body **5**; if 4 blades are used, a body **3** is used which has 4 notches which are 90° apart on the end **7** of the body **3**. The blades will thereby be spaced about the body an equidistance apart.

The blades **12** comprise a curved portion **13** which is arranged to fit the curved body portion **5** of the bit body **3**. The formed portion **11** is integral with the curved portion **13** of the blades **12** and is formed by the surface **14** which is upstanding from the curved portion **13** and surface **15** which meets surface **14** substantially at right angles to form the edge **16** which fits in the corner of the notch **10** on the body **3**. The surface **14** of the blade fits against the surface **14'** of the notch **10** and the surface **15** fits against the surface **15'** of the notch. Upstanding between the curved portion **13** and the surface **14** of the blade is a projecting shoulder or ledge **17** which is of a size to fit into the groove **8**. It therefore seems obvious that when the portion **11** of the blade **12** is placed in the notch **10** and the shoulder **17** inserted into the groove in Figs. 2 and 5, the blade will be firmly positioned on the bit body.

In order to retain the blades in position on the body, a collar **19** is provided which has an internal taper **20** of a size to fit over the outer periphery of the curved portion **13** of the blades **12**. In order to prevent slipping of the retainer collar **19**, the drill collar **21** is provided with internal threads **22** arranged to engage the threaded shank **4**. When the bit is assembled, the drill collar **21** will engage the end **23** of the retainer collar **19** to clamp the blades **12** in position on the body.

Since the blades are positioned in the notches **10** and the groove **8** and are held thereon by the retainer collar **19**, it is impossible for the body to move relative to the blades **3**. The blades cannot move back and forth on a radius since the body and blades for all practical purposes are retained as an integral unit by the collar **19**; nor can they move angularly about the body because they are positioned on the body in the notch and no vertical movement can occur between the blades and the body since the taper on the inner surface of the collar and the taper on the body is such that the blades are held permanently in position therebetween. The taper on the collar **19** is such that when the bit is assembled a double vising effect is produced between the body **3** and the collar **19** to retain the blades firmly in position during operation of the bit.

Features of the blade clamping arrangement are claimed in the above-mentioned patent. That patent may be referred to for a fuller description of the blade clamping arrangement.

Particular attention is directed to the construction of the blades shown in Figs. 3, 4 and 5 wherein the downwardly extending plate **11'** forms a cutting portion which terminates in the stepped cutting edges **30**. These also may be termed cutting fingers. The front, or cutting surface of the downwardly extending plate, is substantially flat or planar as shown in Fig. 3 whereas the rear portion is of a claw like construction as shown in Fig. 4. Extending upwardly from each stepped point **30'** of the cutting edge is a rigid surface **32** which is tapered on each side of **33** and **34** thereof. This construction affords rigidity to the blade by forming a stiffening rib or ridge and permits the blade to be used over a longer period of time before retipping or resharpening of the blade is necessary. It is also apparent that more cutting material exists in the fingers than in the webs therebetween. Therefore, the webs will wear away more quickly than the fingers, thus preserving the profiles of

the cutting portions of the blades all during the useful life thereof.

It is also to be noted that the steps in the blades are displaced relative to each other. As shown in Fig. 5, the stepped point **35** is nearer the center of the bit body than is the stepped point **36**, whereas the stepped point **37** is intermediate the two. The blades, of course, extend radially from the bit body the same amount, the one difference being that each cutting edge point is displaced along the cutting edge relative to the same cutting edge point in the next adjacent blade. The cutting edge points will therefore not follow in the path cut by the previous cutting edge point but rather, each cuts its own path, thereby increasing the efficiency of the bit as it rotates.

Since it is desired to maintain the profile of the bore bottom, and since the outer fingers will travel a greater distance than more inwardly placed fingers, a greater number of tracking as distinguished from non-tracking fingers are provided outwardly of the rotational axis of the bit. As is clearly shown in Figure 5, where three cutting blades are illustrated, there is a tracking finger on each blade for the outermost groove. Similarly, there is a tracking finger on each blade for the next innermost groove. However, further toward the center of the bit, the fingers of the respective blades are non-tracking. If all of the fingers are non-tracking, the outer ones travelling at greater distances would wear down more rapidly, thus changing the profile of the bore bottom. It will be understood, of course, that my invention is not broadly limited to this particular arrangement of tracking and non-tracking fingers.

It seems obvious that blades of different size may be used depending on the type hole to be drilled without varying the inventive concept of the invention.

Broadly the invention claimed in this application contemplates a bit having stepped cutting claws or fingers.

The foregoing description is given for purposes of illustration only and the scope of the invention is to be determined by the appended claim.

What is claimed is:

A drag type rotary drilling bit comprising a body, a plurality of blades on the body, each blade having a cutting portion having a planar front or cutting surface, each cutting portion having cutting fingers extending downwardly therefrom, the cutting surface of the fingers being substantially in a continuation of said planar surface, the lower extremities of the respective fingers on each blade being stepped upwardly and outwardly of the bit center, the rear of each blade being characterized by ridges extending upwardly from the fingers, the cutting portion of each blade including web portions extending between the fingers thereof, the web portion between each pair of fingers beginning substantially at the radially outer side thereof at the lowermost extremity of the radially outermost finger of the pair for providing support to the cutting fingers, said webs having lesser cutting ability than the fingers.

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