

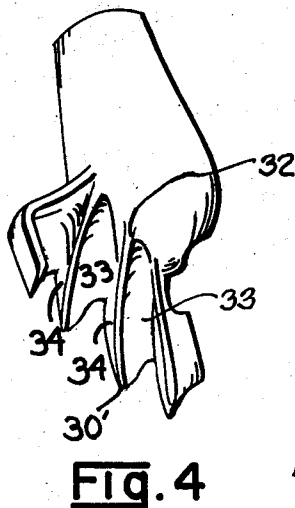
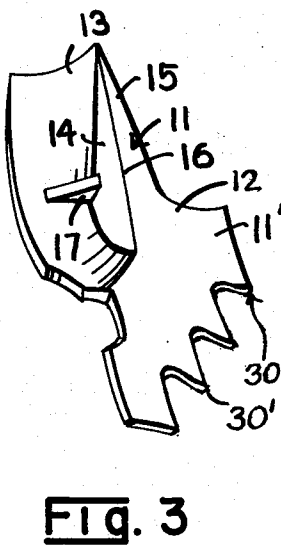
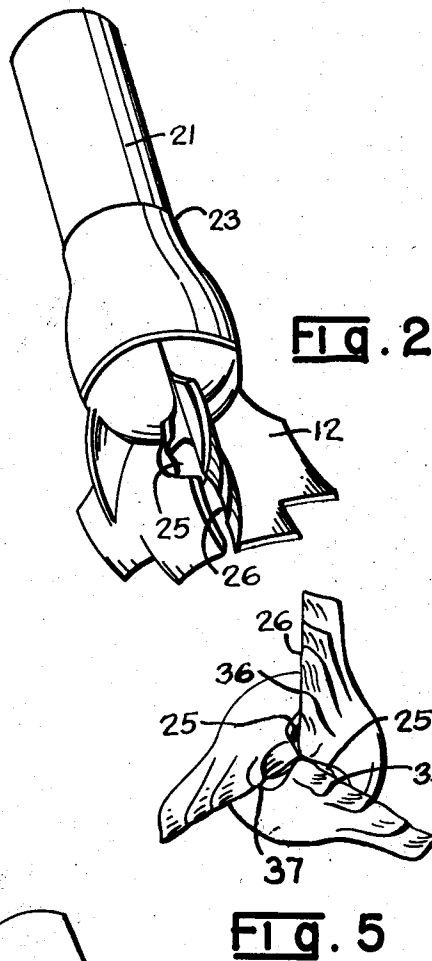
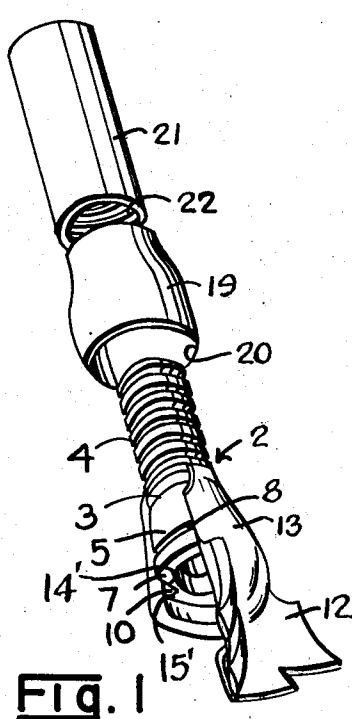
Jan. 19, 1954

H. J. HAWTHORNE  
DETACHABLE BLADE BIT

2,666,622

Filed Dec. 29, 1947

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 6.

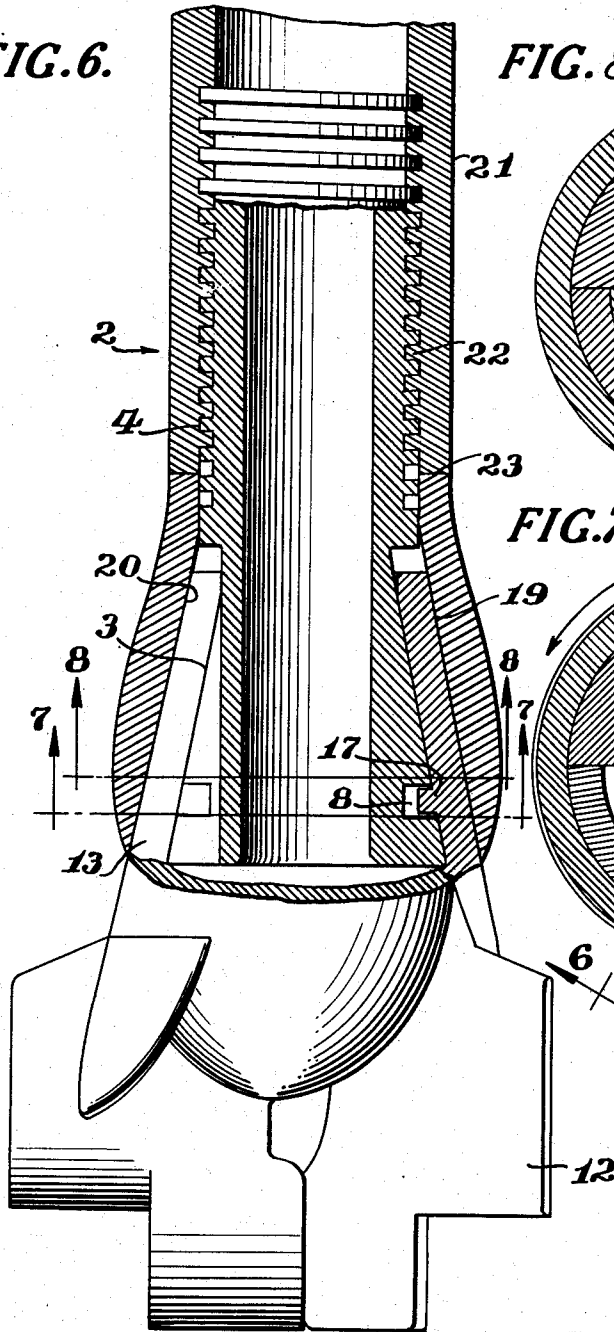


FIG. 8.

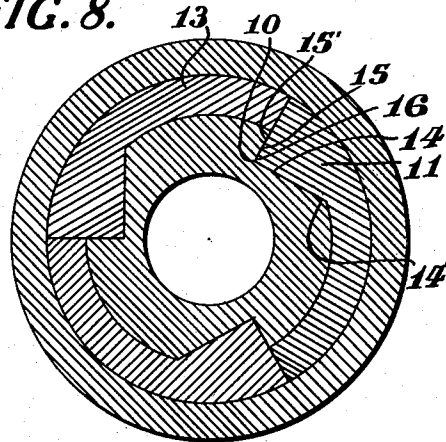
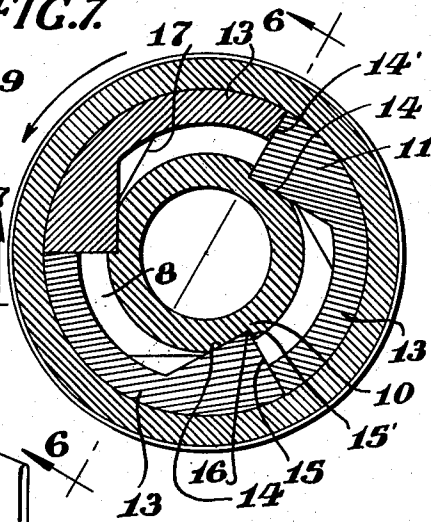


FIG. 7.



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# UNITED STATES PATENT OFFICE

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## DETACHABLE BLADE BIT

Herbert J. Hawthorne, Houston, Tex.

Application December 29, 1947, Serial No. 794,239

9 Claims. (Cl. 255-61)

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The invention relates to a detachable blade bit and is an improvement over my prior co-pending application, Serial No. 612,416 filed August 24, 1945, now Patent 2,615,684.

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

Heretofore, a great deal of difficulty has been encountered in attempting to keep the blades of detachable blade bits firmly secured in position. The difficulty has been due to the fact that a weight is usually placed immediately above the drill bit so that the bit will be forced downwardly against the formation as it is rotated and severe loosening forces are thus imposed.

If the blades are not firmly secured in position, continued rotation of the bit will loosen them and will lessen the efficiency of the drill bit since the weight applied to the bit during rotation will not be transmitted directly through the bit body to the blades and to the formation. Furthermore, due to any looseness between the blade and the body, the wear of both the body and the blade is greatly increased and it has been found that blades will tend to break off in the well unless they are firmly attached to the body and there is little or no relative movement between the two. Any breakage is disadvantageous in view of the fact that the broken blade or blades must be "fished" out of the hole before drilling operations are continued. This is expensive and time consuming.

Accordingly, an object of the present invention is to provide a drag bit having detachable blades which can be readily mounted and dismounted upon the bit body.

Another object of the invention is to provide a drag bit having a body with a tapered portion thereon and detachable blades having shanks fitting about the body in side by side relation, there being a downwardly extending cutting portion on the blades, each such portion having a cutting or drag edge.

Another object of the invention is to provide a drag bit which has a body with a tapered body portion thereon and detachable blades held in position about the periphery of the body by a retainer collar.

A further object of the invention is to provide a drag bit having blades mounted thereon so that any radial movement between the blades

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and the body or any angular movement between the blades and the body is eliminated.

A still further object of the invention is to provide a bit blade which is relatively light and can be easily manufactured. The invention also comprehends a blade of a claw-like construction which is so constructed to dig into the formation 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 perspective view of a form of the bit constructed in accordance with the invention and showing one of the blades removed to better illustrate the construction of the bit;

Fig. 2 is a perspective elevational view showing the bit assembled;

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

Fig. 4 is a rear perspective 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.

Fig. 6 is a lengthwise sectional view of the bit of Fig. 1.

Fig. 7 is a sectional view taken along the line 7-7 of Fig. 6.

Fig. 8 is a sectional view taken along line 8-8 of Fig. 6.

The present application relates generally to the subject matter of my co-pending application Serial Number 612,416, filed August 24, 1945, now Patent 2,615,684, the subject matter of which is incorporated herewith and made a part hereof.

In Figures 1, 2 and 5-8 the bit is shown to comprise a body 3 with a threaded shank 4 and a tapered portion 5 thereon. Spaced from the end 7 of the body portion 5 is an annular groove 8 on the outer periphery of the body 3. A plurality of longitudinal notches 10 are cut in the end 7 and extend up the body 3 to receive shanks 11 of blades 12 to support these blades on the body, as will be more fully described hereinbelow. While there may be any number of the notches 10 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; if 4 blades are used, a body 3 is

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used which has 4 notches which are 90° apart. The blades will thereby be disposed about the body an equal distance apart.

The blades 12 each comprise the curved shanks 13 which are arranged to fit the curved body portion 5 of the bit body 3. The shanks are of arcuately tapering plate-like form, and each one substantially is a segment of a hollow truncated cone. A longitudinal ridge 11 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 section 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 lug 17 which is of a size to fit into the groove 8. It therefore seems obvious that when the ridge 11 of the blade 12 is placed in the notch 10 and the lug 17 inserted into the groove 8 the blade will be firmly positioned on the bit body, whereby the assembly of the bit is readily facilitated.

In order to retain the blades in position on the body, a clamping collar 19 is provided which has an internal taper 20 of a size to fit over the outer surfaces of the shanks 13 of the blades 12. In order to prevent slipping of the collar 19, a 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 collar 19 to clamp the blades 12 in position on the body.

Since the blades are positioned with the edge 16 in the notches 10 and the lug 17 in the groove 8 and are held thereon by the retainer collar 19, it is impossible for the shank to move relative to the bit body 3. The body and blade for all practical purposes are retained as an integral unit by the collar 19. No vertical movement can occur between the blade 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 vicing effect is produced between the body 3 and the collar 19 to retain the blades firmly in position during operation of the bit.

The collar 19 centers itself on the blades as it is forced downwardly by the nipple or drill collar 21. A continuous torque or tightening effect is exerted on the nipple 21 during drilling operations which is transmitted to the collar 19 so that if the blades should tend to become loose on the body, they will be retightened. As the nipple 21 is threaded onto the threaded shank 4, the body 3 with the blades thereon is urged upwardly relative to the collar 19 while the collar 19 is forced downwardly by the nipple 21. Thus the collar and body with the blades thereon are continually urged to a telescoping position whereby the blades stay locked on the body, and no vibration between the body and the blades and the collar can occur.

Usually in the drilling of wells by the rotary method, a fluid is pumped downwardly through the drill string and discharged adjacent the bit. In order to accommodate the discharge of this drilling fluid, each of the blades 12 are provided with flow ports 25 which are arranged to discharge the fluid immediately forward of a cutting portion 26 of the blades 12. Due to the fact

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that a constant stream is playing on the cutting surface, cut particles of formation tending to cling to the bit will be washed loose therefrom and carried to the surface of the well.

Attention is directed to the bowl formed in the bottom of the bit by the sections when the bit is assembled. This construction enhances the jetting effect of the drilling fluid as it is discharged through the ports 25.

The groove 8 in the body 3 and the lug 17 principally assist in the assembly of the bit. The groove and shoulder serve to retain the blades in position on the body as the collar is fitted downwardly thereover. The bit may be assembled without the groove and lug, if it is desired to do so.

Particular attention is directed to the blade construction of the sections shown in Figs. 3, 4, and 5 wherein the downwardly extending plate 11' terminates in the stepped cutting edges 29. The front, or cutting surface of the downwardly extending blade or plate, is substantially flat as shown in Fig. 3 whereas the rear portion is of a claw or finger 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 and permits the blade to be used over a longer period of time before retipping or re-sharpening of the blades is necessary.

It is also to be noted that the steps or fingers in the blades are displaced relative to each other. As shown in Fig. 5, the inner stepped point 35 is nearer the center of the bit body than is the inner stepped point 36 of the next section or blade, whereas the stepped point 37 of the third section is intermediate the other two. The blades, of course, extend radially from the bit body the same distance so that a circular bore is cut, the one difference being that each cutting finger point is displaced along the cutting blade relative to the corresponding cutting edge finger in the next forward or rearward blade. The cutting fingers will therefore not follow in the path cut by the previous cutting finger but rather, each cuts its own path or groove in the formation, thereby increasing the efficiency of the bit as it rotates. The bit is therefore constructed so that the blade points will not track, but rather they will form their own path, hence covering the bottom of the hole more efficiently. Additionally, it is to be pointed out that the load on the bit blades is distributed over a smaller area therefore increasing the load per unit area. This increases the cutting effort applied to each blade point which increases the cutting efficiency of the bit.

If it is desired to change blades, it is only necessary to withdraw the bit from the hole and to unscrew the drill collar 21 whereupon, the retainer collar 19 can be removed from about the blades so that they can then be removed from the body.

A bit in accordance with the present invention has been found to be quite satisfactory in use and it has been found that a construction in accordance with this invention eliminates relative movement between the blades and the bit body as the bit rotates, thereby increasing the life of the bit and effecting a greater efficiency in the bit, since the thrust on the bit is directly transmitted to the blades without lost motion.

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 contemplates a detachable blade bit which can be readily assembled or disassembled and which prevents relative movement between the detachable blades and the bit body.

What is claimed is:

1. A detachable blade rotary drilling bit comprising, a plurality of blades each having a shank having at least one tapering surface, a body having a blade shank receiving portion, the blade shanks being engaged with said shank receiving portion of the body over an extended area so that the combined shanks extend about and encompass said shank receiving portion of the body, inter-engaging means between the body and shanks to prevent relative rotation therebetween, an internally tapered clamping collar, and means for forcing the collar over the shanks to directly engage the shanks over substantially the length of the shank receiving portion of the body to maintain same in clamped relationship on the body.

2. A bit as in claim 1 wherein the inter-engaging means comprises longitudinal notches in the shank receiving portion of the body, and wherein a longitudinal ridge is positioned on the inner side of each shank, said notches and ridges being arranged to inter-fit.

3. A bit as in claim 2 wherein each blade further comprises a cutting portion, the blade cutting portion extending from the shank in the region of the longitudinal ridge, the arrangement being such that the longitudinal ridge provides a rigid support for the cutting portion of the blade.

4. A bit as in claim 2 wherein the longitudinal notches are defined by a radially extending edge in the direction of bit rotation and a receding inclined edge in the opposite direction, the arrangement being such that the ridge of the shank will tend to ride outwardly on said inclined edge under the forces of drilling to further tighten the blade shanks on the body.

5. A bit as in claim 3 wherein the longitudinal notches are defined by a radially extending edge in the direction of bit rotation and a receding inclined edge in the opposite direction, the arrangement being such that the ridge of the shank will tend to ride outwardly on said inclined edge under the forces of drilling to further tighten the blade shanks on the body.

6. A bit as in claim 1 and further including an annular groove in said blade shank receiving portion of the body and inter-engaging lugs on said shanks for use in initially positioning the shanks on the body.

7. A bit as in claim 1 wherein the inner surfaces of the shanks and the shank receiving portion of the body are conformably tapered.

8. A bit as in claim 1 wherein the blade shanks are arcuate in cross-section and the body section engaged therewith is circular in cross-section.

9. A blade for a detachable blade rotary drilling bit, said blade comprising an upper shank portion and a lower cutting portion, said shank portion comprising a hollow segmental body portion having broad inner and outer surfaces substantially concentric in cross-section, at least one of said surfaces being tapered throughout the length of said shank, the inner surface of said shank portion having a longitudinal ridge and a projecting lug thereon, said cutting portion being connected with and depending from the lower extremity of said shank portion leaving the outer surface of said shank portion unobstructed throughout its length for clamping to the bit, the arrangement being such that the shank portion may be clamped with other such shanks between a bit body and a surrounding clamping collar extending substantially the length of said tapered surface.

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