Dec. 16, 1930. O. F. HARDING 1,785,120

CORE BY-PASS DRILL

Filed Oct. 8, 1928 2 Sheets-Sheet 1

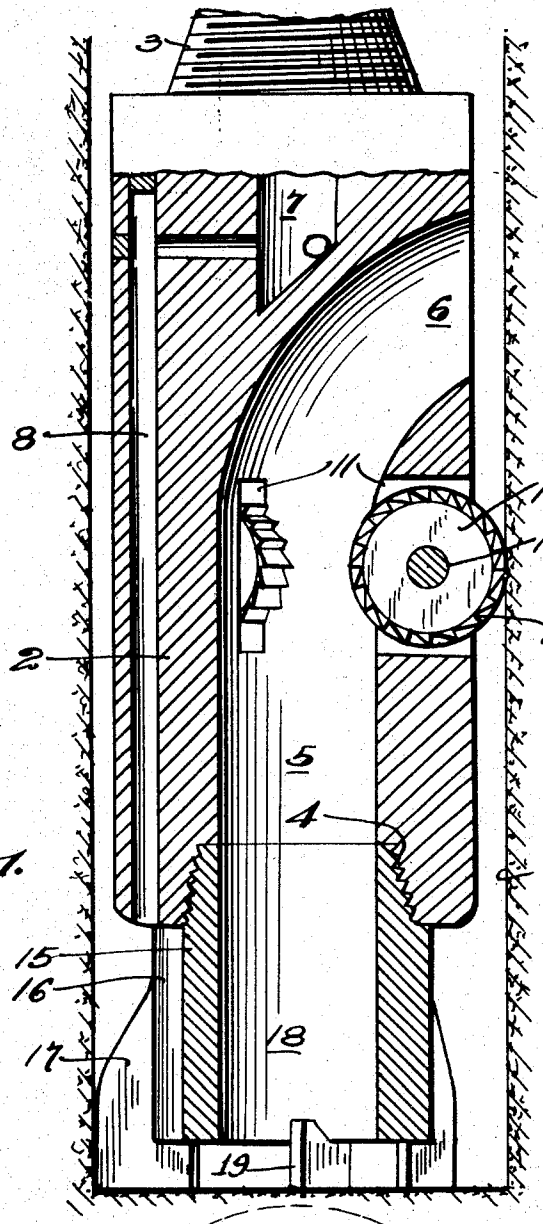


Fig. 1.

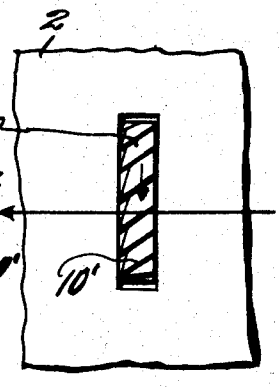


Fig. 3.

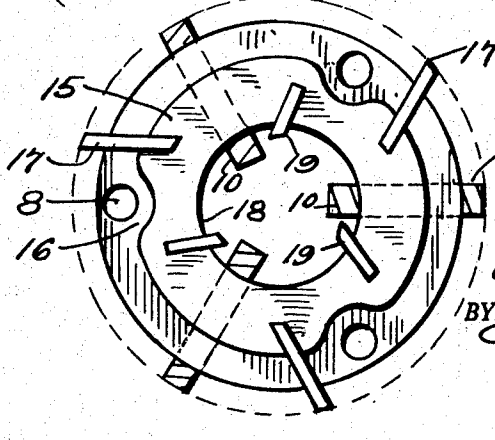


Fig. 2.

INVENTOR.
O. F. Harding.
BY E. E. Maynard
ATTORNEY.

Dec. 16, 1930. O. F. HARDING 1,785,120

CORE BY-PASS DRILL

Filed Oct. 8, 1928 2 Sheets-Sheet 2

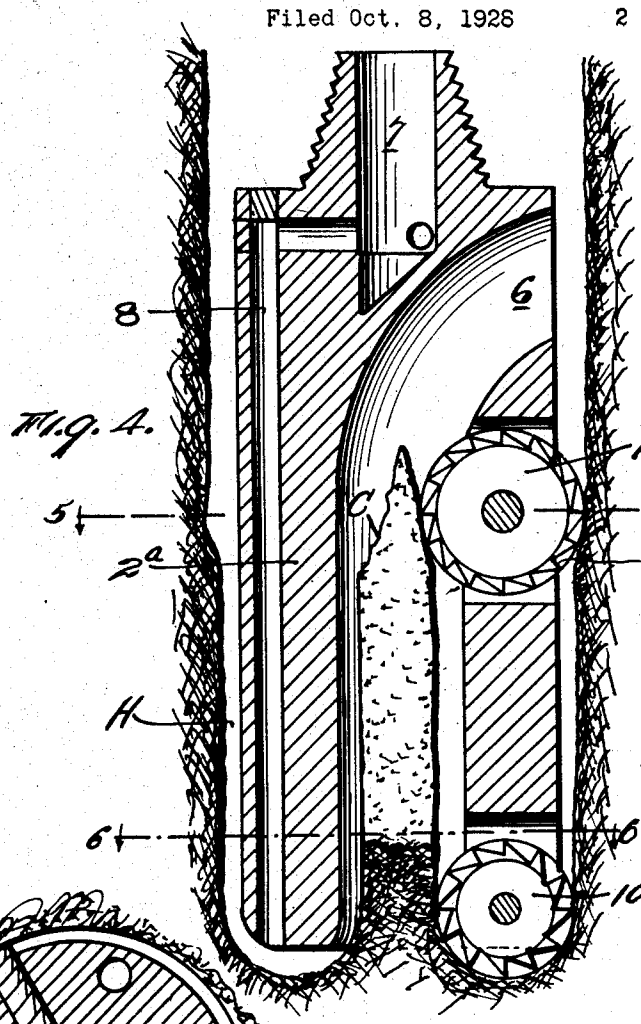


Fig. 4.

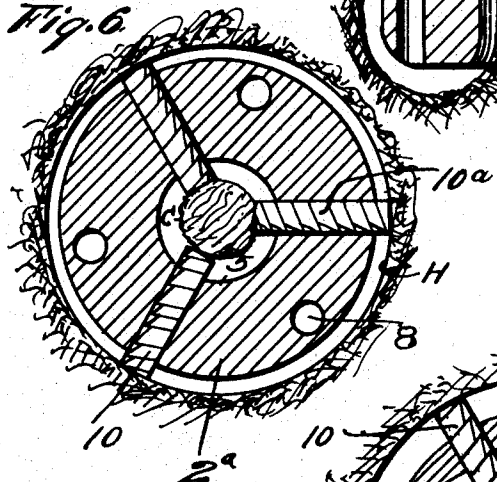


Fig. 6.

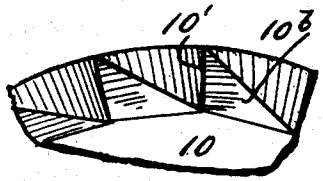


Fig. 9.

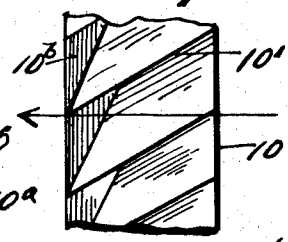


Fig. 7.

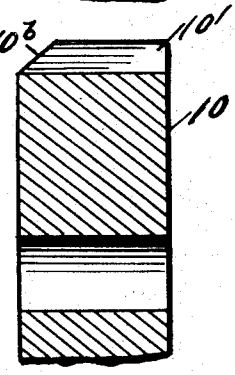


Fig. 8.

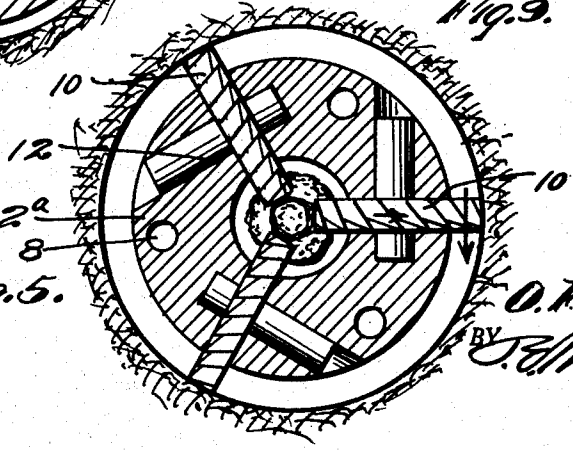


Fig. 5.

INVENTOR,
O. F. Harding;
BY
C. B. Maynard,
ATTORNEY.

Patented Dec. 16, 1930 1,785,120

UNITED STATES PATENT OFFICE

OSCAR F. HARDING, OF LONG BEACH, CALIFORNIA

CORE BY-PASS DRILL

Application filed October 8, 1928. Serial No. 311,158.

This invention relates to deep well drilling tools and more especially to what is known in the art as drill "subs", that is, a short section of the drill string introduced in the line between the tool bit and the upper sections of the string.

From years of experience I have learned that there is a tendency for the bit to "ball" up at or near the lower-most section or the "sub" joint section. One object of the present invention is to provide a "sub" and combined bit whereby the circulation water or mud is forced centripetally and then upward and out into the hole where the balling up commonly occurs.

A further object of the invention is to provide a pilot core cutting bit and a "sub" joint whereby to dig a central core stub to maintain a center guide, to hold the drill true to plumb line as far as possible, and to eliminate a fault or tendency of drilling tools, especially "fishtail" bits, to whip around center, jam and twist off.

It is not intended by the present bit to recover a core, it being an object to dig a short guide or pilot core, and then break it up as fast as possible and discharge it back into the hole.

Therefore, an object is to provide a drill body with a short core passage abruptly deflected laterally, to discharge the core chip out to the side, and to provide means to cut or break up the core to accelerate its riddance.

Another object is to provide a simple, practicable, and substantial, drill and "sub" combination, and one of reasonable cost.

Additional objects, advantages, and features of construction, and details of means of operation will be made manifest in the ensuing description of the herewith illustrated embodiments; it being understood that modifications, variations, and adaptations, may be resorted to within the spirit, scope, and principle, of the invention, as it is hereinafter claimed.

Figure 1 is an axial section of the combined "sub" and its bit. Figure 2 is an upward looking bottom plan of the tool of Fig. 1. Figure 3 is a side elevation of a fragment of the "sub" body showing the exterior face of a core grinding disc. Figure 4 is a specific variation of the invention, showing a body equipped with rotary leader discs. Figure 5 is a section on line 5—5 of Fig. 4. Figure 6 is a section on line 6—6 Fig. 4. Figure 7 is a fragmentary elevation on an enlarged scale, showing the tooth form of a disc. Figure 8 is a cross-sectional detail of one of the cutting discs showing a tooth thereof in side elevation. Figure 9 is a fragmentary perspective view of a disc.

The "sub" consists of a stout coupling section 2 with a pin 3 at one end, and a box 4 at the other end for a drill bit; but it is to be understood that a pin or box may be used on either or both ends.

The lower end of the "sub" has an upwardly extending axial core bore 5, which is laterally deflected to a side outlet 6.

The upper end of the "sub" has a water chamber 7 receiving circulating fluid from the drill string under pump pressure. This water or circulating mud passes down a series of conduits or ducts 8 which terminate at the bottom of the "sub."

Frequently hard formation is encountered in digging the hole, and when a core cutting bit is used the core passes into the bore 5. Means are provided in my improved construction for wearing down and breaking up this core, and for side-wiping the hole wall with a reaming effect. The wall of the drill hole is employed cooperatively to cause the core wearing means to rotate, and thus materially increase its attrition effects.

Said means include a set of discs 10, whose medial planes normal to their axes lie in radial planes in equi-angular relation, in pockets 11 in the wall of the "sub".

The discs 10 rotate freely, upon or with their shafts 12, and are of such size as to reach the wall of drill-hole H dug by the leading cutters of the bit. These discs have oblique ratchet-like teeth 10′, so pitched that contact with the wall of the drill-hole H during rotation of the "sub" string clockwise, will cause the discs to revolve on their axes, and against the head of the core to cut or break it down.

The bit 15 has its body grooved at 16, or is of such size that the water holes 8 are uncovered to permit the circulating water to flow down in front of lateral bit blades 17. The construction of the end-cutting blades of the bit is made such that the circulating fluid can flow inwardly, into an axial bore 18 of the bit.

On the bottom of the bit are core-cutting blades 19, extending into the bit bore 18 which is larger than the core to be cut, so that the circulation water will flow inward to the core chambers 18 and 5 and thence up and out at discharge opening 6.

It will be seen that the circulating water has a centripetal flow past the bit blades, and follows up the core passage. At the outlet of the latter it will flush out the muck and prevent balling.

As shown in detail in Figs. 7, 8, and 9, the forward ends of the helical teeth of the cutting or digging discs 10 are bevelled off at 10^b to facilitate digging as the tool sweeps around in the hole.

While the by-passing bit device of Fig. 1, shows a detachable bit body on the "sub" body 2, a specific form of alternative construction is shown in Fig. 4; wherein the body part 2^a is provided with a lower set of leading rotary cutters 10^a, the latter being adapted to form a core C and dig a hole H smaller than the extreme sweep of the upper discs 10. The latter, in either of the two constructions, serve as side reamers to dig the hole to gage and at the same time break up the core.

It will be noticed that the cutters 10^a project but slightly beyond the body 2^a so that the body so nearly chokes the hole that the circulating fluid is largely compelled to flow centripetally into the bore 5.

What is claimed is:

1. A well drilling tool body having a core receiving bore deflected out to one side, a set of rotary leading cutters cutting the hole and forming a core smaller than the bore, and an upper set of cutters reducing the core and reaming the hole.

2. A drill bit sub-joint, having a co-axial core passage deflected at its upper end out to the side of said joint; and intermediate rotary disc means in the passage for destroying the upper end of a core by cutting away its circumferential surface.

3. A drill bit sub-joint, having a co-axial core passage deflected at its upper end out to the side of said joint; and intermediate rotary disc means in the passage, extending through the joint wall, adapted to ream the wall of a drill hole and concurrently destroy the upper end of a core by cutting away its circumferential surface.

4. A drill bit sub-joint, having a co-axial core passage deflected at its upper end out to the side of said joint; and intermediate rotary means comprising toothed discs in the passage extending through the joint wall, adapted to ream the wall of a drill hole and concurrently destroy the upper end of a core by cutting away its circumferential surface; said discs being adapted for rotative actuation by contacting with said wall while the bit is rotating.

5. A well drilling tool having a co-axial core passage extending upwardly from its lower end; a set of disc cutters at the lower end, adapted to make an annular cut leaving a pilot core smaller than said passage and extending thereinto; and an upper set of cutting discs, adapted by the rotation of the bit to ream the outer wall of the annular cut and concurrently destroy the upper end of the core by cutting away its circumferential surface.

OSCAR FRED HARDING.