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W. F. COMSTOCK

2,553,701

WELL DRILLING BIT

Filed Sept. 16, 1949

2 Sheets-Sheet 1

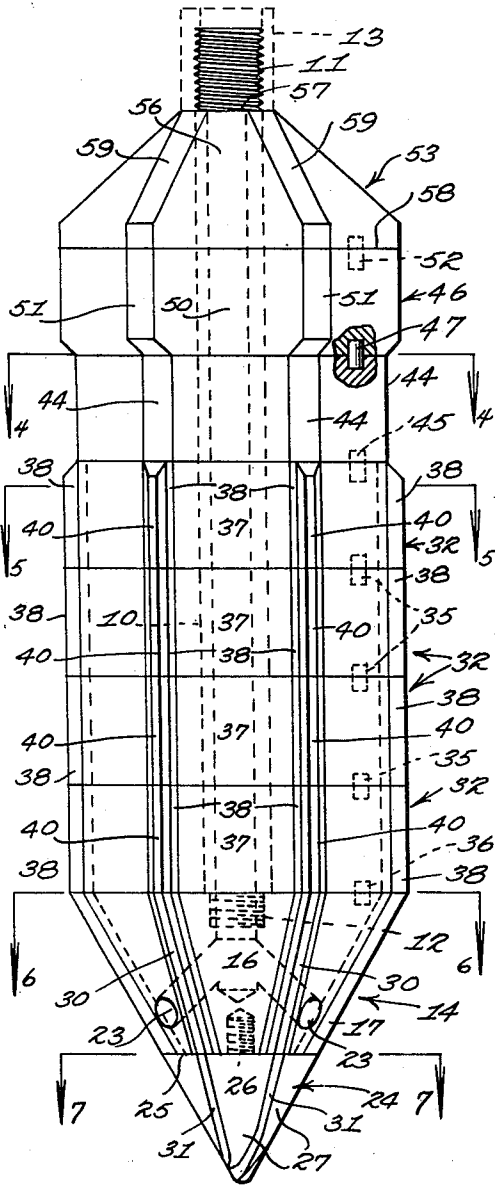


FIG. 1.

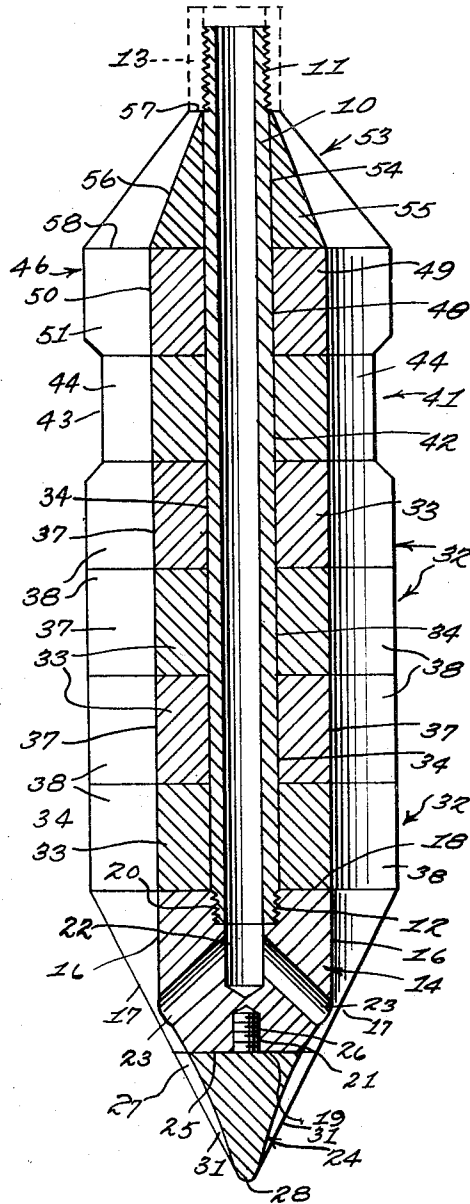


FIG. 2.

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FIG. 3.

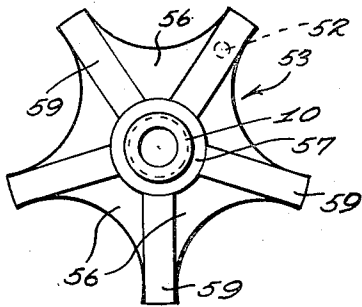


FIG. 5.

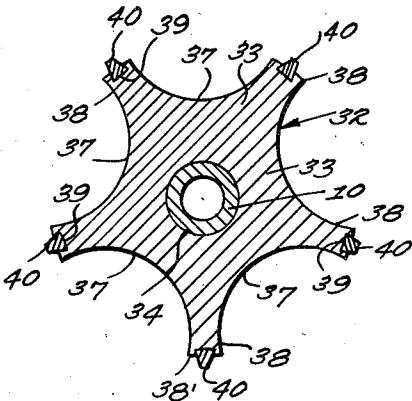


FIG. 4.

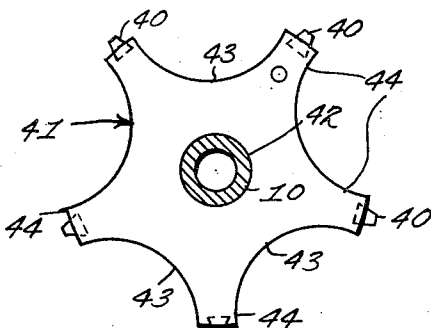


FIG. 6.

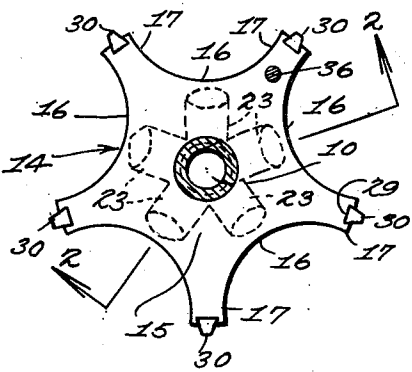
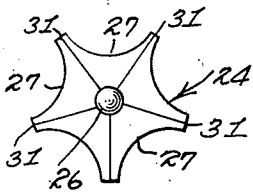


FIG. 7.



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WELL DRILLING BIT

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3 Claims. (Cl. 255-61)

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My invention relates to a drilling bit for oil wells, and the like.

A primary object of my invention is to provide a well drilling bit which will drill rapidly through the various formations generally encountered in the earth's crust, without excessive wear.

A further object is to provide a bit having means to introduce a constant stream of water under pressure to the bottom of the hole during the drilling, so that the drill cuttings or sand pumpings will be flushed upwardly to the top of the hole.

A further object is to provide a bit comprising a plurality of separate sections, any number of which may be employed for forming a bit having the desired length.

A further object is to provide a removable and replaceable cap or nose for a well drilling bit, said nose being either of the moulded "Carborundum" type, or the diamond tipped and studded type.

A further object is to provide a bit having a novel arrangement for maintaining a plurality of "Carborundum" cutters in place.

A still further object is to provide an oil well drilling bit which is highly simplified, compact, extremely strong and durable, and relatively inexpensive to make.

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

In the accompanying drawings, forming a part of this application, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevation of a well drilling bit embodying my invention, part in section,

Figure 2 is a central vertical longitudinal section through the same,

Figure 3 is a plan view of the bit,

Figure 4 is a horizontal transverse section taken on line 4-4 of Figure 1,

Figure 5 is a similar section taken on line 5-5 of Figure 1,

Figure 6 is a similar section taken on line 6-6 of Figure 1, and,

Figure 7 is a similar section taken on line 7-7 of Figure 1.

In the drawings, where for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 10 designates an elongated straight cylindrical tubular spindle, arranged vertically, and having its top and bottom ends externally screw threaded as shown at 11 and 12. The top screw threaded end 11 is adapted to be screwed into the bottom of a lowermost section

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of well tubing 13, additional sections of which are arranged above the section 13 and driven into the ground as the drilling proceeds, as is well known.

The bottom screw threaded end 12 has mounted upon it a lower nose carrying section or head 14, having a solid central body portion 15, provided in its vertical side with a plurality of large vertical recesses or water courses 16, which are arcuate in horizontal cross section, and which form a plurality of circumferentially equidistantly spaced vertical ribs 17. The ribs 17 of the head 14 converge downwardly as shown so that the periphery of the head 14, as defined by the ribs 17 is conically tapered downwardly. The head 14 includes flat horizontal top and bottom ends 18 and 19, and is provided in its top end with a central vertical screw threaded opening 20, receiving the bottom screw threaded end 12 of the spindle therein. In its bottom 19, the head 14 has a central screw threaded opening 21, for a purpose to be described. In the bottom of the screw threaded opening 20, the head 14 has a central vertical recess or bore 22, the bottom of which terminates above the top end of the screw threaded opening 21, and the central main body portion 15 is provided in its side and above the bottom end 19 with a plurality of circumferentially spaced passages or ports 23, which are radially arranged and which converge upwardly for communication with the central bore 22. The bottom or discharge ends of the ports 23 terminate between and slightly inwardly of the peripheral edges of the ribs 17, Figure 2.

Secured to the bottom of the head 14 is a pointed drill cap or nose 24, which is conically tapered downwardly, and which has a flat top 25 for engagement against the bottom 19. The cap 24 carries a central upstanding screw threaded stud 26, for engagement within the screw threaded opening 21, and the cap is provided in its conical side with a plurality of longitudinal downwardly converging cutting grooves or lands 27, which extend from the bottom or point 28 of the cap to its top 25 as shown. These cutting grooves 27 are generally longitudinally straight, but may be spirally arranged, if desired. The nose or cap 24 may be formed from a suitable moulded abrasive material, such as moulded "Carborundum," and it may be provided with a diamond point or tip, and diamond studded in its side if desired.

I contemplate providing a plurality of noses or caps 24 with my bit. The diamond tipped and studded nose or cap may be employed when cut-

ting through extremely hard formations in the ground, while the moulded abrasive noses may be used to cut through softer formations.

The ribs 17 of the head 14 are provided in their outer faces with straight longitudinal dove-tailed grooves 29, extending throughout the entire lengths of the ribs and through the top and bottom of the head 14. Removably mounted within these dove-tailed grooves 29 are straight elongated cutters 30 of "Carborundum," or the like. These cutters 30 are tapered radially outwardly as shown, and project radially beyond the outer faces of the ribs 17. The ribs 17 and cutters 30 are so arranged about the head 14 that the bottoms of the ribs and cutters are spaced circumferentially between the cutting grooves 27 of the nose or cap 24, and adjacent to the conically tapered peripheral portions 31 of the nose or cap. This arrangement places the grooves 27 of the nose or cap in communication with the recesses or water courses 16 of the head 14, so that the drill cuttings or sand pumpings may be flushed upwardly through the grooves 27 and into and through water courses 16. The top 25 of the nose 24 engages the bottom ends of the cutters 30 to retain them within the dove-tailed grooves 29. The screw threads upon the stud 26 and bottom end 12 are formed so that when the drilling bit rotates during drilling, the head 14 and nose or cap 24 will be tightened.

Removably mounted upon the lower head 14 in contacting superposed relation are a plurality of intermediate body sections or segments 32, having central solid main body portions 33, provided with central vertical aligned cylindrical bores 34, receiving the tubular spindle 10 there-through, in assembly. The sections or segments 32 have a close sliding fit upon the tubular spindle, and any number of these segments may be employed, with a spindle of the proper length, to produce a drilling bit of the necessary length. While I have shown four of the segments 32, it is to be understood that I do not wish to restrict the invention to this number, and any desired number of sections may be employed, as previously stated. The adjacent contacting faces of the segments 32 are connected and held against relative rotation by means of dowel pins 35, and a similar dowel pin 36 connects the lowermost segment or section 32 with the head 14, and holds these elements against relative rotation. The segments 32 are provided in their sides with equi-distantly circumferentially spaced large vertical recessed passages or water courses 37, forming equi-distantly spaced radial ribs 38, provided in their outer vertical faces 38' with vertical longitudinal dove-tailed grooves 39, extending for the entire vertical lengths of the ribs, and removably receiving elongated straight vertical cutter sections 40, of "Carborundum," or the like. These cutter sections 40 carried by the ribs of the segments 32 engage the sides of the well bore above the tapered lower end of the bit and maintain the bore of the well at the desired diameter. The recessed passages 37 are of the same size as the tops of the recesses 16, and register with each other in assembly and with the tops of the recesses 16, to form continuous vertical channels or water courses about the side of the bit, for conducting upwardly water ladened with the sand or cuttings formed at the bottom of the hole by the bit. Likewise, the ribs 38 of the segments 32 register in assembly and register with the tops of the ribs 17. The ribs 38 are of the same width as the ribs 17, and the cutter sections 40 have

the same shapes and widths as the cutters 30 carried by the head 14. The cutter sections 40 of the adjacent segments 32 have their adjacent ends contacting, and the lowermost cutter sections 40, carried by the lowermost section or segment 32 contact the tops of the cutters 30. The cutter sections 40 are thus held against downward longitudinal movement in the grooves 39, and cannot move radially because of the dove-tailed shape of the grooves.

Above the intermediate body sections or segments 32, I provide one or more dummy sections or segments 41, having the same general shape as the sections or segments 32, and not being provided with cutter sections, like the sections 40. The dummy section 41 has a bore 42, receiving the spindle 10 and is provided with recessed passages 43 and radial ribs 44 for registration with the recessed passages 37 and ribs 38 in assembly. The outer diameter of the dummy section 41, as measured about the periphery defined by the ribs 44 is larger than the outside diameter of the sections 32, so that the lower ends of the ribs 44 of the dummy section will extend over the tops of the uppermost cutter sections 40 to hold all of the cutter sections 40 against upward movement, Figure 4. The dummy section 41 is connected with the uppermost section or segment 32 by a dowel pin 45, which prevents relative rotation between the elements. In addition to securing the cutter sections 40 in place, the dummy section 41 gives additional length to the bit, and additional dummy sections may be employed where necessary to provide a longer bit.

Above the dummy section 41, I provide one or more upper body or guide sections 46, doweled to the dummy section 41 by a lower dowel 47, and having a central bore 48, receiving spindle 10. The guide section 46 has a central solid body portion 49, provided in its side with vertical recessed passages 50 for registration with the recessed passages 43 and 37, and forming with such recesses the continuous vertical water courses about the bit for the upward passage of water and drill cuttings or sand pumpings. The guide section 46 has radial ribs 51 which project radially outwardly for the same distance as the cutter sections 40 for defining the same outside diameter which the cutter sections 40 define. These ribs 51 serve to guide the bit within the hole which has been produced by the cutters 30 and cutter sections 40.

Arranged above and upon the guide section 46 and doweled thereto by means of a dowel pin 52 is a separate body cap or top 53, having a bore 54 receiving the spindle 10, and a solid upwardly conically tapered body portion 55 provided in its side with circumferentially spaced, recessed passages 56 which extend through its top and bottom 57 and 58. The passages or recesses 56 have their bottoms in registration with the recesses 50 to form therewith and with the recesses 43 and 37 the continuous vertical channels or water courses extending from the point of the nose 23 upwardly along the bit, to the top thereof, for conducting upwardly the water ladened with sand or drill cuttings as stated. The top 53 further includes upwardly converging radial ribs 59, the bottoms of which register with and engage the tops of the ribs 51. The top 57 forms a lateral shoulder for the bottom end of the tubing section 13.

The operation of the well drilling bit is as follows:

The tubing including the bottom section 13 is

rotated by conventional machinery including a rotary table supported on the ground at the top or head of the well, and the tubular spindle 10 is rotated by the tubing and rotates the bit. The head 14 and nose 24 must and will rotate with the spindle 10. The dowel pins 36, 35, 45, 47, and 52 cause the various sections 32, 41, 46 and 53 to rotate as a unit with the spindle 10, and the various superposed sections cannot partake of relative rotation because of the dowel pins, and cannot move axially, because they are held down by the bottom of the tubing section 13, which engages the top end 57. The various separate superposed sections are thus tightly clamped together upon the head 14 for forming a continuous unitary bit.

As the bit rotates, the "Carborundum" or diamond tipped and studded nose 24 penetrates the ground and starts the cutting action. This cutting is continued by the radially projecting inclined cutters 30 of the head 14. The vertical cutter sections 40 finish the cut above the head 14 as the bit descends, and serve to produce a straight, clean, and uniform cut. If the cutters 30 wear before the cutter sections 40, and this is usually the case, the cutter sections 40 will finish the cut to the proper diameter. The ribs 51 of the guide section 46 serve to guide or pilot the top end of the bit, which is sometimes quite long, depending upon how many of the sections 32, 41, and 46 are employed.

The nose 24 is readily removable and replaceable, so that when wear occurs a new nose may be readily applied. Further, when cutting through extremely hard substances, the diamond tipped and studded nose will be employed, rather than the "Carborundum" nose, which is adequate to cut through softer substances.

All of the cutter sections 40, as well as the cutters 30 are readily removable and replaceable when worn, by removing the dummy section 41 and the sections above it, and sliding the cutter sections 40 vertically out of their respective dovetailed grooves. The cutters 30 are likewise removable longitudinally from their grooves 29, when the sections 30 are first removed from the spindle.

During the drilling, water under very high pressure is continuously forced downwardly through the tubing sections from the top of the well and through the bottom section 13 and the bore of the tubular spindle 10. This water passes out through the ports 23 and flushes about the head 14 and nose 24. Upon leaving the ports 23 the water flows into the water courses 16 of the head 14 and into the cutting grooves 27 of the nose 24. The water will flush away the sand or cuttings formed by the drilling operation, and convey the cuttings or sand pumpings upwardly through the wide water courses formed by the recesses 37, 43, 50, and 56. The water and cuttings will eventually pass to the top of the hole.

It is to be understood that the form of my invention, herewith shown and described is to be taken as a preferred example of the same, and that various changes in shape, size and arrangement of parts may be resorted to, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. A well drill bit assembly comprising an elongated tubular spindle having screw thread formations one at each end thereof, a head including a central portion having a centrally disposed recess provided at one end of said head with screw

threads receiving one end of said spindle and radially projecting ribs disposed at substantially equal angular intervals around said central portions, said ribs being inclined inwardly from said one to the other end of said head and the central portion of said head having radially disposed passages therein extending from said recess to the exterior of said central portion between adjacent ribs, a conical drill nose secured at its larger end to said head at said other end of the latter, body sections mounted on said spindle and each including a central portion provided coaxially with a spindle receiving bore and having ribs projecting radially therefrom at substantially the same angular intervals as the ribs on said head and to substantially the same extent as the ribs on said head at said one end of the latter, said head and said body sections having flat and substantially parallel end surfaces, means interconnecting said body sections and said head maintaining corresponding ribs of said head and said body sections in alignment longitudinally of the bit, said body sections together constituting a stack mounted on said spindle with one end in contact with said one end of said head, a dummy section mounted on said spindle at the other end of said stack of body sections and comprising a body of substantially the same diameter as the central portions of said body sections having a central bore receiving said spindle, a guide section mounted on said spindle at the end of said dummy section remote from said stack of body sections and including a central portion provided with a central bore receiving said spindle and ribs projecting radially from said central portion at angular intervals and substantially to the same radial extent as the ribs on said body sections, the ribs on said head and said body sections being notched at their outer ends to provide undercut grooves extending longitudinally of said bit, and elongated cutter sections of hard material seated one in each of said grooves.

2. A well drill bit assembly comprising an elongated tubular spindle having screw thread formations one at each end thereof, a head including a central portion having a centrally disposed recess provided at one end of said head with screw threads receiving one end of said spindle and radially projecting ribs disposed at substantially equal angular intervals around said central portion, said ribs being inclined inwardly from said one to the other end of said head and the central portion of said head having radially disposed passages therein extending from said recess to the exterior of said central portion between adjacent ribs, a conical drill nose secured at its larger end to said head at said other end of the latter, body sections mounted on said spindle and each including a central portion provided coaxially with a spindle receiving bore and having ribs projecting radially therefrom at substantially the same angular intervals as the ribs on said head and to substantially the same extent as the ribs on said head at said one end of the latter, said head and said body sections having flat and substantially parallel end surfaces, means interconnecting said body sections and said head maintaining corresponding ribs of said head and said body sections in alignment longitudinally of the bit, said body sections together constituting a stack mounted on said spindle with one end in contact with said one end of said head, a dummy section mounted on said spindle at the other end of said stack of body sections and comprising a body of substan-

tially the same diameter as the central portions of said body sections having a central bore receiving said spindle, a guide section mounted on said spindle at the end of said dummy section remote from said stack of body sections and including a central portion provided with a central bore receiving said spindle and ribs projecting radially from said central portion at angular intervals and substantially to the same radial extent as the ribs on said body sections, the ribs on said head and said body sections being notched at their outer ends to provide undercut grooves extending longitudinally of said bit, and elongated cutter sections of hard material seated one in each of said grooves, the spaces on said head and said body sections between adjacent ribs being arcuately concave to provide water channels extending longitudinally of said bit between adjacent ribs of said head and body sections.

3. A well drill bit assembly comprising an elongated tubular spindle having screw thread formations one at each end thereof, a head including a central portion having a centrally disposed recess provided at one end of said head with screw threads receiving one end of said spindle and radially projecting ribs disposed at substantially equal angular intervals around said central portion, said ribs being inclined inwardly from said one to the other end of said head and the central portion of said head having radially disposed passages therein extending from said recess to the exterior of said central portion between adjacent ribs, a conical drill nose secured at its larger end to said head at said other end of the latter, body sections mounted on said spindle and each including a central portion provided coaxially with a spindle receiving bore and having ribs projecting radially therefrom at substantially the same angular intervals as the ribs on said head and to substantially the same extent as the ribs on said head at said one end of the latter, said head and said body sections having flat and substantially

parallel end surfaces, means interconnecting said body sections and said head maintaining corresponding ribs of said head and said body sections in alignment longitudinally of the bit, said body sections together constituting a stack mounted on said spindle with one end in contact with said one end of said head, a dummy section mounted on said spindle at the other end of said stack of body sections and comprising a body of substantially the same diameter as the central portions of said body sections having a central bore receiving said spindle, a guide section mounted on said spindle at the end of said dummy section remote from said stack of body sections and including a central portion provided with a central bore receiving said spindle and ribs projecting radially from said central portion at angular intervals and substantially to the same radial extent as the ribs on said body sections, the ribs on said head and said body sections being notched at their outer ends to provide undercut grooves extending longitudinally of said bit, and elongated cutter sections of hard material seated one in each of said grooves, said dummy section having ribs at angular intervals therearound projecting radially a distance somewhat less than the radial projection of the ribs on said body sections and overlying the adjacent ends of said cutter sections to maintain said cutter sections in said grooves.

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