W. WAGNER.

UNDERREAMER.

APPLICATION FILED APR. 15, 1911.

1,038,243. Patented Sept. 10, 1912.

Fig. 1.

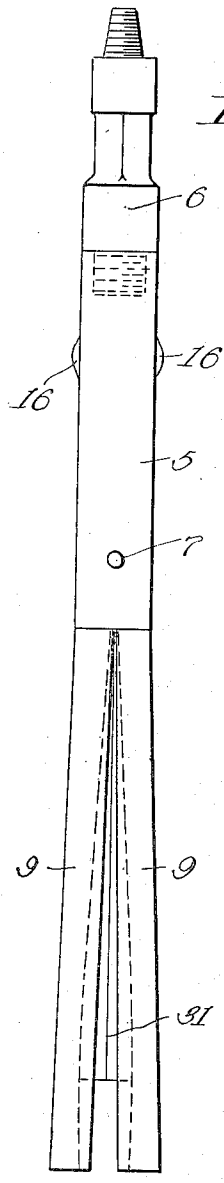


Fig. 3.

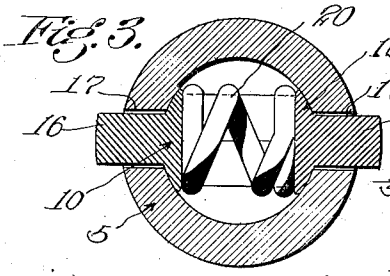


Fig. 4.

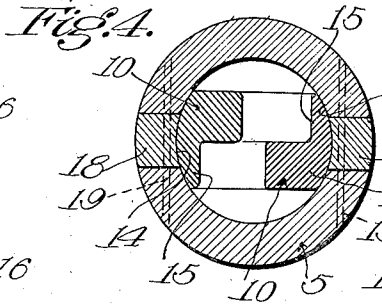


Fig. 5.

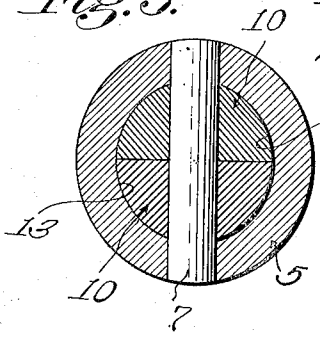


Fig. 6.

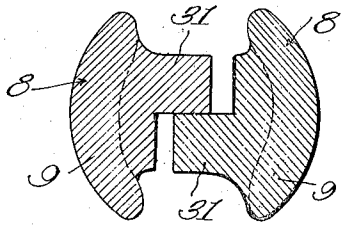
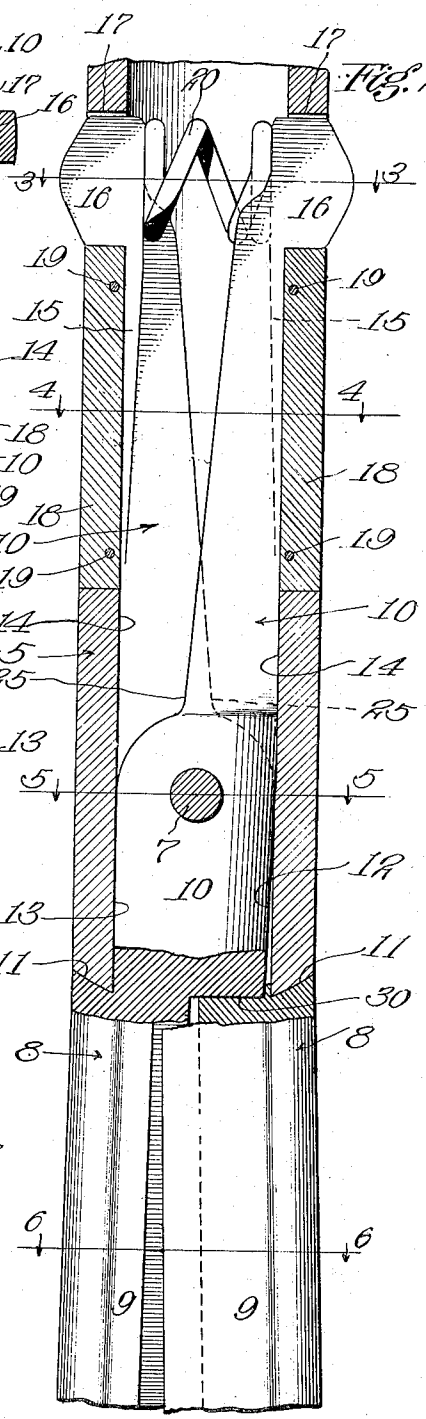


Fig. 2.



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UNITED STATES PATENT OFFICE.

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UNDERREAMER.

1,038,243. Specification of Letters Patent. Patented Sept. 10, 1912.

Application filed April 15, 1911. Serial No. 621,278.

To all whom it may concern:

Be it known that I, WARREN WAGNER, a citizen of the United States, residing at Petrolia, in the county of Clay, State of Texas, have invented new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to an under-reamer adapted particularly for use in oil wells and the like, being designed for drilling a hole beneath the casing and of the same or larger diameter than the outside diameter of the casing; and the prime object of the invention is to produce an under-reamer which is as nearly similar in its construction as possible to an ordinary drilling bit, which has but two parts of simple configuration, and in which the possibility of losing any part in the hole is reduced to a minimum.

The object of making my under-reamer as nearly similar to the ordinary drilling bit as possible is based on the fact that such a drilling bit is of extremely strong construction and that it also acts with a maximum efficiency to mix up the stuff being drilled through and form it into removable slush. For this reason the ordinary drilling bit is far superior to the ordinary reamer now in use in cleaning out a hole beneath the casing; and it is sometimes necessary to first clean out the hole beneath the casing with an ordinary bit and then to ream out with a reamer on this account. With my reamer both operations can be accomplished at once.

My reamer consists essentially of a hollow mandrel or bowl carrying two cutters pivoted thereto and extending upwardly thereinto. The major part of the constructive difficulty of my arrangement is centered around the placement of the cutters within the bowls in such a manner that the cutters interlock within the bowl and with the bowl to prevent their dropping out, and also in such a manner as to provide solid bearing shoulders for the support of the cutters when in use. All of these features, and others of more or less nature of detail, will be best understood from the following specification and the accompanying drawings, in which—

Figure 1 is a side elevation of my improved under-reamer. Fig. 2 is an enlarged fragmentary longitudinal section showing the working parts of the same. Fig. 3 is a cross section taken on line 3—3 of Fig. 2. Fig. 4 is a cross section taken on line 4—4 of Fig. 2. Fig. 5 is a cross section taken on line 5—5 of Fig. 2. Fig. 6 is a cross section taken on line 6—6 of Fig. 2.

In the drawings 5 designates a mandrel or bowl of suitable size and proportions, the proportions illustrated being those for an under-reamer designed to pass through a seven and five eighths inch casing, with the cutters expansible to a diameter of ten inches below the casing. Mandrel 5 is of plain hollow cylindrical form, being provided with a stub 6 on its upper end for connection to a string of drilling tools in the usual manner. Located at a suitable distance above the lower end of the mandrel is a pivot pin 7 on which the cutters are mounted. Cutters 8 are of the size and configuration shown in Figs. 1 and 2, having cutting portions 9 extending below the mandrel and having upward extensions 10 within the mandrel. The lower end of the mandrel is shouldered in some such manner as shown in Fig. 2 at 11 and similar shoulders on the cutters bear against shoulders 11. These shoulder pieces are arranged circumferentially around pin 7, so that, on the swinging motion of the cutters around the pins, the shoulder surfaces will remain in true engagement with each other. Within the mandrel and up to a point directly above pivot pin 7, extensions 10 of the cutters are practically semicylindrical—with the exception that surfaces 12 on these portions must be beveled away from the inner surface of the mandrel to the extent shown in Fig. 2, so that the cutters may be allowed to swing inwardly toward each other. In their expanded position, it will be seen that surfaces 13 bear flatly and solidly against the inner surface of the mandrel, thus preventing the cutters from being spread apart. Surfaces 13 extend from a point adjacent the lower end of the mandrel to a point opposite pivot pin 7; and another set of surfaces 14 extend from points above pivot pin 7 to the upper ends of extensions 10. Surfaces 14 bear against the opposite sides of the interior surfaces of the mandrel from the sides borne against by the surfaces 13. Surfaces 13 extend only to a diametral plane at right angles to pin 7; but surfaces 14 are enlarged and extend equally on both sides of this diametral plane by reason of an extending flange or web on both of extensions 10, this flange being shown at 15.

At the upper ends of extensions 10 are placed outwardly projecting lugs 16, these lugs being formed integrally with the cutters and their extensions. Lugs 16 project outwardly from the mandrel through slots 17. Slots 17 extend from points just above lugs 16 to points above pivot pin 7. Below lugs 16 the slots are closed by means of members 18 held in place by small pins 19. These members 18, are of such extent that lugs 16 bear downwardly on them when the lugs are in the position shown in Fig. 2. By this means the weight of the cutters is borne by a solid shoulder contact under the lugs, and all weight is taken off of pin 7. A heavy spring 20 serves to keep lugs 16 apart and to thereby expand the cutters at their lower cutting ends. The cutters are contracted by pressing inwardly on lugs 16, the outermost points of the lugs being slightly above the outer surface of the mandrel when the lower parts of the cutters are completely contracted. It will thus be seen that it is impossible to drop the cutters out of the mandrel, as the lower parts of the cutters coming into contact with each other prevent the lugs 16 from ever leaving engagement with members 18. The cutters are consequently always supported; and it is impossible to lose a cutter unless both pin 7 is sheared off and lug 16 is broken. This is highly improbable.

In view of the fact that it is impossible to remove the cutters from a mandrel without breaking the cutters, with the parts arranged as shown, it has been necessary to adopt special means for removing the cutters from the mandrel and for placing them therein. This means is provided in members 18, which are removable, and in the provision of extensions 10 of the configuration shown. Members 18 may be removed by removing pins 19; and it will then be seen that both cutters may be moved together downwardly when pin 7 is removed. This downward motion of the cutters in the mandrel may be continued until lugs 16 engage with the lower ends of slots 17. When the cutters reach this position the proportions and dimension of the parts are such that points 25 on the extensions 10 have reached positions opposite the lower end of the mandrel. This allows each cutter to be then moved horizontally sufficiently to disengage the lugs 16 from the slots 17, when both cutters may again be moved downwardly and out of the mandrel. Spring 20 is removed initially through the top of the mandrel; it may be replaced by compressing it and driving it down to position between the two lugs 16.

It is seen that there is ample provision to prevent the cutters dropping out of the mandrel; in fact the cutters can only be lost unless they or the mandrel are broken in several places. As the structure is extremely strong, such a breakage would be practically the equivalent of breaking a solid drill.

To resist the shocks of drilling, the cutters are firmly shouldered against the mandrel and against one another. The shoulders at 11 provide ample surfaces for the downward pound of the mandrel on the cutters, while each of the cutters is shouldered against the other by a surface 30 on the lower end of each of extensions 10 bearing on the upper end of each of cutting portions of cutters 9.

Lower portions of the cutters are formed somewhat after the design shown in Fig. 6, being each provided with extending lips 31 which pass each other and thereby more or less connect the lower portion of the cutters. These lips may extend to the lower ends of the cutters, or may extend to a point slightly above the lower ends, as is illustrated in Fig. 1. This may be arranged to suit different drilling conditions.

Having described my invention, I claim:

1. An under-reamer, comprising a slotted hollow mandrel, a pair of cutters pivoted within the mandrel and extending below the same, upward extensions from the cutters, and lugs on the upper ends of the extensions and projecting out through the slots in the mandrel.

2. An under-reamer, comprising a hollow mandrel having longitudinal slots through opposite walls, a pivot pin extending across the interior of the mandrel below the bottoms of and perpendicularly to the plane of said slots, a pair of cutters mounted on the pivot pin and extending downwardly out of the mandrel, upward extensions on the cutters, and lugs on the upper ends of the extensions and projecting out through the slots in the mandrel.

3. An under-reamer, comprising a hollow mandrel having longitudinal slots through opposite walls, a pivot pin extending across the interior of the mandrel below the bottoms of and perpendicularly to the plane of said slots, a pair of cutters mounted on the pivot pin and extending downwardly out of the mandrel, inter-engaging shoulders on the lower end of the mandrel and the cutters, upward extensions on the cutters, and lugs on the upper ends of the extensions and projecting out through the slots in the mandrel.

4. An under-reamer, comprising a hollow mandrel having longitudinal slots through opposite walls, a pivot pin extending across the interior of the mandrel below the bottoms of and perpendicularly to the plane of said slots, a pair of cutters mounted on the pivot pin and engaging downwardly out of the mandrel, inter-engaging shoulders on the lower end of the mandrel and the cutters, upward extensions on the cutters, lugs on the upper ends of the extensions and pro-

jecting out through the slots in the mandrel, and a compression spring arranged between the lugs.

5. An under-reamer, comprising a hollow mandrel having longitudinal slots through opposite walls, a pivot pin extending across the interior of the mandrel below the bottoms of and perpendicularly to the plane of said slots, a pair of cutters below the mandrel and on opposite sides of a vertical plane determined by the axis of the pivot pin, upward extensions on each of the cutters surrounding and supported by the pivot pin and lying one on each side of the vertical plane of said slots, a shoulder on the lower end of each extension and engaging with the upper end of the other cutter, interengaging shoulders on the lower end of the mandrel and the upper ends of the cutters, each of said extensions extending to points adjacent the upper end of the slot opposite the cutter carrying that extension and being of such configuration as to bear against the inner wall of the mandrel adjacent that slot and to be spaced from the opposite wall, lugs mounted on the upper ends of the extensions and extending outwardly through the upper portions of the slots, and members placed in the lower portions of the slots below the lugs.

6. An under-reamer, comprising a slotted hollow mandrel, a pivot pin extending across the mandrel near its lower end, a pair of cutters arranged below the mandrel and having extensions projecting upwardly thereinto surrounding and supported by the transverse pivot pin, the extensions being arranged on opposite sides of an axial plane of the mandrel perpendicular to the pivot pin, means for forcing the said extensions apart, and lugs on the upper extensions of the cutters projecting through the slots in the mandrel.

7. An under-reamer, comprising a slotted hollow mandrel, a pivot pin extending across the mandrel near its lower end, a pair of cutters arranged on opposite sides of a plane determined by the axes of the mandrel and the pivot pin, an extension on each of the cutters projecting upwardly into the mandrel and surrounding the pivot pin, the said extensions being arranged on opposite sides of a plane determined by the axis of the mandrel and perpendicular to the pivot pin, and lugs on the upper extensions of the cutters projecting through the slots in the mandrel.

8. An under-reamer, comprising a hollow mandrel having slots through its walls above its lower end, a pair of cutters below and extending up into the mandrel being medially pivoted near the lower end of the mandrel, and lugs on the upper ends of the cutters extending out through said slots.

9. An under-reamer, comprising a hollow mandrel having slots through its walls above its lower end, a pair of cutters below and extending up into the mandrel being medially pivoted near the lower end of the mandrel, and lugs on the upper ends of the cutters extending out through said slots, the lugs resting on the bottom walls of the slots to support the cutters in the mandrel.

In witness that I claim the foregoing I have hereunto subscribed my name this 8th day of April 1911.

WARREN WAGNER.

Witnesses:
JAS. H. BALLAGH,
JAMES T. BARKELEW.