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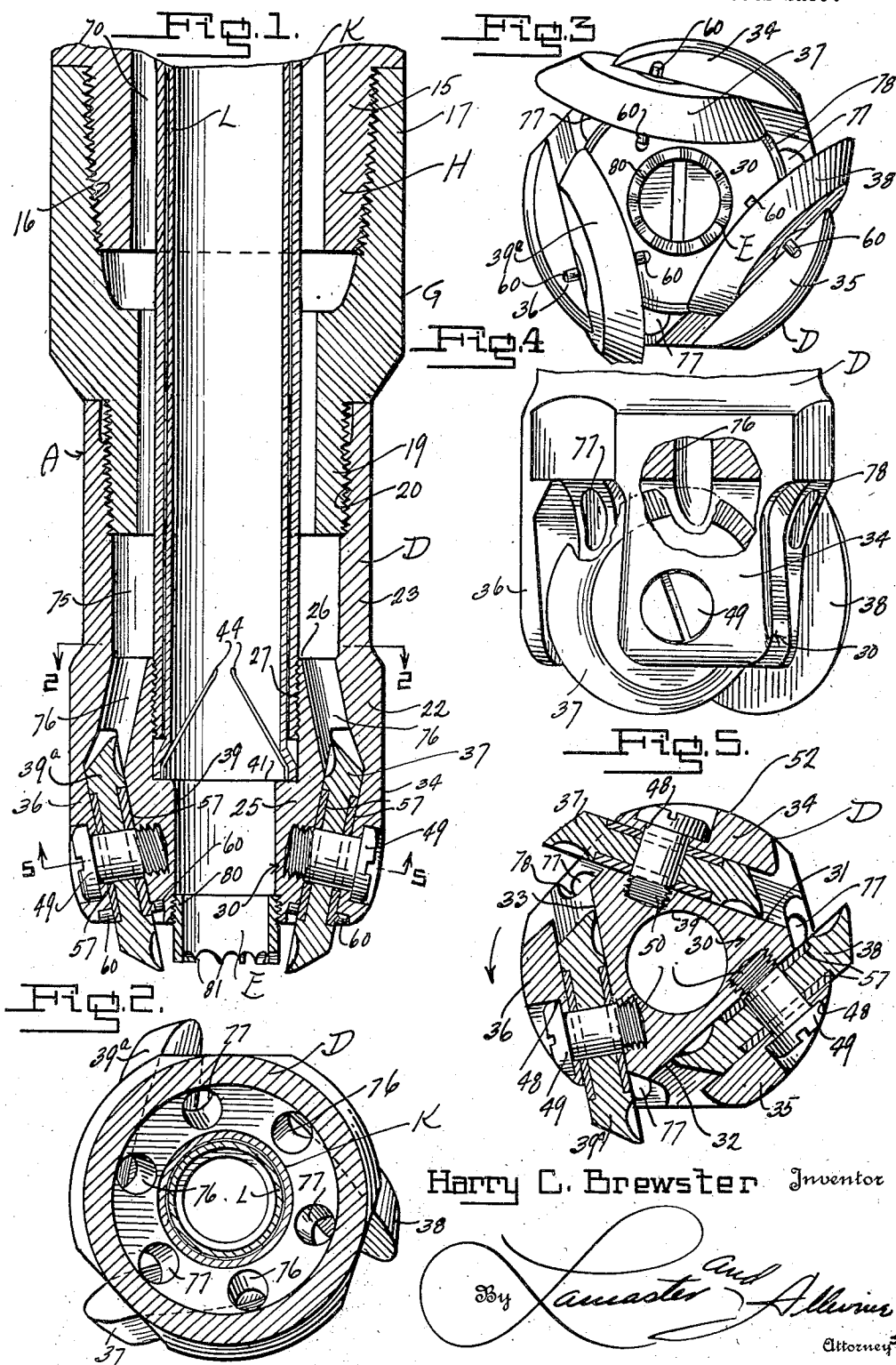
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DRILLING APPARATUS

Filed Jan. 30, 1928

2 Sheets-Sheet 1



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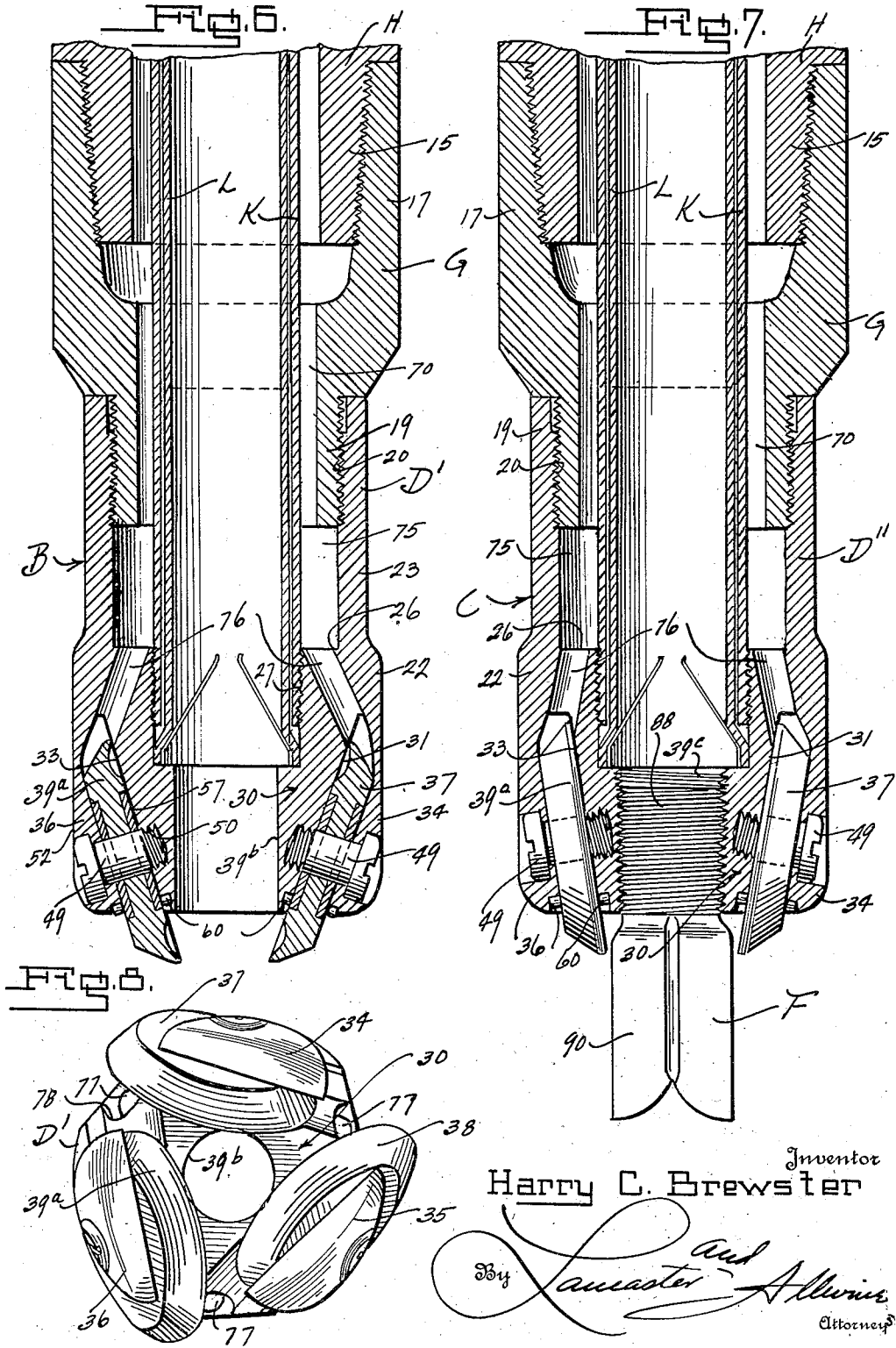
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UNITED STATES PATENT OFFICE

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DRILLING APPARATUS

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This invention relates to improvements in well drilling apparatus.

The primary object of this invention is the provision of an improved drill head for core barrel drills, by means of which hard or semi-hard formations may be rapidly drilled through to receive a complete core.

A further object of this invention is the provision of an improved well drilling bit embodying a core receiving barrel and an improved cutter arrangement cooperating therewith to efficiently and quickly cut an annular opening of increasing width about a core column which is received in the core passageway in an efficient and complete relation.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Figure 1 is a vertical sectional view taken through the improved and preferred type of core taking drilling bit.

Figure 2 is a cross sectional view taken substantially on the line 2—2 of Figure 1, showing means for distributing water on the drilling bit.

Figure 3 is a bottom plan view of the preferred form of drilling bit illustrated in Figure 1.

Figure 4 is a fragmentary side elevation of details at the lower end of the drilling bit illustrated in Figure 1.

Figure 5 is a cross sectional view taken substantially on the line 5—5 of Figure 1.

Figure 6 is a vertical sectional view taken through a modified form of drilling bit, including all of the structure of the preferred form of drilling bit, with the exception of a cutting collar surrounding the core receiving passageway at the bottom of the core taking head.

Figure 7 is a vertical sectional view taken through a further modified form of core taking drilling head, showing means to apply a fish tail or other type of bit in the core

taking passageway, when a core is not to be taken.

Figure 8 is a bottom plan view of the form of invention as embodied in Figure 6.

In the drawings, wherein for the purpose of illustration are shown preferred and modified forms of the invention, the letters A, B and C may generally designate the invention as embodied in Figures 1, 6 and 7 respectively. Respectively these forms of the invention include drill heads D, D', and D'', which are substantially of the same formation, except as modified to take a core shaving sleeve cutter E in the form A, and the fish tail or other type of bit F for the form of invention C, when a core is not to be taken by the drilling bit of the form C.

The drill heads D, D', and D'' are each adapted to be detachably screw threaded onto an adapter or coupling G, which in turn is detachably secured to the lower end of a conventional rotary drill pipe H. A retainer tube K is detachably carried by the head D, D', or D'', and which receives therein the core sleeve or barrel element L, of preferably the type manufactured by Oil City Iron Works, of Shreveport, Louisiana.

The drill pipe H is of usual construction, being formed of a plurality of sections, and at the lower end thereof having a screw threaded shank 15 for detachable threading in the screw threaded socket in the upper end 17 of the adapter or coupling G. The adapter or coupling G is provided with a reduced screw threaded shank 19 detachably threaded into the socket 20 at the top of the drill head D, D', or D''.

Referring further to the construction of the drill heads D, D', and D'', each of the same includes a body portion 22 intermediate the ends thereof, which is relatively thick, and the upper portion 23 of the drill head is provided with thin walls; the portions 23 and 22 at the juncture thereof having an internal shoulder 26. In the upper part of the body portion 22 immediately below the shoulder 26 is a screw threaded socket 27 adapted to receive the threaded lower end of the retainer tube K. In the body portion 22 the drill head D is of novel formation,

including the central substantially triangular shaped shank portion 30, having flat sides 31, 32 and 33, shown in Figure 5. Spaced ears or lugs 34, 35 and 36 face the sides 31, 32 and 33 respectively, to provide downwardly opening slots wherein rotatable disc bits 37, 38 and 39^a are respectively received. The triangular shank portion 30 below the socket 27 is provided with a reduced passageway 39, see form A, wherein the core is initially received. This core passageway 39 opens at the extreme lower end of the triangular shank 30.

The core sleeve L is adapted to seat on the shoulder 41 immediately above the core passageway 39, in a non-obstructing relation with the passageway 39, below the screw threaded engagement of the retainer tube K, and the said core sleeve may be provided with ordinary flexible retaining springs or arms 44 to hold the core in place.

The disc receiving slots of the drill head relatively converge downwardly to the bottom of the said drill head, and rotatably receive the disc cutters 37, 38 and 39^a therein. The lugs 34, 35 and 36 are provided with counter-bored openings 48 for receiving detachable bearing bolts 49 which screw thread at 50 into the triangular extension 30 of the drill head; said bolts 49 having the heads countersunk inwardly of the outer peripheral surfacing 52 of the drill head, with the shanks thereof transversely intersecting the respective slots at right angles thereto, and presenting therein smooth bearing portions on which the disc cutters respectively rotate. The bearing bolts or members 49 are disposed non-radial to the axis of the drill head and core taking passageway therethrough, and said bearing bolts or members 49 relatively slope upwardly from their outer ends towards their inner ends, so that the disc cutters when rotatably mounted thereon are supported for rotation on axes which are non-radial to the drill head and are inclined at an angle to a plane normal to the axis of the drill head, whereby the disc cutters relatively converge downwardly towards the formation engaging end of the drill head. As thus mounted each of the disc cutters at one side projects beyond the adjacent periphery of the drill head, and at the diametrically opposed side is disposed entirely in the slot of the drill head within which positioned, as can readily be understood from Figure 5 of the drawings. Also, the disc cutters extend below the lower surface of the drill head for ground engagement.

As a further aid in mounting the disc cutter, and preserving the same, wear receiving washers 57 are disposed at opposite sides of each disc cutter, in recesses countersunk in said disc cutter, and adapted to engage the opposite sides of the slot within which the disc cutter is positioned, the said wear re-

ceiving washers 57 being apertured to receive the bearing bolt 49 therethrough, and having lugs 60 detachably extending into shallow recesses in the drill head, to prevent their rotation, and permit the rotation of the respective disc cutters.

The core sleeve and retainer tube are so mounted in the drill head that water passageways 70 surround the same in the drill pipe and adapter, and water enters the annular compartment 75 in the drill head, below the adapter, and above the shoulder 26. Downwardly divergent water passageways 76 are provided, extending from the shoulder 26 to the top of the slots in which the disc cutters are mounted, for conveying water directly to the top of the disc cutters. Other passageways 77, alternating with the passageways 76, are provided, downwardly convergent and similarly opening on the shoulder 26, but which open on shoulders 78 recessed inwardly of the triangular shank 30 of the drill bit, at locations where the flat sides of said triangular portions 30 meet, to convey water to the leading edges of the disc cutters which extend beyond the peripheral edges of the drill head for biting into the formation, as is well shown in Figure 5 of the drawings. Each disc cutter is therefore provided with two water passageways, one of which outlets directly on top of the cutter, and the other of which outlets forwardly of and at the formation engaging side of the disc cutter.

In the usual construction, exemplified in the form B of the invention, as shown in Figure 6, it is preferred that the lowermost cutting edges of the downwardly converging disc cutters overlap in the core receiving passageway 39^b of the form of drill head D', as extended. This cuts the core to form for easy reception in the passageway 39^b. In this form of invention it is not intended to use any other cutting or core obstructing expedients.

In the form of invention A, the core cutting collar E is screw threaded at 80 in the lower screw threaded end of the core receiving passageway 39, the cutting collar E having a series of cutting teeth 81 around the lower edge thereof, which shape the core to be received in the passageway 39, as can readily be understood. Under these circumstances the slope of the cutting discs need not be so acute as to overlap with the core receiving passageway 39, inasmuch as the core shaping is taken care of by the cutting collar E.

Under some circumstances it may be desirable to use the core receiving drill head, as a drill, without core cutting. To this end the fish tail bit is provided, which has a screw threaded shank 88, detachably screw threaded into the core receiving passageway 39^c, which is screw threaded to receive the shank

88. The fish tail bit F has cutting blades 90 extending downwardly therefrom, for cutting the formation which would ordinarily be the core, between the cutting discs, which are also positioned to cut the formation in a facile and expeditious relation. Under these circumstances no part of the core is received in the core receiving tube or sleeve of the drill head.

10 I understand that disc cutters have heretofore been used for core cutting. However, there is no core taking drill head of the disc cutter type in which the disc cutters are tapered in or downwardly convergent and
15 mounted on axes inclined to a plane normal to the axes of the drill head, and with the axis of rotation of each disc cutter non-radial to the drill head. While such type of disc cutter drills have been used, they have never been used in connection with core taking, and I am the first to provide a core taking drill head of compact and efficient formation, which will meet practical conditions and operate quickly for the taking of a complete core in hard or semi-hard formation, all of which is accomplished with the specific mounting, and relation of the disc cutters in combination with a device which may take an adequate sample of the formation. Furthermore it is obvious that the disc cutters have been so mounted in the improved drill head that they are protected from bore cutting except at the leading edges thereof, and the formation wash is efficiently directed onto the disc cutters.

Various changes in the shape, size, and arrangement of parts may be made to the forms of invention herein shown and described, without departing from the spirit of the invention or the scope of the claim.

I claim:

In a drill bit the combination of a drill head having a core receiving passageway there-through rotary disc cutters carried by the
45 head with the axes of the cutters disposed non-radial to the axis of the drill head and with the axes of the cutters inclined to a plane normal to the axis of the head so that the cutters converge downwardly and project at their lower ends beyond the lower end of the drill head into core cutting formation, and a detachable ring-shaped core cutter projecting below and mounted upon the drill head between the lower cutting portions of the cutters and providing a passageway through
50 which the core cut thereby may enter the passageway of the drill head, the lower cutting edge of the core cutter being disposed in a plane above the plane in which the lowermost cutting edges of the disc cutters lie.

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