

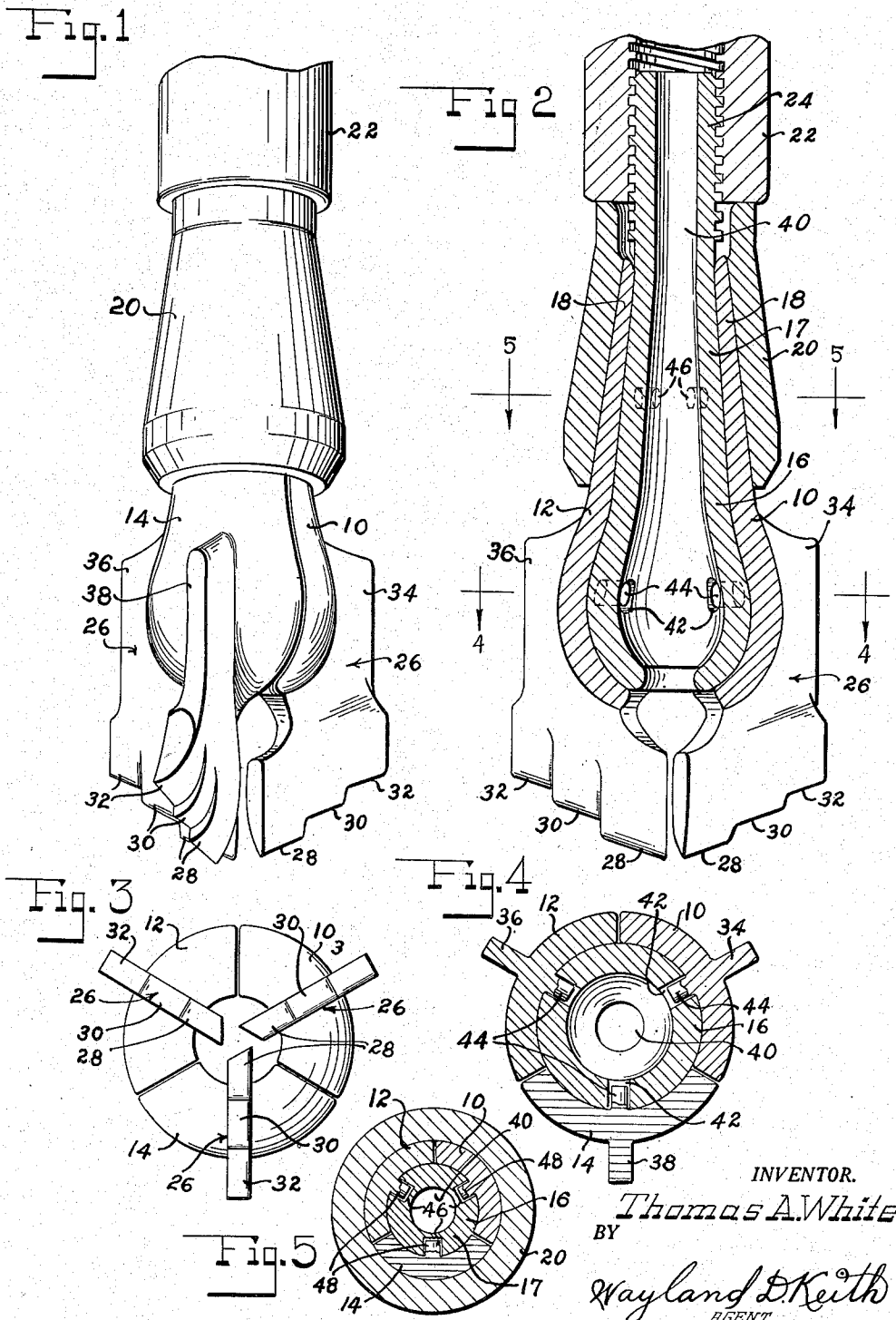
Oct. 20, 1953

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2,656,153

ROTARY DRILLING BIT

Filed Sept. 12, 1949



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2,656,153

ROTARY DRILLING BIT

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Application September 12, 1949, Serial No. 115,255

2 Claims. (Cl. 255—61)

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This invention relates to rotary drilling bits, and more particularly to a multi-blade bit structure having improved characteristics of strength and rapidity of cutting action.

The invention has for its chief object the provision of a multi-blade drilling bit wherein the parts of the bit are constructed and adapted for ease of assembly, and which can be readily disassembled for purposes of repair or replacement.

Another object of the invention is to provide a multi-blade rotary bit structure in which the cutter members are arranged in enclosing relation about the bowl of the bit and positioned thereon by means of lugs on the cutter members extending into recesses in the bowl, the cutter members being secured in place by a tapered collar fitting over the assembled parts and retained in position by a drill collar.

A further object of the invention is the provision of a multi-blade drilling bit which is capable of use in a wide variety of formations, and which will produce a clean, full-gauge bore hole when employed with formations varying greatly in hardness and consistency.

A still further object of the invention is to provide a multi-blade drilling bit structure of simple design and rugged construction, capable of withstanding the extreme conditions of wear and rough use to which such mechanism is likely to be subjected.

The invention will best be understood from the following description, constituting a specification of the same, when taken in conjunction with the annexed drawings wherein—

Fig. 1 is a perspective view of the multi-blade bit structure in assembled condition;

Fig. 2 is a vertical cross-sectional view of the structure shown in Fig. 1, revealing the construction and arrangement of the various parts;

Fig. 3 is a bottom view of the invention as shown in Fig. 1;

Fig. 4 is a cross-sectional view of the invention taken along the line 4—4 of Fig. 2 looking in the direction indicated by the arrows; and

Fig. 5 is cross-sectional view of the invention taken along the line 5—5 of Fig. 2, looking in the direction indicated by the arrows.

Referring to the drawings in greater detail the bit comprises a plurality of cutter members 10, 12 and 14, adapted to be assembled about the bowl 16 of the bit, in enclosing relation to the same. The cutter members extend upwardly about the bowl 16, and are tapered upwardly as best seen in Fig. 2, to receive the tapered collar 20, which surrounds the assembled cutter mem-

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bers and retains the same in closely assembled relation about the bowl. The tapered collar 20 is held against axial displacement with relation to the bowl and the cutter members by the drill collar 22, which is threaded upon the upper, externally-threaded end 24 of the drill bowl.

Each of the cutter members 10, 12, and 14 comprises a shell-like portion conforming in contour to the shape of the bowl 16, and having at its lower end a cutter 26. The cutter 26 is formed with teeth 28, 30 and 32, the innermost tooth 28 being the lowermost, and the teeth 30 and 32 being progressively higher outwardly from the center of the bit.

The teeth are formed on wing-like projections 34, 36, and 38, respectively, extending outwardly from the cutter members 10, 12, and 14, and the edges of the teeth may be formed of hardened material, or coated with a suitable hard alloy, or similar material, to prolong the life of the cutting edges, and make them more effective in use.

As will be seen in Figs. 1, 2 and 3 of the drawings, the innermost teeth of the cutters are slightly spaced from the axis of the bit, which enables the cutters to operate without interference with each other, and form a very small core from the material being drilled during the drilling operation. The center core, however, is of very small diameter and does not interfere with the flow of drilling mud, or other fluid used, to the cutter or the removal of the detritus from the working area.

The bowl 16 of the bit is somewhat enlarged at the lower portion, and tapers upwardly in a shank 17 to terminate in the threaded portion 24 upon which the drill collar 22 is positioned. A passage 40 extends vertically through the bowl 16, which passage communicates with the hollow drill stem, in order to introduce the drilling mud to the cutting zone, and remove the same therefrom.

Near the lower end of the bowl 16 holes 42, at circumferentially spaced intervals extend radially through the bowl, for the reception of lugs 44, formed on the inner surfaces of the cutter members. At points above the enlarged lower end portion of the bowl 16, circumferentially radial recesses 46 are provided, into which lugs 48 on the inner surfaces of the cutter members project. When assembled about the bowl of the bit the cutter members 10, 12, and 14 substantially completely enclose the bowl, and are immovably secured to the same by the lugs 44 and 48 extending into holes 42 and recesses 46, respectively, so that when the tapered collar 20 has

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been positioned over the upper portions of the cutter members the parts are rigidly secured together and the bit is in condition to withstand the twisting and shearing forces to which it is subjected during the drilling operation. Moreover, the longitudinal edges of the cutter members readily come into intimate contact under the twisting force required to rotate the drill, and serve to give added strength to the structure to withstand the force applied to the bit during the drilling operation.

It will be noted that the teeth 32 of the cutters extend laterally somewhat beyond the wing-like portions 34, 36 and 38 of the cutter members thus assuring that the body of the bit will clear the wall of the bore, and also tending to produce a clean, full-gauge hole. The vertical edges of the outermost teeth 32, as well as the vertical edges of the wing-like portions 34, 36 and 38, may, of course, be provided with hardened surfaces, or coated with a suitable hard metal alloy if desirable.

As best seen in Fig. 4, the lug 44 is disposed opposite the wing-like portions 34, 36 and 38, so that the greatest thickness of the cutter members is in the region where the lugs are located, thus serving to substantially reinforce the parts where the maximum strength is needed. The parts of the rotary drilling bit are preferably of steel and may be conveniently made in the form of castings.

In assembling the bit structure described above, the cutter members are positioned about the bowl 16, with the lugs 44 and 48 extending into the holes 42 and recesses 46, respectively, and the tapered collar 20 is positioned over the upper end portion 18 of the cutter members, to retain the same in assembled position about the bowl. The drill collar 22 is then screwed onto the upper threaded end portion 24 of the bowl, into engagement with the upper end of the tapered collar, to force the same into close contact with the cutter members, thus locking the same securely in position. The bit may then be connected to a drill stem of conventional structure by means of the drill collar 22 or otherwise.

Upon rotation of the bit the cutting edges of the teeth 28 are the first to engage the material which is being drilled, and the outwardly and upwardly stepped teeth 30 and 32 are subsequently brought into operation. Moreover, the bit thus cuts the material over relatively small areas at slightly different levels, and is thereby effective for rapid drilling through various types of materials with a minimum expenditure of power and strain on the drill structure. The very small core produced by the spacing of the inner extremities of the cutters forms no substantial obstruction, and readily crumbles or breaks away as the drilling progresses.

It will thus be seen that the invention provides a rotary drill bit of simple design and rugged construction, having no complicated parts likely to be expensive in manufacture, and which may be assembled or disassembled with a maximum of facility.

Having thus clearly shown and described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. A rotary drill bit comprising a bit support member having a downwardly and outwardly tapered portion annular in cross section, a plu-

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ality of cutter body members surrounding said bit support member, each of said cutter body members having an arcuate inner face and an outside surface which extends downwardly and outwardly over said tapered portion of the bit support member, a cutter blade integral with each of said body members and projecting downwardly therefrom, pins, and holes receiving said pins, on and in said cutter body members and bit support member, for interlocking said cutter body members and bit support member against the tendency of said cutter blades to retrogress in a rotational sense on said bit support member or move axially of said bit support member under the rotary and axial forces of drilling, sleeve means having a tapered inside extending downwardly and outwardly over the outsides of said cutter body members for restraining said cutter body members to said bit support member against escape from the interlocked positions, and means connected to said bit support member for longitudinally thrusting said sleeve to the restraining position.

2. A rotary drill bit comprising a bit support member having a downwardly and outwardly tapered portion annular in cross section, a plurality of cutter body members surrounding said bit support member, each of said cutter body members having an arcuate inner face and an outside surface which extends downwardly and outwardly over said tapered portion of the bit support member, a cutter blade integral with each of said body members and projecting downwardly therefrom, longitudinally spaced pins, and longitudinally spaced holes receiving said pins, along each of said cutter body members and said bit support member for positively aligning said cutter body members and bit support member with respect to each other and interlocking the same against the tendency of said cutter blades to retrogress in a rotational sense on said bit support member or move axially of said bit support member under the rotary and axial forces of drilling, sleeve means having a tapered inside extending downwardly and outwardly over the outsides of said cutter body members for restraining said cutter body members to said bit support member against escape from the interlocked positions, and means connected to said bit support member for longitudinally thrusting said sleeve to the restraining position.

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