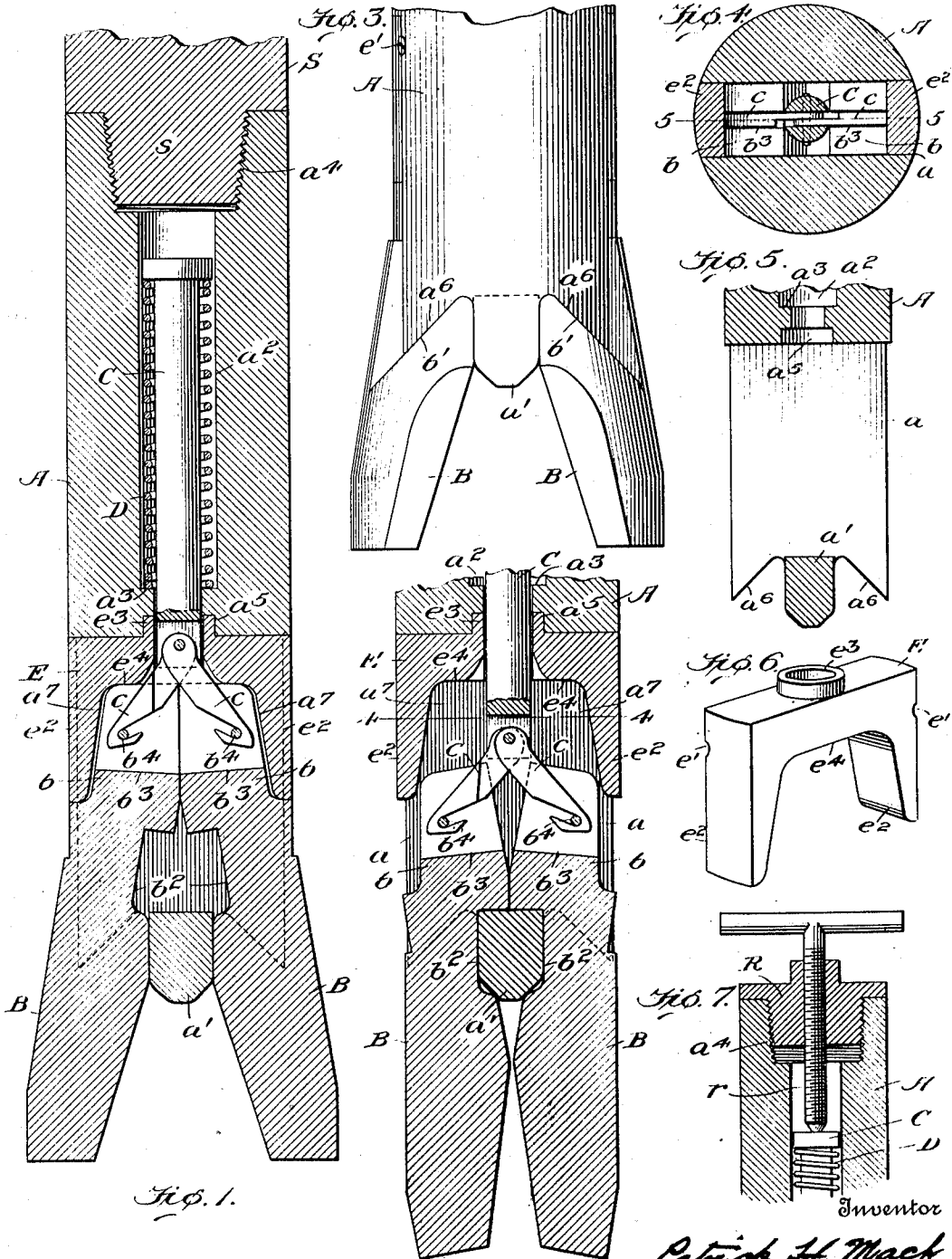


P. H. MACK.  
UNDERREAMER.  
APPLICATION FILED DEC. 10, 1909.

982,513.

Patented Jan. 24, 1911.



Witnesses  
Edwin L. Bradford  
J. P. Ritter

Fig. 2.  
By

Inventor  
Patrick H. Mack  
J. W. Ritter Jr.  
Attorney

# UNITED STATES PATENT OFFICE.

PATRICK H. MACK, OF BRADFORD, PENNSYLVANIA, ASSIGNOR TO OIL WELL SUPPLY COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## UNDERREAMER.

982,513.

Specification of Letters Patent.

Patented Jan. 24, 1911.

Application filed December 10, 1909. Serial No. 532,387.

*To all whom it may concern:*

Be it known that I, PATRICK H. MACK, a citizen of the United States, residing at Bradford, in the county of McKean and State of Pennsylvania, have invented certain new and useful Improvements in Underreamers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the construction of that class of devices used in drilling oil and Artesian wells, commonly termed underreamers, having for their purpose the enlargement of the diameter of the well to accommodate the casing.

Tools of this class are introduced and withdrawn through the casing and the cutters or bits thereof are necessarily collapsible to facilitate the passage of the underreamer through the casing.

Generally considered the combining elements of all underreamers comprise a stock or mandrel, cutters or bits movable with relation to the stock, and means for maintaining the bits expanded and in operative relation with the stock.

Of the two prevailing types of underreamer classified as above, the sliding connection between the stock and bits in one type is effected by means of dovetailed ways, and in the other type by a socket in the stock for the reception of the tangs of the bits, and in both types the bits are suitably connected with a spring which maintains the bits in their expanded and operative position.

My invention relates more especially to that type wherein the stock or mandrel is socketed for the reception and control of the tangs of the movable bits, and has for its objects such a construction of the stock as will facilitate and cheapen its production without weakening or complicating the structure, and also the provision of such a connection between the spring and bits as will facilitate the assembling of the combining elements as well as the removal of the bits when desired. To effect the first of said purposes I form the stock with a straight or through slot which leaves the distance block, or portion of the stock which maintains the bits in their expanded or operative position, as an integral part of the stock, and I insert in said slot a separate socket mem-

ber which constitutes the socket for the reception of the tangs of the bits, and such a construction embodies one feature of my invention. To effect the second of said purposes, I interpose between the bits and the spring which actuates the bits pivoted hooks for detachably connecting said bits and spring, and such a construction embodies a second feature of my invention.

There are other, minor, features of invention, embracing particular combinations and features of elemental construction, all as will hereinafter more fully appear.

In the drawings chosen for the purpose of illustrating my invention, the scope whereof is pointed out in the claims, Figure 1 is a longitudinal central section of an underreamer embodying my invention, the bits being shown as in the expanded or operative position. Fig. 2 is a sectional view similar to Fig. 1, with the bits in collapsed position to permit of the underreamer being passed through the casing. Fig. 3 is a view, in elevation, of the lower end of the underreamer stock and the bits, showing the character of the abutments at the lower end of the stock, and the engagement of the shoulders of the bits therewith. Fig. 4 is a transverse section of the underreamer taken on the plane of the line 4-4, Fig. 2. Fig. 5 is a longitudinal central section of the lower end of the stock taken on the plane of the line 5-5, Fig. 4, the bits omitted. Fig. 6 is a detached perspective view of the socket block of the underreamer. Fig. 7 is a detail view showing a means for compressing the actuating spring for the bits at such times as the bits are to be applied to or removed from the stock.

Like symbols refer to like parts wherever they occur.

I will now proceed to describe my invention more fully so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates the stock and B, B the bits of an underreamer.

The stock A has just above its lower end a transverse slot *a* which is of rectangular form, extends entirely through the stock, and constitutes the bit chamber of the stock. The side walls of the slot *a* are connected below by the transverse bridge portion, which constitutes the distance block *a'*, or that portion of the stock which maintains

the bits in their expanded or operative position, and which is integral with the stock.

$a^2$  indicates a central bore for the reception of a spring actuated rod C with which the bits B, B are connected, said bore provided with a shoulder or seat  $a^3$  for the lower end of a rod actuating spring D. The upper end of the stock A is enlarged in diameter and threaded as at  $a^4$  to constitute the box whereby the stock A is secured to the pin  $s$  of the usual hub S employed for connecting the underreamer with the drill rod or tube.

Where the bore  $a^2$  of the stock enters the transverse slot  $a$  of the stock it is preferably enlarged or counterbored as at  $a^3$  to receive a nipple  $e^3$  on the upper side of the socket block E. The lower end of the stock A on both sides of the distance block  $a'$  is beveled or inclined inwardly and upwardly to form the inclined abutments  $a^6$  for the reception of the shoulders  $b'$  of the bits B.

E indicates a socket block of a form adapted to be inserted and secured in the upper end of transverse slot  $a$ , and said block is secured in said slot by screws which pass through the edges of the block and stock as at  $e'$  or in any other suitable manner. This socket block E is of general U shape, or of such shape that its portions  $e^2$ ,  $e^2$  when in position in the transverse slot  $a$  of the stock, shall co-act therewith to form a socket  $a'$  for the reception of the tangs  $b$  of the bits.

The upper portion of the socket block E is perforated for the passage of the rod C to which the bits are attached, and said perforation is surrounded by an annular projection or nipple  $e^3$  which enters the counterbore or enlarged mouth  $a^5$  of the bore  $a^2$  in order to support the socket block E against lateral strain.

The under surface  $e^4$  of the socket block E constitutes the abutment for the upper ends of the bit tangs  $b$ , and the pendent portions  $e^2$ ,  $e^2$  afford a lateral support to the bit tangs, the bit tangs  $b$ ,  $b$  engaging in the axis of the stock so as to mutually support each other.

It is to be noted that the rectangular shape of slot  $a$  permits of the easy machine finish of the walls of said slot, while at the same time great strength of stock is secured having the distance block  $a'$  integral therewith, and it will be also noted that by reason of the shape of said slot the tang socket  $a'$  of the stock is secured by means of a block which being separable from the stock, can also be readily and cheaply shaped and machine finished.

B, B indicate the bits or cutters of the underreamer. These bits are provided with tangs  $b$  which extend up into the socket  $a'$  of the stock when the bits are in operative position and with upwardly and inwardly inclined shoulders  $b'$  which engage the abut-

ments  $a^6$  on the lower end of the stock A. The inner faces of the tangs  $b$  of bits B are cut back as at  $b^2$  to accommodate the distance block when the bits are in the lower or collapsed position shown in Fig. 2 of the drawing, and the upper ends of tangs  $b$  are slotted as at  $b^3$  for the reception of the hooks  $c$   $c$  pivoted on the spring-actuated rod C, which hooks engage pins  $b^4$  extending across the slots  $b^3$ .

$c$ ,  $c$  indicate hooks pivoted on the spring-actuated member C and adapted to engage the pins  $b^4$ ,  $b^4$  in the slotted upper ends of the bit tangs  $b$ , and thus establish a flexible connection between the bits and actuating spring of a character which will not interfere with the tilting of the bits in passing to and from the collapsed and operative positions of said bits.

In Fig. 7 is shown means for facilitating the assembling of the parts of the underreamer and for applying the bits to and removing them from the stock. This means as shown comprises a threaded stub R adapted to be screwed into the box  $a^4$  of the stock A and a screw rod  $r$  which passes through the stub R and is adapted to engage the upper end of the member C when in position in the stock A.

The several parts of the underreamer being of the character hereinbefore pointed out, said parts may be assembled as follows: The socket block E is inserted in the slot  $a$  of stock A, and secured by screws as indicated at  $e'$ . The spring D is placed on the rod C and the rod and spring inserted in the bore  $a^2$  of the stock with the lower end of spring D resting on the shoulder  $a^3$  of the bore. The stub R is then screwed into box  $a^4$  of the stock and the screw rod  $r$  is operated to force the member C down until its lower end projects into the socket  $a'$  of the stock A sufficiently far to permit the pivotal attachment of the hooks  $c$   $c$  and member C to be made, after which the bits B B may be entered in the slot  $a$  of the stock, and the hooks  $c$   $c$  caused to engage the pins  $b^4$  in the slots  $b^3$  of tangs  $b$ . When the screw rod  $r$  is retracted, the expansion of spring D will draw the tangs  $b$   $b$  of the bits B. B up into the socket  $a'$  of the stock A, and in the upward movement of the bits they will be spread into operative position by the distance block  $a'$  of the stock, the shoulders  $b'$  of the bits will engage the inclined abutments  $a^6$  at the lower end of the stock, and the upper ends of the tangs  $b$  will abut on the under surface  $e^4$  of the socket block E, in which operative position the parts will be maintained by the action of the spring and distance block. The stub R may then be removed from box  $a^4$  of the stock until such time as it may be desired to remove the bits B, B for sharpening or for replacing the same.

The parts of the underreamer being in the normal or operative position, as shown in Fig. 1 of the drawing, when it is desired to introduce the underreamer into the casing, the bits B B will be drawn down and temporarily secured in the position shown in Fig. 2 of the drawing, in which condition the bits B B will be entered in the casing and the securing device removed to release the bits. The casing will retain the bits in collapsed position while the underreamer is passing therethrough, but as the bits B B escape from the lower end of the casing the expansion of spring D will cause the bits to again assume the operative position, as shown in Fig. 1 of the drawing.

When the underreamer is to be withdrawn from the casing, the upward pull on the stock A will bring the outer surfaces of the bits into engagement with the lower end of the casing and the bits will be held until the upward movement of the stock brings the distance block *a'* opposite the recesses *b' b'* on the inner faces of the tangs *b*, whereupon the bits will collapse or assume the position shown in Fig. 2 of the drawing, in which condition the underreamer can be withdrawn through the casing.

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

1. A slotted underreamer stock, having a distance block integral with the stock, and adapted to extend between and maintain underreamer bits in operative position and an inserted socket-block.

2. In an underreamer, the combination of a slotted stock having abutments and a distance block adapted to extend between and

support the underreamer bits, said distance block integral with the stock, an inserted socket-block, and bits slidable on the stock and having tangs which enter the socket-block.

3. In an underreamer, the combination of a slotted stock having a socket for the reception of the tangs of the bits, a distance-block at its lower end and abutments adjacent thereto, bits slidable on the bit stock, a spring for actuating the bits, and pivoted hooks interposed between the bits and spring for actuating the bits.

4. In an underreamer, the combination of a slotted bit stock having abutments and a distance-block integral with the stock, an inserted socket-block, bits slidable on the stock and having tangs which enter the socket-block, a spring for actuating the bits, and hooks interposed between the spring and bits.

5. In an underreamer, the combination with a stock having a central bore, a rectangular slot extending through the stock and intersecting the bore, and a distance-block adapted to extend between and maintain underreamer bits in operative position, said distance block integral with the stock, of an inserted socket block of general U-shape and provided with an annular projection or nipple adapted to enter the bore of the stock.

In testimony whereof I affix my signature, in presence of two subscribing witnesses.

PATRICK H. MACK.

Witnesses:

G. P. RITTER,

CHARLES LOWELL HOWARD.