July 27, 1937. W. L. CHURCH 2,088,025

DRILL

Filed Nov. 19, 1934

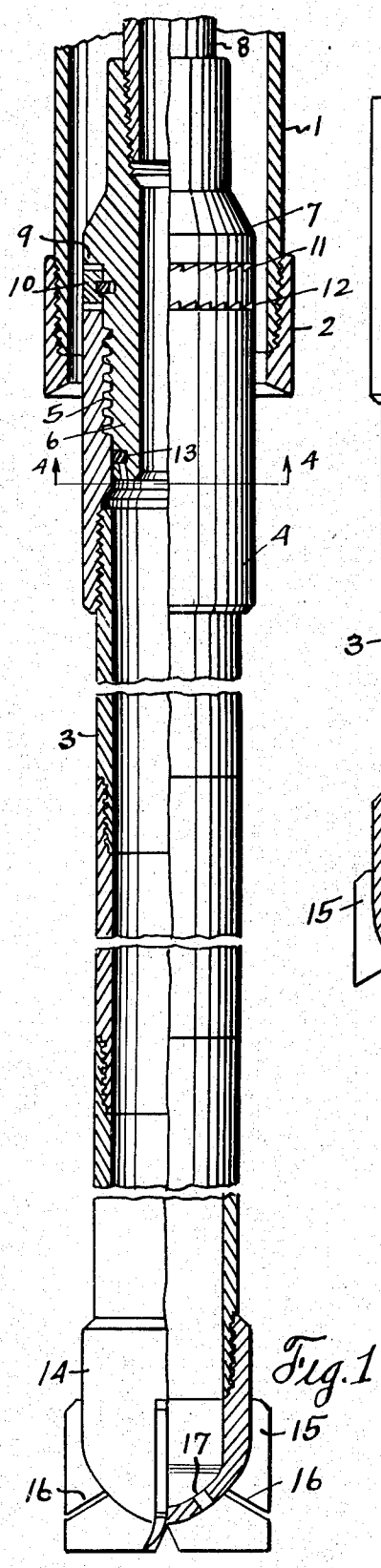


Fig. 1.

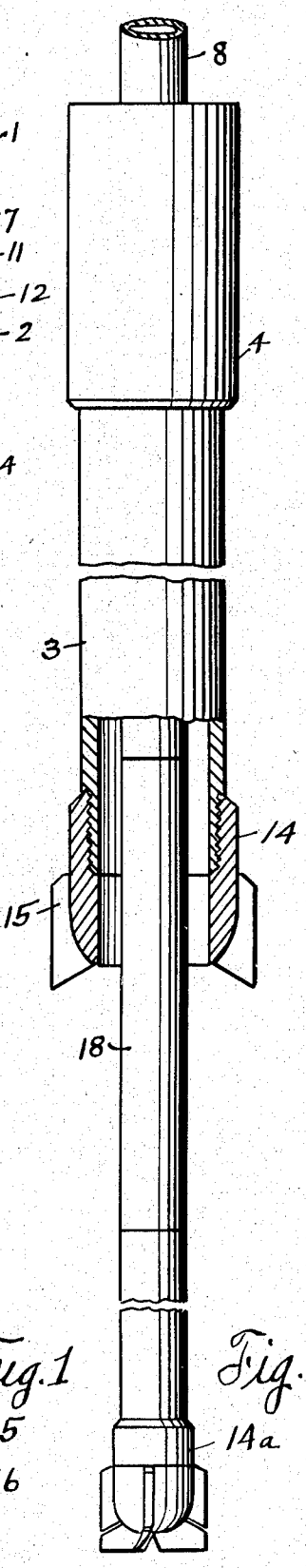


Fig. 2.

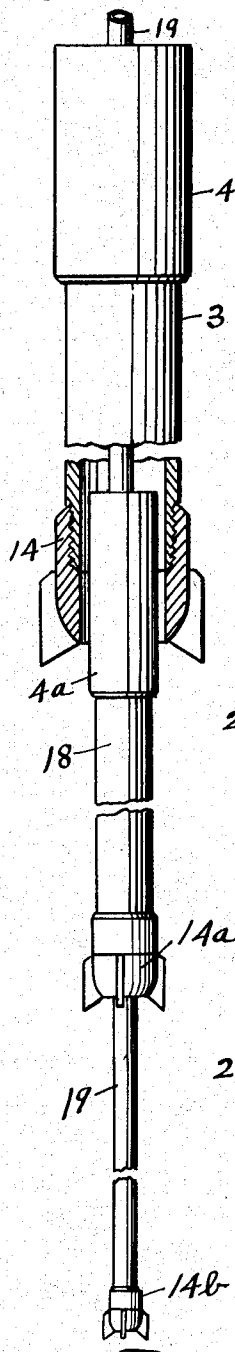


Fig. 3.

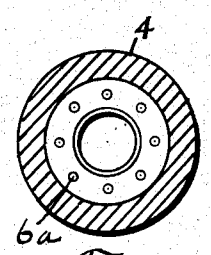


Fig. 4.

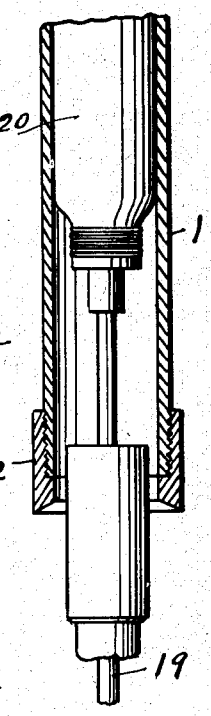


Fig. 5.

Inventor
Walter L. Church.
By
Hardway & Lathey
Attorneys

Patented July 27, 1937 2,088,025

UNITED STATES PATENT OFFICE

2,088,025

DRILL

Walter L. Church, Houston, Tex.

Application November 19, 1934, Serial No. 753,675

2 Claims. (Cl. 255—61)

This invention relates to apparatus and method for drilling wells.

The invention relates primarily to drilling through formations having a tendency to cave, and particularly to that type of formation commonly known as "heaving shale." In drilling a well through "heaving shale" formation, the formation is liable to cave in against the drill stem so that the same can not be rotated or withdrawn; and if the drill stem is once withdrawn, the formation is liable to cave in and completely destroy the bore so that a new bore must be formed often with like results. It is the primary object of this invention to provide a novel type of apparatus whereby the method hereinafter described may be employed to advance the bore in stages through the caving formation and into the stratum beneath.

With the above and other objects in view, the invention has particular relation to certain novel features of construction, and use, and example of which is given in this specification and illustrated in the accompanying drawing, wherein:—

Figure 1 shows a side elevation partly in section showing the surface casing, as set in the well and illustrating the upper section of casing to be set in the caving formation, with the drill attached to the lower end thereof.

Figure 2 shows a side view partly in section of the upper section of casing to be set in the caving formation, illustrating also, a reduced section of the casing advanced further into the formation.

Figure 3 shows a side view partly in section of a complete string of casing reduced from above downwardly as assembled in a well which has been completed through the formation.

Figure 4 shows a cross-sectional view taken on the line 4—4 of Figure 1, and

Figure 5 shows a fragmentary side elevation partly in section, illustrating the relation of the upper end of the string of casing set in the caving formation, with the surface casing, showing also the packing between them.

Referring now more particularly to the drawing wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates a surface casing whose lower end is equipped with the set shoe 2. The surface casing 1 is ordinarily set in the top of the well at any required depth, but above the caving formation to be encountered. Beneath the surface casing 1, there is a string of casing 3 whose upper end is equipped with a coupling 4 having an internal coarsely threaded box 5, into which the externally threaded pin 6 of the tool joint member 7 is threaded. This tool joint member 7 is connected to the lower end of the drill stem 8. It is reduced beneath its upper end forming the external annular shoulder 9 which is spaced above the upper end of the coupling 4 and between said upper end, and the shoulder 9, there is a ring 10 which is keyed on the pin 6 so as to be rotatable independently thereof. The upper and lower margins of the ring 10 have the reversely pitched ratchet teeth 11, 12, provided to engage the shoulder 8 and the upper end of the coupling 4 respectively, so that the pin 6 will not be screwed too tightly into the box 5, to the end that the joint may be readily unscrewed and separated. The threads connecting the pin and box are protected by means of the packing ring 13 around the lower end of said pin so that the gritty drilling fluid under pressure will not cut out the threads, but may act, through the ports 6a, to expand the packing.

Attached to the lower end of the string of casing 3 there is a drill 14 formed with a hollow head and radial blades 15. The lower ends of the blades are separated from the upper portions thereof by the slots 16 extending from the outer margins of the blades to the head, as shown in Figure 1. The head of the drill is provided with suitable outlet openings 17 for the outlet of the drilling fluid which is forced under pressure down through the drill stem and string of casing 3.

When "heaving shale" is encountered, the string of casing 3 is lowered into the well and the drill stem 8 is attached to the upper end thereof and drilling is proceeded with through the "heaving shale" formation until the formation caves in against the string of casing 3 to such an extent that it cannot be rotated, and drilling proceeded with. Thereupon, the drill stem 8 is rotated to the left to unscrew the pin 6 from the box 5 and the drill stem is then withdrawn from the well. A milling tool is then lowered into the well and the lower end of the drill 14 is milled out and the sections of the blades 15 beneath the slots 16 will drop off and may be side-tracked. A smaller string of casing, as 18, with a drill 14a, in all respects similar to the drill 14, is then lowered into the well and through the casing 3 and drilling is proceeded with. This smaller casing 18 is connected to the drill stem 8, as hereinabove explained, and the bore is deepened through the "heaving shale" formation with the casing 18 as far as possible. When drilling can not be carried on further, the drill stem is again detached from the string 18, as before and a drilling

tool is lowered to drill off the lower end of the drill 14*a* as hereinabove explained. A still smaller string of casing, as 19 is then lowered into the well as before through the strings 3 and 18, and the bore is further deepened. This string 19 has the drill 14*b* on the lower end thereof similar to the drill 14 and the method may thus be proceeded with until the bore has passed beneath the "heaving shale" stratum. It will be noted that each string of casing, 3, 18, and 19, is left permanently in the well to hold up the caving formation and to preserve the bore. After the lower string of casing 19 has been set, its drill 14*b* may be milled away, as herein above explained, and the drilling operations resumed to carry the bore to the desired depth. The lower string of casing, as 19, is preferably extended on up through the larger strings of casing above and into the surface casing 1, and a packer 20 of conventional construction is then set between the upper end of the inner or smaller string 19, and the surface casing 1 so as to prevent the water from any stratum that may be encountered from entering the casing 19.

The upper end of any intermediate string of casing so set should preferably extend up into the lower end of the string next above, as illustrated in Figure 3.

When the "heaving shale" has been cased off, as hereinabove explained, the well may then be completed and brought in without any interference from the caving formation.

What I claim is:—

1. A drill for use in drilling wells comprising a thin walled, closed, hollow head, blades on its lower end, said blades being formed of two portions separated by a narrow slot which extends from the head to the outer margins of the blades whereby the lower portion of the head and blades may be removed from the remainder of the drill by milling through the wall of the head at a point in line with the slots in the blades, the lower portion of the blades having cutting edges extending substantially to the longitudinal axis of the drill.

2. A drill for use in drilling wells comprising a thin walled, closed, hollow head, blades on its lower end, said blades being formed of portions separated by a narrow slot which extend from the head to the outer margins of the corresponding blades whereby the lower portion of the head and blades may be removed from the remainder of the drill by milling through the wall of the head at a point in line with the inner ends of the slots in the blades, the lower portions of the blades having cutting edges extending substantially to the longitudinal axis of the drill.

WALTER L. CHURCH.