Oct. 28, 1930. E. WILSON 1,779,575

UNDERREAMER

Filed Nov. 21, 1927 2 Sheets-Sheet 1

FIG. 1.

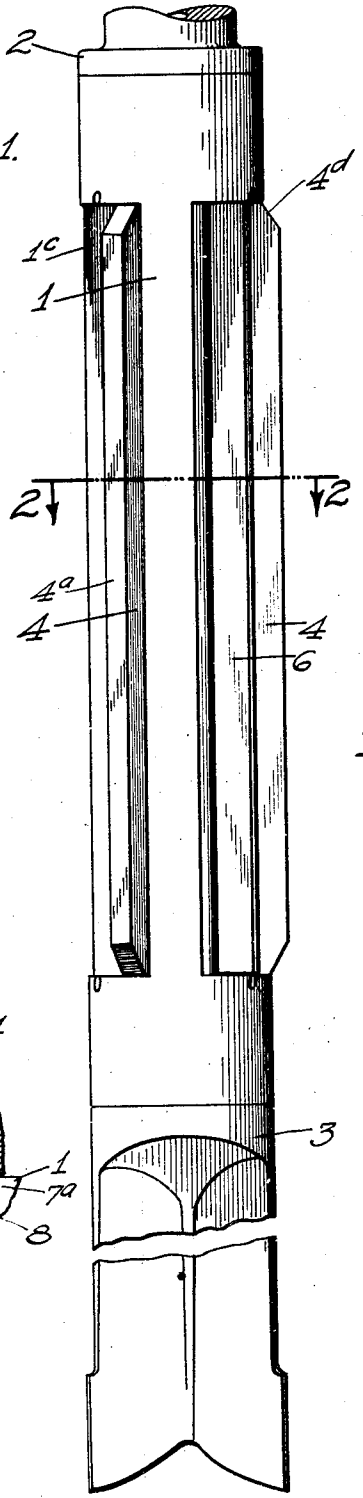


FIG. 2.

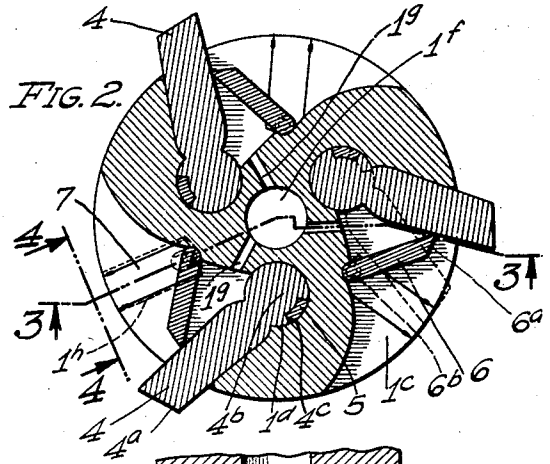


FIG. 3

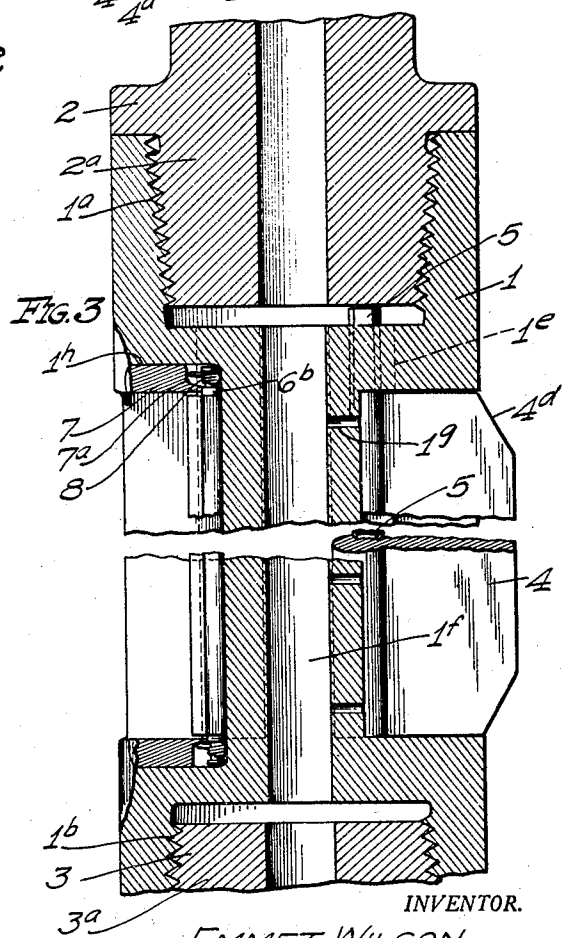
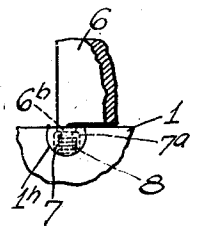


FIG. 4



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Oct. 28, 1930. E. WILSON 1,779,575

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Filed Nov. 21, 1927 2 Sheets-Sheet 2

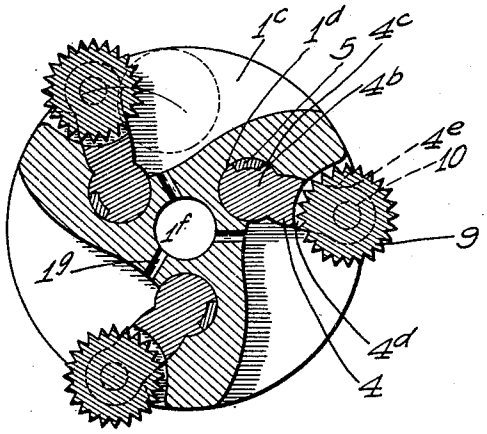


FIG. 6.

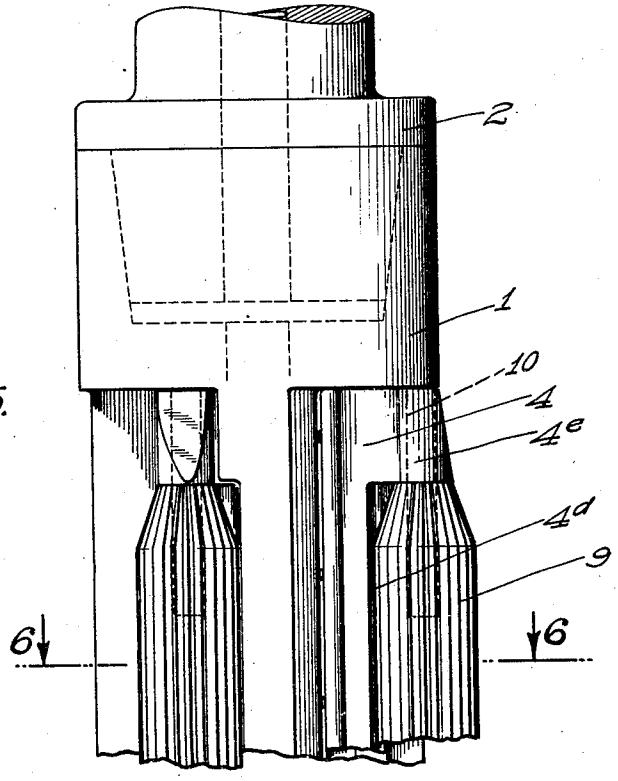


FIG. 5.

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UNITED STATES PATENT OFFICE

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UNDERREAMER

Application filed November 21, 1927. Serial No. 234,663.

My invention relates to under reamers for under reaming holes in oil wells, or other wells, after the same have been drilled.

The objects of my invention are: first, to provide a new and particularly simple and economical reamer of this class; second, to provide a reamer of this class which is applicable for reaming holes in soft formation, as well as in hard rock; third, to provide a reamer of this class having longitudinally pivoted reamer members, or blades, which may be folded inwardly when the reamer is inserted into or removed from the hole, and one in which the reamer members, or blades, are automatically forced outwardly during the reaming operation; fourth, to provide a reamer of this class in which the machine work is reduced to a minimum; fifth, to provide a reamer of this class in which the blades, or movable reamer members, which are pivotally mounted in the body, are removed from the sides, together with their pivot portions, the same being retained in position by removable keys loosely inserted from one end of the reamer; sixth, to provide a novel pivotal connection for blades, or movable pivot members, in a reamer of this class, and, seventh, to provide, as a whole, a novelly constructed under reamer for wells, and one which is durable, efficient, and which will not readily deteriorate or get out of order.

With these and other objects in view, as will appear hereinafter, my invention consists of certain novel features of construction, combination and arrangement of parts and portions, as will be hereinafter described in detail, and particularly set forth in the appended claims, reference being had to the accompanying drawings and to the characters of reference thereon which form a part of this application in which:

Figure 1 is a longitudinal elevational view of my reamer in one form of construction, showing the same connected at its upper end to a driver, or "sub", and at its lower end to a fishtail drill, shown fragmentarily; Fig. 2 is an enlarged transverse sectional view thereof, taken through 2—2 of Fig. 1, showing by dotted lines one of the cutter members folded inwardly; Fig. 3 is a longitudinal sectional view thereof, taken on the line 3—3 of Fig. 2, the reamer being shown fragmentarily and also shown connected to fragmentary portions of the driver and fishtail; Fig. 4 is a fragmentary elevational view thereof, taken at 4—4 of Fig. 2; Fig. 5 is an enlarged fragmentary elevational view of my reamer in a certain modified form of construction; and, Fig. 6 is a transverse sectional view thereof, taken through 6—6 of Fig. 5.

Like characters of reference refer to similar parts and portions throughout the several views of the drawings.

The reamers, illustrated in the drawings, and the bodies of which are designated by 1, are positioned, as in the conventional method of oil well drilling, between the driver 2, commonly known as "sub", at the upper end and a fishtail drill 3 at the lower end. The body 1 of the reamer also forms the coupling between the "sub" and the fishtail drill, and for this purpose is provided with internally threaded coupling portions, or sockets, 1^a and 1^b at its upper and lower ends for receiving the externally threaded male ends 2^a and 3^a of the "sub" and fishtail drill 2 and 3, respectively.

The reamer may be provided with two or more cutting blades or other reamer members 4. As shown in the drawings, the reamer is provided with three cuting blades, or other reamer members, to provide self-centering and more rapid and uniform cutting. Between the head portions at the opposite ends of the body 1, in which the threaded sockets are provided, are provided longitudinally extending flutes 1^c of peculiar shape. At the bottom portions of these flutes, are provided longitudinally extending recess portions 1^d, which are circular in cross section with the walls thereof extending more than a half circle, thus providing long circular recesses open but constricted at one side for positively retaining pivot portions of the blades, or other reamer members. The reamer members 4, shown in Figs. 1, 2, 3 and 4, consist of steel blades which are provided with cutting edges 4^a at their outer sides and with longitudinally extending pivot portions 4^b

at their inner edges. These pivot portions 4^b are also of circular cross section and of more than semi-circular extent. The connecting portion between the pivot portions 4^b and the main poriton of the cutting blade is narrower than either of the former portions so as to provide bearing portions in the recess 1^d of more than semi-circular extent for retaining the cutting blades and for permitting the pivotal movement thereof, as will be described later. At one side of the pivot portions 4^b, are provided longitudinally extending segmental channels 4^e in which are fitted correspondingly shaped keys 5 which are inserted after the pivot portions 4^b are in place and form a part of the pivot portions 4^b after the same are placed. Said keys are inserted through openings 1^e which extend through the upper head of the body 1 and which are extensions of the recesses 1^d and extend into the sockets 1^a, as shown best in Fig. 3. It will be noted that when the keys 5 are removed prior to inserting the blades 4 in position, recesses are formed in the pivot portions 4^b which permit the pivot portions to be inserted into the recesses 1^d when the same are in or substantially in the position of the blade, shown by dotted lines in Fig. 2. When the pivot portions are in position and the keys 5 inserted in the grooves 4^e of the pivot portions, as stated, the blades cannot be removed. The blades are provided at their upper and lower ends with beveled portions 4^d which extend to the peripheries of the heads of the body, so that when the reamer is inserted into the hole, or withdrawn therefrom, the beveled portions tend to engage obstructions in the hole and force the blades 4 about their pivotal axes and within the extremities of the heads of the bodies.

At the axial portion of the body is provided a water circulating hole 1^f which communicates with similar holes in the "sub" and the fishtail drill, and receives water from the "sub". The hole 1^f is provided with a plurality of outwardly directed orifices 1^g, as shown in Figs. 2 and 3. These orifices direct water under considerable pressure against the blades 4, tending to force the same outwardly against shoulders of the body, as shown, and also to wash deposits from the blades.

To take the place of the blade opening and cleaning means, just described, or to facilitate the action thereof, I have provided cleaning blades 6 which consist of thin blades provided with relatively sharp edges 6^a at their free ends and with pivot portions 6^b at the upper and lower ends of their inner edges, as shown, best in Fig. 3. These extended ends are inserted into their respective pivot portions in the opposite heads of the body through radial slots 1^h at the adjacent inner sides of said heads, or head portions. These radial slots are plugged by plugs 7 after the pivot portions are in place, said plugs being welded in position, as indicated in Fig. 2. At the inner ends of said plugs 7 are provided small recesses 7^a which receive the free ends of coil springs 8 which are positioned in annular reduced portions intermediate the ends of the pivot portions 6^b at the opposite ends of the cleaning blades 6. The free edges of the blades 6 are in continuous engagement with the forward sides of the cutting blades 4 and normally force the latter in a cutting position, as well as clean the same as the cutting blades are forced inwardly.

In the modified form of construction, shown in Figs. 5 and 6, the principle is substantially the same, but the cutting blades 4, or the reamer members, are slightly enlarged at their outer edges and are provided with cut out portions 4^d. The enlarged portions at the outer edges of the members 4 and at the opposite ends of the cut out portions 4^d form pivot portions 4^e. Within the cutout portions 4^d, are positioned the longitudinally grooved, or corrugated, steel cutting members, or rollers, 9 which are revolubly connected to the pivot portions 4^e by pins 10, shown by dotted lines in Figs. 5 and 6. The opposite ends of the cutting members 9 are slightly tapered to within the edges of the pivot portions 4^e to permit the reamer to be more easily inserted into and withdrawn from the hole. Since the pivot portions 4^e extend slight distances beyond the extremities of the heads at the opposite ends of the body, the same are also slightly beveled, as indicated in Fig. 5.

In this modification the cleaning blades 6 are eliminated and the reamer members forced outwardly and the cutting rollers cleaned merely by the water under pressure which is discharged from orifices, as described above. The operation of the modified structure is substantially the same as that described in connection with the other structure. The latter structure, however, is more particularly adapted for reaming holes in rock.

Though I have shown and described a particular construction, combination and arrangement of parts and portions, and a certain modification thereof, I do not wish to be limited to this particular construction, combination and arrangement, nor to the modification, but desire to include in the scope of my invention the construction, combination and arrangement substantially as set forth in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a reamer of the class described, a body member having longitudinal flutes in its sides and pivot portions at the inner portions of said flutes, cutting members having pivot portions at their inner edges, said pivot portions being pivotally mounted in

the pivot portions of said body, and keys securing said cutting members within the pivot portions of said body.

2. In a reamer of the class described, a body member having longitudinal flutes in its sides and pivot portions formed at and by the inner walls of said flutes, cutting members having pivot portions formed at and by their inner edges, said pivot portions being pivotally mounted in the pivot portions of said body, and keys recessed within the pivot portions of said cutting members, extending longitudinally therewith and forming an exterior part of the pivot portions thereof.

3. In a reamer of the class described, a body member having longitudinal flutes in its sides and pivot portions formed at and by the inner walls of said flutes, cutting members having pivot portions formed at and by their inner edges, said pivot portions being pivotally mounted in the pivot portions of said body, and keys recessed within the pivot portions of said cutting members, extending longitudinally therewith and forming an exterior part of the pivot portions thereof, said keys being inserted through openings at one end of the body.

4. In a reamer of the class described, a body having flutes in its sides, said flutes extending to near but spaced from the ends of said body, cutting members of substantially the length of said flutes, the inner edges of said cutting members being provided with pivot portions extending to and within the ends of said cutting members and pivotally mounted at the inner portions of said flutes, and keys positioned within and forming an external part of the pivot portions of said cutting members for retaining said cutting members on said body and in pivotal relation thereto.

5. In a reamer of the class described, a body having flutes in its sides, said flutes extending to near but spaced from the ends of said body, the inner edges of said cutting members being provided with pivot portions extending to and within the ends of said cutting members and pivotally mounted at the inner portions of said flutes, and keys positioned within and forming an external part of the pivot portions of said cutting members for retaining said cutting members on said body and in pivotal relation thereto, said keys being inserted through openings at the end of said body.

6. In a reamer of the class described, a body having a longitudinally extending constricted recess intermediate its ends, and a reamer member having a pivot portion at its inner edge of greater width than the width at the opening of the recess to prevent withdrawal of the reamer member from the recess through the side opening thereof, the pivot portion of said reamer member having a removable portion permitting the pivot portion of the reamer member to be inserted into and withdrawn from said recess through the side opening thereof.

7. In a reamer of the class described, a body having a longitudinally extending recess therein, said recess being of circular cross section and of more than semi-circular extent, and a reamer member having a pivot portion at its inner edge, said pivot portion being of circular cross section and of more than semi-circular extent and fitted into said recess through the side thereof, said pivot portion having a removable key forming a part of the pivot portion, said key, when removed from the pivot portion, permitting the pivot portion to be inserted into said recess from the side thereof, said key being inserted from the end of the body.

8. In an under-reamer, a spider means, head means connected to the ends of said spider means, bearings formed at the juncture of the legs of said spider means, and extending between said head means, incomplete journal means arranged to fit into said bearings, key means completing said journal means and arranged to lock said journal means in said bearings, and cutting members associated with said journals arranged to shift in the spaces between the legs of said spider means.

9. In an under-reamer, a hub portion, arms extending from said hub, bearing means formed in certain sides of said arms, the axes of said bearing means extending longitudinally with said hub, cutting members having incomplete journal portions arranged to fit in said bearing means, and a key means arranged to complete said journal portions and lock the same in said bearings.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 9th day of November, 1927.

EMMETT WILSON.