C. S. WRIGHT.

UNDERREAMER.

APPLICATION FILED APR. 20, 1920.

1,387,032.

Patented Aug. 9, 1921.

2 SHEETS—SHEET 1.

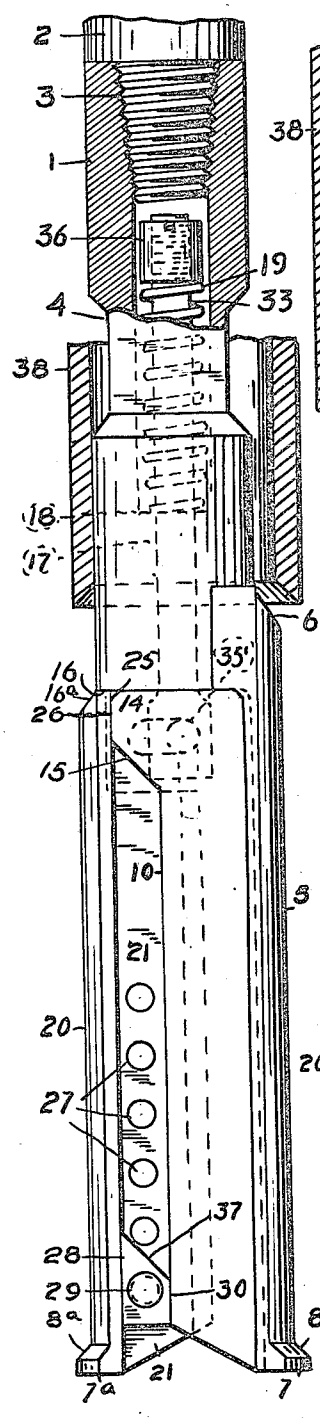


Fig. 1

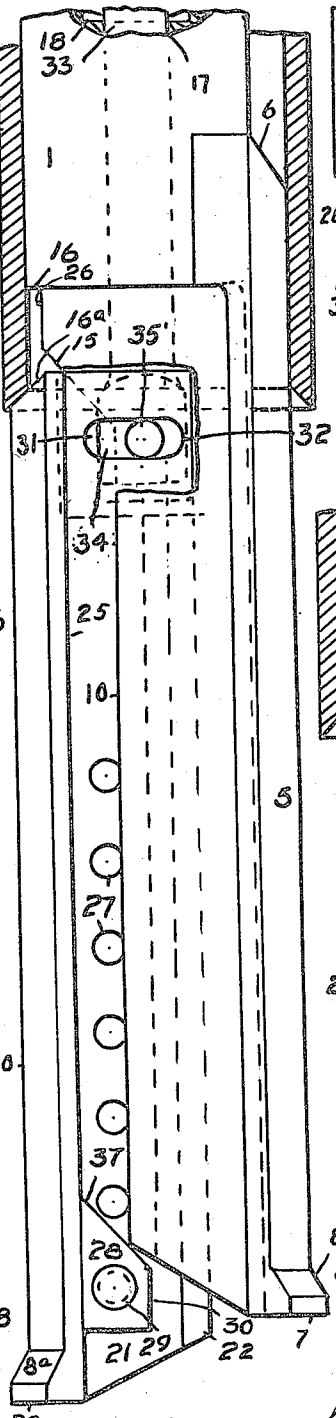


Fig. 2

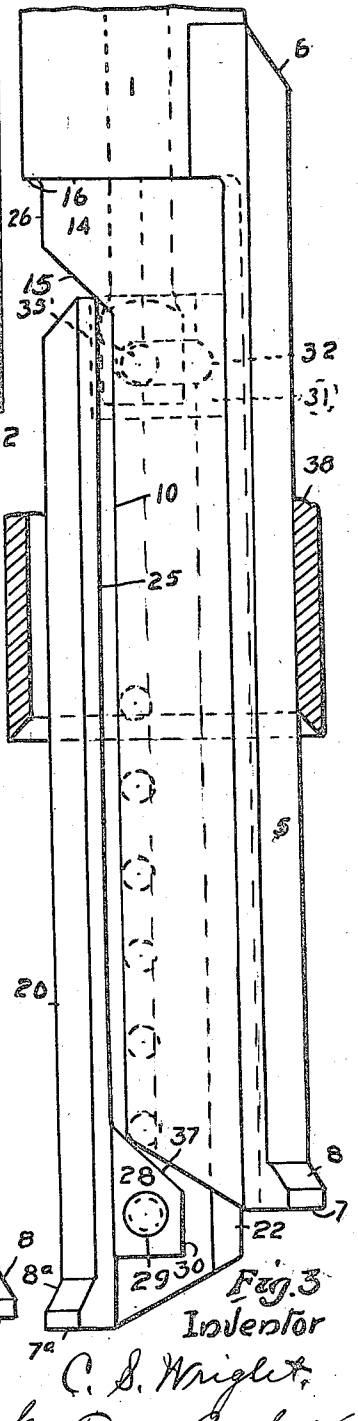


Fig. 3

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2 SHEETS—SHEET 2.

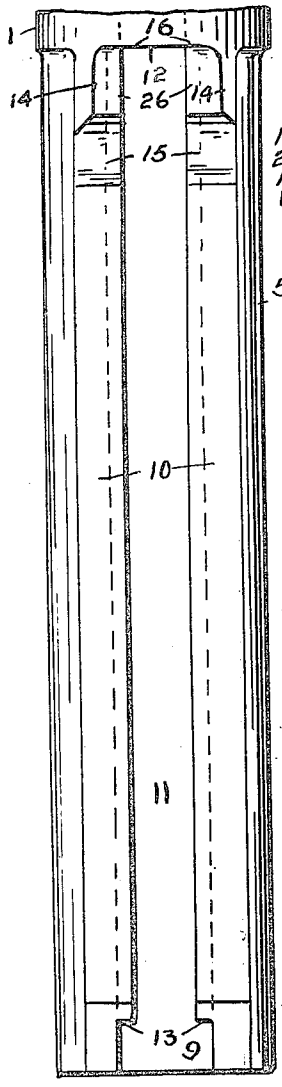


Fig. 4

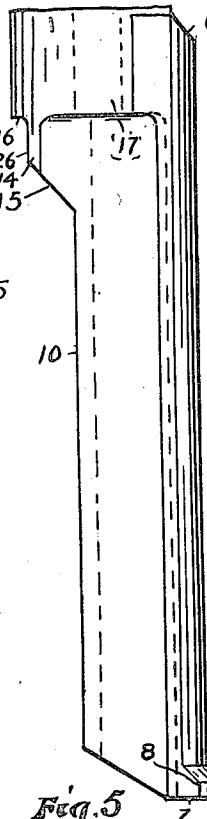


Fig. 5

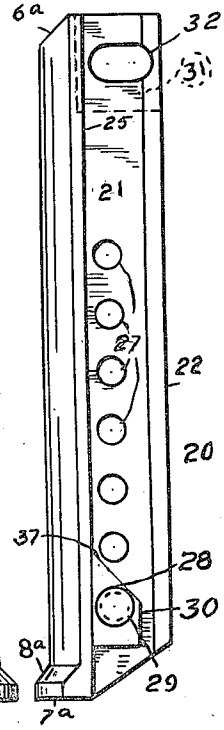


Fig. 6

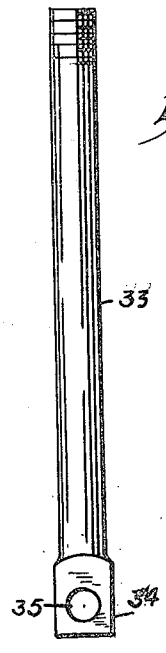


Fig. 11

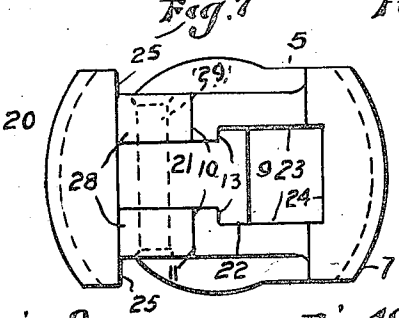


Fig. 7



Fig. 12

Fig. 8

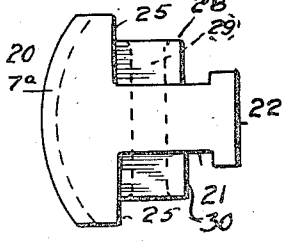


Fig. 9

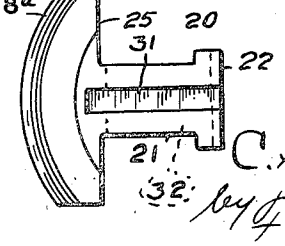


Fig. 10

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UNITED STATES PATENT OFFICE.

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UNDERREAMER.

1,387,032. Specification of Letters Patent. Patented Aug. 9, 1921.

Application filed April 20, 1920. Serial No. 375,273.

To all whom it may concern:

Be it known that I, CLYDE S. WRIGHT, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented new and useful Improvements in Underreamers, of which the following is a specification.

My invention relates to expanding underreamers for enlarging the diameter of wells below the casing.

The object of this invention is to provide an underreamer with one bit or cutter integral with the body of the underreamer, the other bit or cutter being collapsible by moving downwardly and inwardly or longitudinally and transversely. Another object is to provide an expanding underreamer which may be employed also in drilling the well deeper like an ordinary solid bit. Another object is to prolong the life of the tool as compared with the life of the usual tool with two movable bits. Other objects appear hereinafter.

Referring to the accompanying drawings, Figure 1 is a side elevation of an underreamer embodying my invention, the casing shoe being shown in vertical section and broken off,—in this figure the parts of the tool are in drilling positions. Fig. 2 is a view similar to Fig. 1, but with the movable bits partly collapsed; Fig. 3, a similar view, but with the movable bit fully collapsed; Fig. 4, an elevation of the tool body; Fig. 5, an elevation of the tool body, the view being at right angles to that of Fig. 4; Fig. 6, a side elevation of the movable bit; Fig. 7, a bottom plan view of Fig. 1; Fig. 8, a bottom plan view of Fig. 5; Fig. 9, a bottom plan view of Fig. 6; Fig. 10, a top plan view of Fig. 6; Fig. 11, a side view of the bit-suspending rod; and Fig. 12, a bottom plan view of Fig. 11.

On the drawings, 1 designates the body of the underreamer, 2 the sub, 3 the usual box-and-pin connection for the body and the sub, and 4 the flats on the body for the application of a wrench. The lower end of the body has the extension constituting the fixed bit 5, preferably integral with the body. The bit 5 has its outer face rounded transversely on the arc of a circle and extending outwardly beyond the face of the body. This rounded surface extends upward a short distance above the lower end of the body into which it merges by the downwardly and outwardly inclined shoulder 6. The lower end of the bit has the outwardly extending reaming flange 7 connected to the body of the bit by the downwardly and outwardly inclined shoulder 8. The lower end of the bit may be shaped to suit the particular purposes, whether of reaming or drilling or both.

The bit 5 is provided with the longitudinal hole 9, here shown rectangular in cross-section, extending up to the body 1. The inner face 10 of the bit is provided with the slot 11 opening into the hole 9. The inner face 10, which is directly opposite the outer face of the bit, lies considerably within the downward continuation of the body and is preferably parallel with the axial center of the body. The slot 11 terminates above at the horizontal shoulder 12 which may be considered the lower end of the body 1. The slot 11 is somewhat narrower than the adjacent side of the hole, whereby the two longitudinal internal shoulders 13 are provided at the sides of the slot. The side walls of the slot 11 have the wider portions 14 above, these portions being connected to the face 10 below by the upwardly and outwardly extending inclined faces 15. Above the faces 15 the portions 14 have the faces 26 which extend up to the body parallel with the face 10. The portions 14 do not extend out quite to the outer face of the body, but leave the shoulders 16 at the bottom of the body 1 and in line with the shoulder 12.

17 is an axial opening in the body 1. It extends from the bottom of the pin-and-box connection 3 to the hole 9 and the slot 11, its upper part being enlarged to provide the seat 18 for the coiled spring 19.

The movable bit 20 has its outer face shaped the same as the outer face of the bit 5, and has the flange 7^a and the inclined shoulder 8^a corresponding to the flange 7 and inclined shoulder 8 of the bit 5. It has the top inclined shoulder 6^a corresponding to the shoulder 6 of the bit 5, but it is at a lower position than the shoulder 5. The bit 20 in working position has its upper end seated on the shoulder 12 on the lower end of the body while the shoulder 6 is somewhat above this end of the body. When in working position the bit 20 has its outer face extending beyond the body 1, the shoulder 6^a tapering up to the top of the bit 20 or

to the bottom of the body 1. The bit 20 has the web 21 which extends through the slot 11 and has its inner edge provided with the double-flanged head 22 seated against the shoulders 13 when the bit is in expanded or working position. This head preferably engages the sides 23 of the hole 9 adjacent to the shoulders 13, but there is considerable space between the head and the opposite wall 24 of the hole 9 when the bit 20 is fully expanded, as shown in Fig. 7.

On the rear face of the bit 20 and adjacent to the web 21 are the two shoulders 25 preferably parallel with the face 10 when the bit 20 is fully expanded or collapsed. The upper ends of these shoulders rest on the faces 26 and travel up or down the inclined faces 15 as the bit 20 is moved to the position shown in Fig. 1 from that shown in Fig. 3, or to the position shown in Fig. 3 from that shown in Fig. 1.

The web 21 is provided with a vertical series of holes 27. Spreader blocks 28 are placed against the sides of the web 21 and the shoulders 25 and secured to the web by the rivet 29 which is passed through the blocks, one at each side of the webs, and the lowest hole 27. Each block is as wide as the distance between the faces 10 and the shoulders 25 when the bit 20 is in working position, in which position the inner faces 30 of the blocks rest on the faces 10 to maintain the bit in its expanded or working position. The upper faces 37 of the blocks are inclined downwardly and inwardly so as to be parallel with the faces 15 when the bit is expanded as in Fig. 1. The faces 26 and 30 have equal length, the faces 10 terminating at the lower ends of the faces 30, from which the bottom of the bit 5 is inclined downwardly and outwardly.

The upper end of the bit 20 has the slot 31 open upwardly in the web 21 and the head 22. A hole 32 intersects the slot 31 and is elongated transversely. The suspension rod 33 has the flattened lower end 34 with the hole 35.

To assemble the underreamer, the end 34 of the rod 33 is placed in the slot 31 and the pin 35′ is placed through the alined slot 32 and the hole 35, the length of the pin being the distance between the sides 23 of the hole 9. The free end of the rod is then inserted in the lower end of the hole 9, and the rod and bit 20 are moved longitudinally, the rod passing through the hole 17 and the spring 19 and the head 22 moving in the hole 9 and the web 21 in the slot 11. When the bit and rod are at their uppermost position, the nut 36 is screwed on the rod and against the top end of the spring so as to compress the same somewhat.

When the tool is to be inserted into a well, the movable bit 20 is drawn down by any suitable means and moved inwardly toward the bit 5, as shown in Fig. 3, and then put into the upper end of the well casing and pushed downwardly, the spring 19 causing the bits to engage the well-casing. As the inclined shoulder 6 passes below the casing, the tool is moved laterally by the action of the bit 20 reacting against the side of the well, the bit 20 moving upwardly under the action of the spring and outwardly under the action of the inclined shoulders 15 and 37 until the bit is in full working position as shown in Fig. 1.

When the tool is to be withdrawn from the well, an upward pull is exerted on the sub 2. The shoulder 6 first engages the lower end of the casing shoe 38, and moves the tool toward the bit 20. Soon the inclined shoulder 6^a contacts with the casing-shoe, which holds the bit 20 back while the remainder of the tool proceeds upwardly. When the tops of the shoulders 25 reach the inclined shoulders (at which time the tops of the faces 30 reach the bottom of the faces 10), the upper end of the bit 20 begins to move inwardly toward the bit 5 until the distance between the outer faces of the bits equals the internal diameter of the shoe 38. Then the bits move up together. When the shoulder 8^a engages the shoe the lower end of the bit 20 is swung inwardly and the bit 20 retained, if necessary, until the bit is further moved inwardly to allow the flanges 8 and 8^a to be moved into the shoe. During the lateral movement of the bits the slot 32 rides on the pin 35′ without affecting the constant strain of the spring on the bit 20. As the bits become worn away the blocks 28 may be reset by removing the rivet 29 and securing them by a fresh rivet in the next hole 27 above the one from which the old rivet was taken.

The bit 5 may be used alone for drilling if desired.

I claim:

1. In an underreamer, a body, a fixed underreaming bit carried thereby at its lower end, a complementary underreaming bit movable longitudinally and laterally from its working position to its collapsed position, and yieldable means tending to move the movable bit toward its working position when displaced therefrom.

2. In an underreamer, a body, a fixed underreaming bit on the lower end of the body, a complementary underreaming bit movable longitudinally and laterally to its working and collapsed positions, a reciprocable rod seated in an opening in the body above the movable bit and suspending the movable bit, a spring surrounding the rod, and means causing the spring to exert a pull on the rod tending to move the movable bit toward its working position when displaced therefrom.

3. In an underreamer, a body having a longitudinal opening, a fixed underreaming

bit on the lower end of the body, a complementary underreaming bit movable longitudinally and laterally to its working and collapsed positions, a rod reciprocable in the hollow body, means for moving the movable bit laterally when it is moved longitudinally, a rod reciprocable in the longitudinal opening, a pin-and-slot connection between the rod and the movable bit, and a spring tending to move the rod and the movable bit to their working positions when displaced therefrom.

4. In an underreamer, a body having a longitudinal opening, a fixed underreaming bit having a longitudinal hole and a longitudinal slot communicating with the hole and the inner face of the bit, a complementary underreaming bit movable longitudinally and laterally and having a web in said slot and a head in said hole, the relative cross-sections of the head and the hole and width of the web permitting the movable bit to move transversely, means for moving the movable bit longitudinally, and means for causing the movable bit to move laterally away from the fixed bit when moved from collapsed to working position.

5. In an underreamer, a body having a longitudinal opening, a fixed underreaming bit having a longitudinal hole and a longitudinal slot communicating with the hole and the inner face of the bit, a complementary underreaming bit movable longitudinally and laterally and having a web in said slot and a head in said hole, the relative cross-sections of the head and the hole and width of the web permitting the movable bit to move transversely, means for moving the movable bit longitudinally, and means for causing the movable bit to move laterally away from the fixed bit when moved from collapsed to working position, and permitting the movable bit to move laterally toward the fixed bit when moved from working position to collapsed position.

6. In an underreamer, a body, a fixed underreaming bit carried by the lower end of the body, a movable underreaming bit, a head-and-slot connection between the bits permitting longitudinal and limited transverse movement of the movable bit, and a reciprocable spring actuated rod in the body having a pin-and-slot connection with the movable bit and tending to move the movable bit toward the body portion of the underreamer.

7. In an underreamer, a body, a fixed underreaming bit carried by the lower end of the body and having a longitudinal slot at its inner face, a movable bit having a web movable longitudinally and transversely in the slot, means carried by the web for controlling the transverse movements of the movable bit, and means for resetting the first means at a higher position on the web to compensate for the removal of portions of the lower end of the bit.

8. In an underreamer, a body, a fixed underreaming bit carried by the body, a longitudinally and transversely movable complementary underreaming bit, means carried by the body for moving the movable bit longitudinally, and means controlling the lateral movements of the lower end of the movable bit, and adjustable to compensate for the removal of portions from the lower ends of the bits.

9. In an underreamer, a body, a fixed underreaming bit carried by the lower end of the body, a complementary underreaming bit movable longitudinally and transversely and having a web longitudinally of its inner face, the web having a longitudinal series of openings, a cam-block on the web for controlling the lateral movements of the movable bit, and removable means passing through the cam-block and the lowest of said openings for securing the cam-block to the web.

Signed at Toledo, Ohio, this 12th day of April, 1920.

CLYDE S. WRIGHT.