

June 16, 1925.

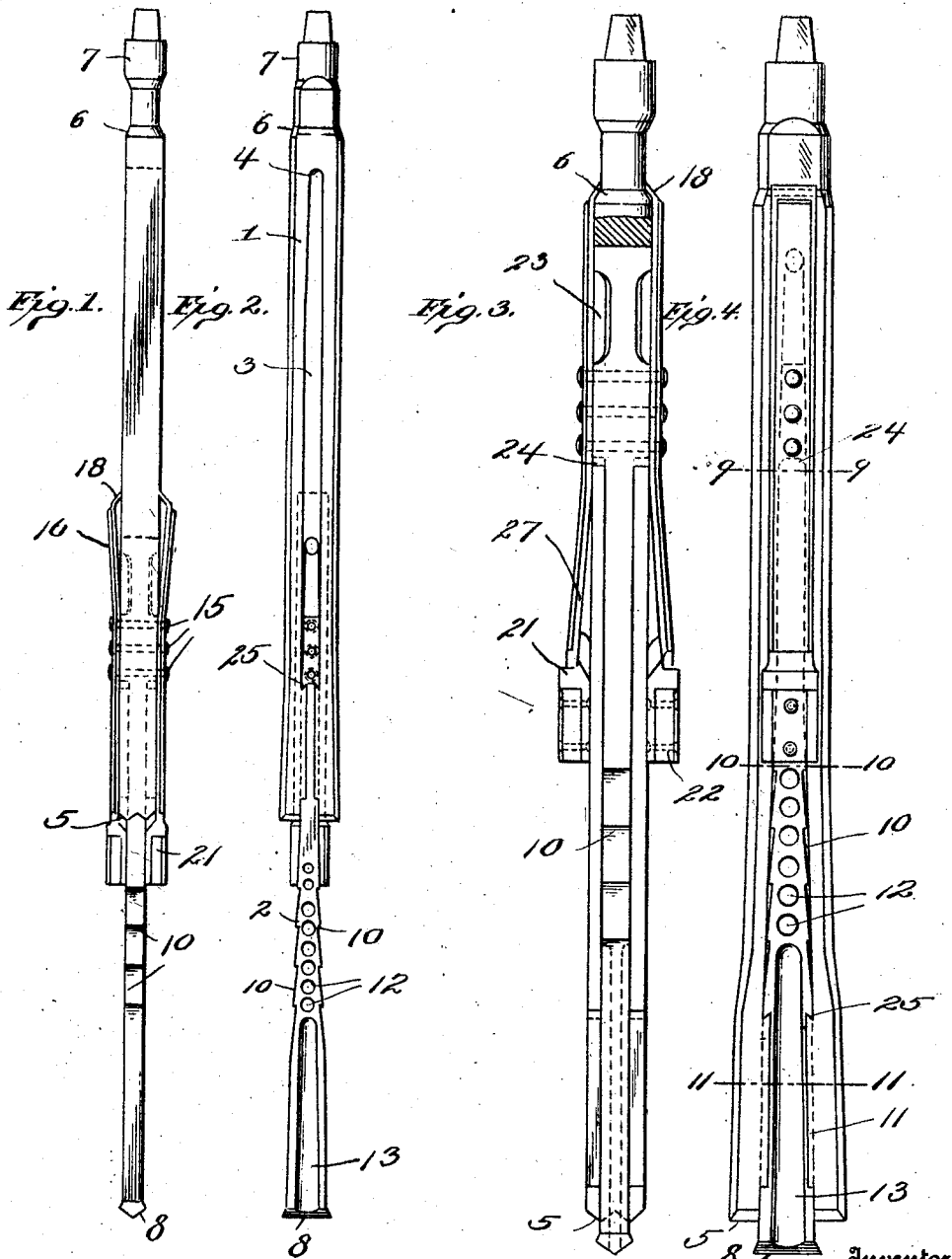
W. F. SHUTT

1,542,736

UNDERREAMER

Filed Dec. 7, 1921

2 Sheets-Sheet 1



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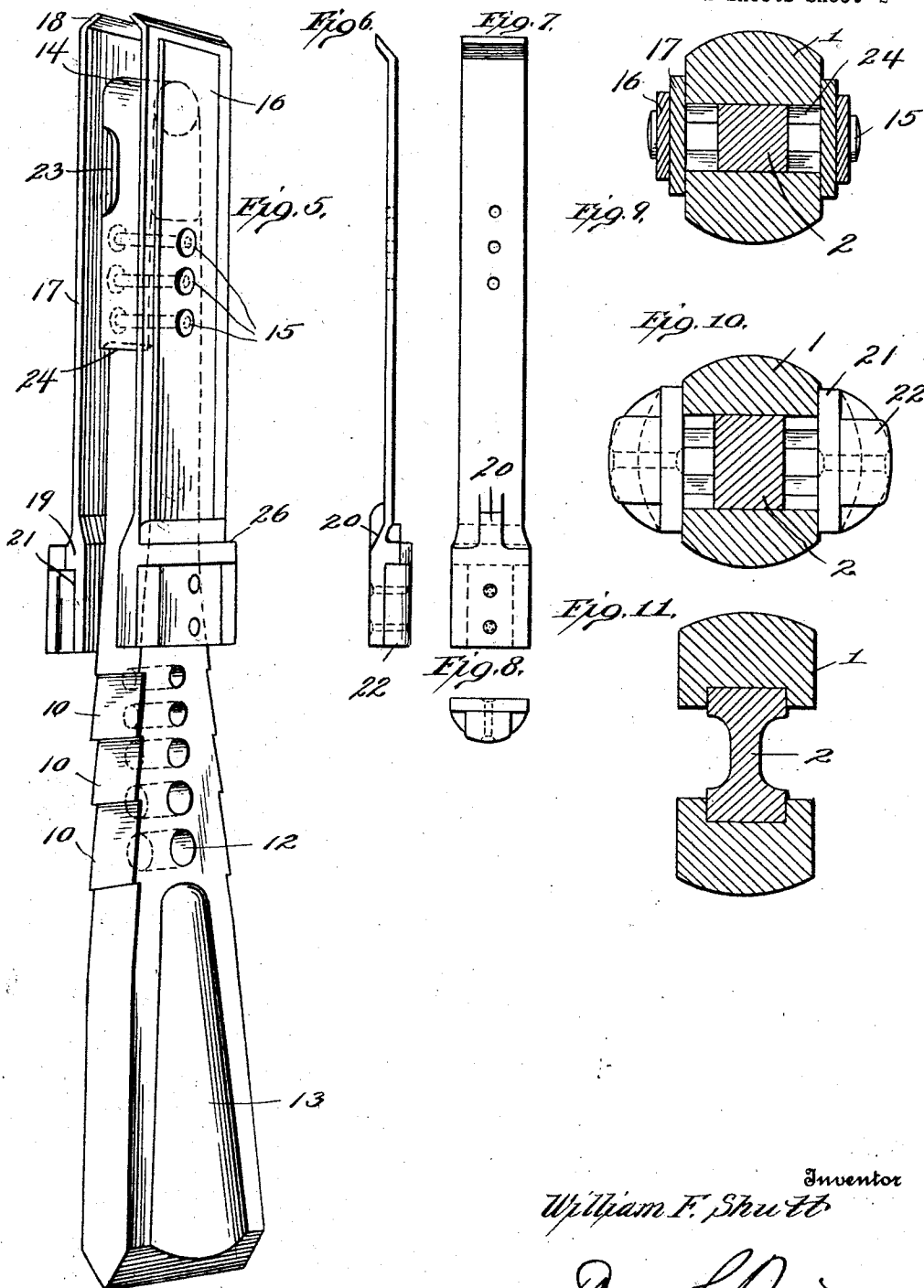
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UNITED STATES PATENT OFFICE.

WILLIAM F. SHUTT, OF DOLORES, TEXAS.

UNDERREAMER.

Application filed December 7, 1921. Serial No. 520,676.

To all whom it may concern:

Be it known that I, WILLIAM F. SHUTT, a citizen of the United States, residing at Dolores, in the county of Webb and State of Texas, have invented new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to drilling bits as used with cable tools and also with slight modifications, rotary tools, for drilling wells, test holes and the like, and has for its object an improved construction of bits of the class known as under-reamers which are lowered through the well casing, the cutting heads being expansible when below the lower end of said casing to a diameter greater than the internal diameter of the casing.

With this and other objects in view, my invention consists in the improved under-reamer illustrated in the accompanying drawings, described in the following specification, and particularly claimed, and in such variations and modifications thereof as will be obvious to those skilled in the art to which my invention relates.

In the drawings accompanying and forming a part of this specification, and wherein the preferred embodiment of my invention is illustrated:—

Figure 1 is a plan view of the under-reamer in the position of least diameter.

Figure 2 is a side elevation of the device shown in Figure 1.

Figure 3 is a plan view of the device shown in Figure 1 with the parts expanded.

Figure 4 is a side elevation of the view shown in Figure 3.

Figure 5 is a perspective view of the removable element of the bit stock.

Figure 6 is a side elevation of the leaf spring.

Figure 7 is a plan view of the same viewed from the side which lies adjacent the bit stock.

Figure 8 is an end elevation of the view shown in Figure 7.

Figures 9, 10 and 11 are cross sectional views taken respectively along the lines 9—9, 10—10 and 11—11 of Figure 4.

Referring in detail to the drawings it will be observed that my improved under-reamer includes two relatively movable members, the bit stock body member 1 and the expanding or wedging member 2 which is best shown in its entirety in Figure 5.

The body member 1 of the bit stock preferably comprises an elongated element substantially cylindrical except that it is reduced in diameter at intermediate portions to provide for the escape of debris past the cutting edge thereof in the manner of the ordinary club bit. The body member is diametrically slotted throughout the greater portion of its length as shown at 3, the slot being open at the lower end of the body member and closed by a semi-cylindrical wall 4 adjacent the upper end thereof.

The body member is thus divided into bifurcated portions or prongs which, in a position of repose, lie substantially parallel to one another. In planes parallel to the plane of the slot said bifurcated portions are massive and rigid while in the planes at right angles to the plane of the slot they are comparatively slender and therefore resilient. At their lower ends the bifurcated portions each may be provided with a pair of spaced guide flanges 11 having undercut inclined ends 25 best shown in Figure 4, and said bifurcated portions also carry cutting teeth 5, best shown in Figures 1 and 3 forming what I shall term the primary reamer. The outside inclined faces of the teeth of each pair have a function in the operation of the device which will hereinafter be duly described.

At its upper end the body member is provided with an inclined shoulder 6 the function of which will also presently be disclosed. The upper end of the body member also carries the connecting means 7 by which the under-reamer is connected to the string of tools by which it is operated.

The expanding or wedging member 2 is so shaped at its upper end to enter freely into the slot 3 of the body member and its sides gradually diverge toward the lower end giving the member 2 a wedge like form so that as it is advanced into the slot 3 the bifurcated portions of the body member will be expanded at their lower ends beyond the normal diameter of said body member. The wedging element 2 is provided at its lower end with a cutting face 8 which is of less length than the expanded dimension of the cutting end of the body member 1. The sides of the wedging member 2 which engage with the inner surface of the body member are provided with scraping shoulders 10 having the purpose of frictionally removing excavated material

which may have become deposited between the guides 11 of the body member from the inner surface of the seat 3. For the purpose of lightening of weight of the under-reamer, the wedging element is bored out forming a plurality of apertures 12 and it may be also, for the same purpose, recessed as at 13. The upper end of the wedging member is made transversely cylindrical in form as shown at 14 and seats within the cylindrical recess formed in the wall 4 of the slot 3 when the parts are fully telescoped.

The width of the wedging member is such that it is flush with the surface of the slot 3 on both sides when it is telescoped within the body member and it carries secured thereto near its upper end by means of the riveted bolts 15 a pair of leaf springs, one on each side, sufficiently wide to extend over both edges of said slot and slidably engaging the outer surface of the body member. Each of these leaf springs comprises two leaves an upper leaf 16 consisting of a flat bar of spring steel and a lower or main leaf 17 which is inwardly bent toward the body member 1 at its outer end as shown at 18. The lower end of the main spring leaf is thickened as at 19 and provided on its lower surface with the projecting inclined shoulders 20 which are best shown in Figures 6 and 7, and is reinforced by the projecting rib 27. The outer surface of the thickened portion of the spring leaf 17 is recessed as at 21 for the reception of a removable cutting element 22 which is riveted or otherwise secured to its seat. The cutting elements 22 are not of such diameter as to enlarge the hole made by the primary reamer but scrape the sides of the hole and keep it true. They also function as wear plates to protect the abrupt shoulders 26 which are formed on the outer side of the thickened portion 19 of the spring leaf 17, for the purpose of engaging with the lower edge of the well casing for contracting the under-reamer.

The thickness of the inclined cam shoulder 20 causes that portion of the spring 18 below the line of rivets to stand away from the surface of the body member 1 forming a space back of the lower portion of the leaf spring and the upper portion of the wedging member 2 is recessed as at 23 forming a space behind the upper half of the leaf spring. These spaces are for the purpose of preventing the accumulation of particles of debris between the leaf spring and the body member 1 and thus preventing the proper functioning of said spring.

The wedging member 2 is provided just below the line of rivets with under-cut portions forming outwardly projecting edges best shown at 24 in Figure 4. When the wedging element is withdrawn these edges

engage with the under-cut ends 25 of the guides 11 as clearly shown in Figures 4 and 5 and prevent further separation of the parts.

The operation of the under-reamer is as follows: When the parts are in the extended position shown in Figure 1 the diameter of the primary reamer formed by the cutting teeth 5 at the lower ends of the bifurcated portions of the body member 1, and the diameter of the secondary reamer 22 are sufficiently small to permit the entire under-reamer to be freely lowered through the casing of the well.

When the lower end 8 of the wedging member strikes the bottom, said member will be forced inwardly between the bifurcated portions of the body member spreading the latter and enlarging the diameter of the primary reamer. The secondary reamer 22 is at the same time expanded by the inclined shoulders 20 engaging inclined surface 5 of each pair of teeth on the lower end of the body member. A few strokes of the under-reamer against the bottom of the well will force the wedging element 2 into its uppermost position with the cylindrical upper end thereof firmly seated against the cylindrical recessed wall 4 of the slot in the body member. In this position the inturned upper ends 18 of the spring leaf 17 engage around the inclined shoulder 6 holding the parts firmly in telescoped position. The wedging member is held rigidly in central position by the guides 11 which embrace it on both sides and by the walls of the slot 3 in one direction and by the leaf spring engaging the body member in the other direction. The frictional engagement of the wedging member with the bifurcated portions of the body member is vise like in its action so that the parts are held firmly together and function as well as if they were a single integral member such as constitutes the ordinary club bit.

The diameter of the cutting face 8 is smaller than the diameter of the expanded primary reamer which latter is a little larger than the external diameter of the casing. For instance, for an eight inch casing the cutting face 8 will drill a hole 6 inches in diameter, and the primary reamer, will drill a hole 10 inches in diameter, the diameter of the secondary reamer being slightly less than that of the primary reamer. The length of the parts when in working position is such that the primary reamer lies intermediate the cutting face 8 and the secondary reamer. By this means the work progresses much faster than where the cutting tools are all in the same plane for the debris created by each of the reamers is produced in stepped stages and does not so rapidly accumulate under the cutters.

In removing the under reamer from the

well it is elevated until the shoulders 26 come into contact with the lower edge of the well casing. Further pull on the cable will drag the inwardly bent clasp ends 18 of the leaf spring away from the inclined shoulder 6, and drawing the wedging element 2 out of the body member 1, causing the collapse of both the primary and secondary reamers to their smallest diameter, which will permit the under reamer to freely enter the casing and be withdrawn therefrom. Engagement of the projecting edges 24 with the under-cut ends 25 of the guides 11 prevent complete separation of the wedging element from the body members.

It is obvious that the specific details of construction and configuration of parts described herein may be modified in various ways without sacrificing the advantages of the invention or departing from the scope thereof as defined in the appended claims.

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

1. An under-reamer comprising a body member provided with a slot extending from its lower end to a point remote therefrom bifurcating said body member into arms provided with cutting edges at their lower ends, a wedging member within said slot, telescopically arranged in relation to said body member, and the upper end of said wedging member seating against the inner end wall of said slot when said parts are in fully telescoped position, means engaging the outer surface of said body member, comprising leaf springs each connected intermediate its ends with said wedging member through said slot on opposite sides thereof and provided at their lower ends with cutting edges comprising a secondary reamer.

2. An under-reamer comprising a body member provided with a slot extending from the lower end thereof to a point remote therefrom and bifurcating said body member into arms each provided with a cutting edge comprising a pair of teeth having inclined outside edges, a wedging member within said slot telescopically arranged in relation to said body member, the upper end of said wedging member seating against the inner end wall of said slot when the parts are in fully telescoped position, means engaging the outer surface of said body member and connected to said wedging member through said slot on the opposite sides thereof comprising leaf springs having cutting edges at their lower ends comprising a secondary reamer the lower ends of said leaf springs being expanded by engagement with the inclined sides of said teeth when the wedging member is telescoped within the body member.

3. In an under-reamer, a body member

provided with a slot extending from the lower end thereof to a point remote therefrom bifurcating said body member into arms each provided with a cutting edge comprising a pair of teeth having outside inclined sides, a wedging member within said slot telescopically arranged with respect to said body member, the upper end of said wedging member seating against the inner end wall of said slot when the parts are in fully telescoped position, said wedging member having a cutting edge at its lower end, leaf springs connected to said wedging member through said slot and engaging the outer surface of said body member, said leaf springs being provided at their lower ends with cutting edges comprising a secondary reamer and having inclined shoulders projecting from their lower surfaces, the lower ends of said leaf springs being expanded by engagement of said inclined shoulders with the inclined sides of said teeth when the wedging member is telescoped into the body member.

4. In an under-reamer, a body member having an extended shoulder adjacent its upper end and provided with a slot extending from the lower end thereof to a point remote therefrom bifurcating said body member into arms each provided with a cutting edge comprising a pair of teeth having outside inclined sides, a wedging member within said slot telescopically arranged with respect to said body member, the upper end of said wedging member seating against the inner end wall of said slot when the parts are in fully telescoped position, said wedging member having a cutting edge at its lower end, leaf springs connected to said wedging member through said slot and engaging the outer surface of said body member, said leaf springs being provided at their lower ends with cutting edges comprising a secondary reamer and having inclined shoulders projecting from their lower surfaces, the lower ends of said leaf springs being expanded by engagement of said inclined shoulders with the inclined sides of said teeth when the wedging member is telescoped into the body member, and the upper ends of said leaf springs being provided with inturned ends adapted to engage said external shoulder.

5. An under-reamer comprising a body member provided with a slot extending from its lower end to a point remote therefrom bifurcating said body member into arms, each having cutting edges at its lower end, a wedging member within said slot, telescopically arranged in relation to said body member and leaf springs engaging the outer surface of said body member and connected intermediate their ends to said wedging member through said slot, the lower ends of said leaf springs being provided with

cutting edges forming a secondary reamer and having shoulders projecting inwardly therefrom spacing the lower ends of said leaf spring from the surface of said body member, said wedging member being cut away to the rear of the upper portion of said leaf springs to form spaces between said leaf springs and body member.

6. An under-reamer comprising a body member provided with a slot extending from the lower end thereof to a point remote from said lower end bifurcating the body member into arms having cutting edges at their lower ends, a wedging member within said slot telescopically arranged in relation to said body member, a leaf spring engaging the outer surface of said body member and connected intermediate its ends to said wedging member through said slot, said leaf spring comprising a top leaf and a main leaf in superposed relation, said main leaf having a thickened lower end recessed on its upper surface to form a seat for a removable cutter and having an abrupt shoulder facing the upper end of said under-reamer.

7. An under-reamer comprising a body portion provided with a slot extending from its lower end to a point remote therefrom bifurcating said body member into arms provided at their lower ends with cutting edges forming a primary reamer, a wedging member telescopically arranged within said slot for expanding said primary reamer, said wedging member being provided at its lower end with a cutting edge, the upper end of said wedging member seating against the inner end wall of said slot when the parts are in fully telescoped position, leaf springs engaging the outer surface of the body member and connected intermediate their ends to said wedging member through the opposite sides of said slot, the lower ends of said leaf springs being provided with cutting edges comprising a secondary reamer, said leaf springs being provided on their under surfaces with means cooperating with means on said body portion for expanding said secondary reamer when the parts are telescoped together.

8. An under-reamer comprising a body portion provided with a slot extending from its lower end to a point remote therefrom bifurcating said body member into arms provided at their lower ends with cutting edges forming a primary reamer, a wedging member telescopically arranged within said slot for expanding said primary reamer,

said wedging member being provided at its lower end with a cutting edge, the upper end of said wedging member seating against the inner end wall of said slot when the parts are in fully telescoped position, leaf springs engaging the outer surface of said body member and connected intermediate their ends to said wedging member through the opposite sides of said slot, the lower ends of said leaf springs being provided with cutting edges comprising a secondary reamer, said leaf springs being also provided on their under surfaces with means cooperating with means on said body portion for expanding said secondary reamer when the parts are telescoped together, the relative length of said body member, wedging member and leaf springs being such that the primary reamer will lie intermediate the cutting surface of the wedging member and the secondary reamer when the parts are in fully telescoped position.

9. An under-reamer comprising a body member having cutting edges at its lower end and provided with a slot extending from the lower end to a point remote therefrom, bifurcating said body member into arms, each arm having spaced guide flanges extending inwardly into said slot, a wedging member within said slot telescopically arranged with respect to said body member and provided with a cutting edge at its lower end, said wedging member having transverse teeth on its sides adjacent the walls of said slot, for scraping said walls between said guides when the body member and wedging member are relatively moved.

10. An under-reamer comprising a body member provided with a slot extending inwardly from its lower end bifurcating said body member into arms each having a cutting edge, a wedging member for spreading said arm reciprocally mounted in said slot, leaf springs secured to said wedging member and yieldingly engaging said body member, said leaf springs being formed with means for holding said wedging member in retracted position and being furnished with means engageable with an extraneous object for causing the withdrawal of said wedging member.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILLIAM F. SHUTT.

Witnesses:

WILL W. GREGG,
JUSTO S. PENN.