

Oct. 23, 1923.

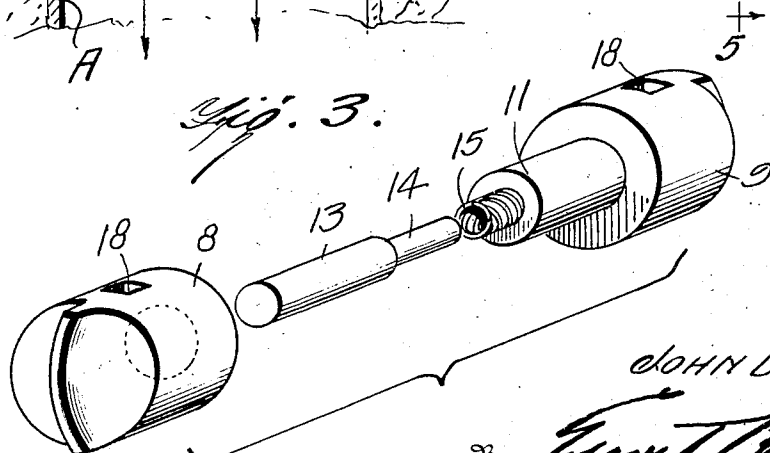
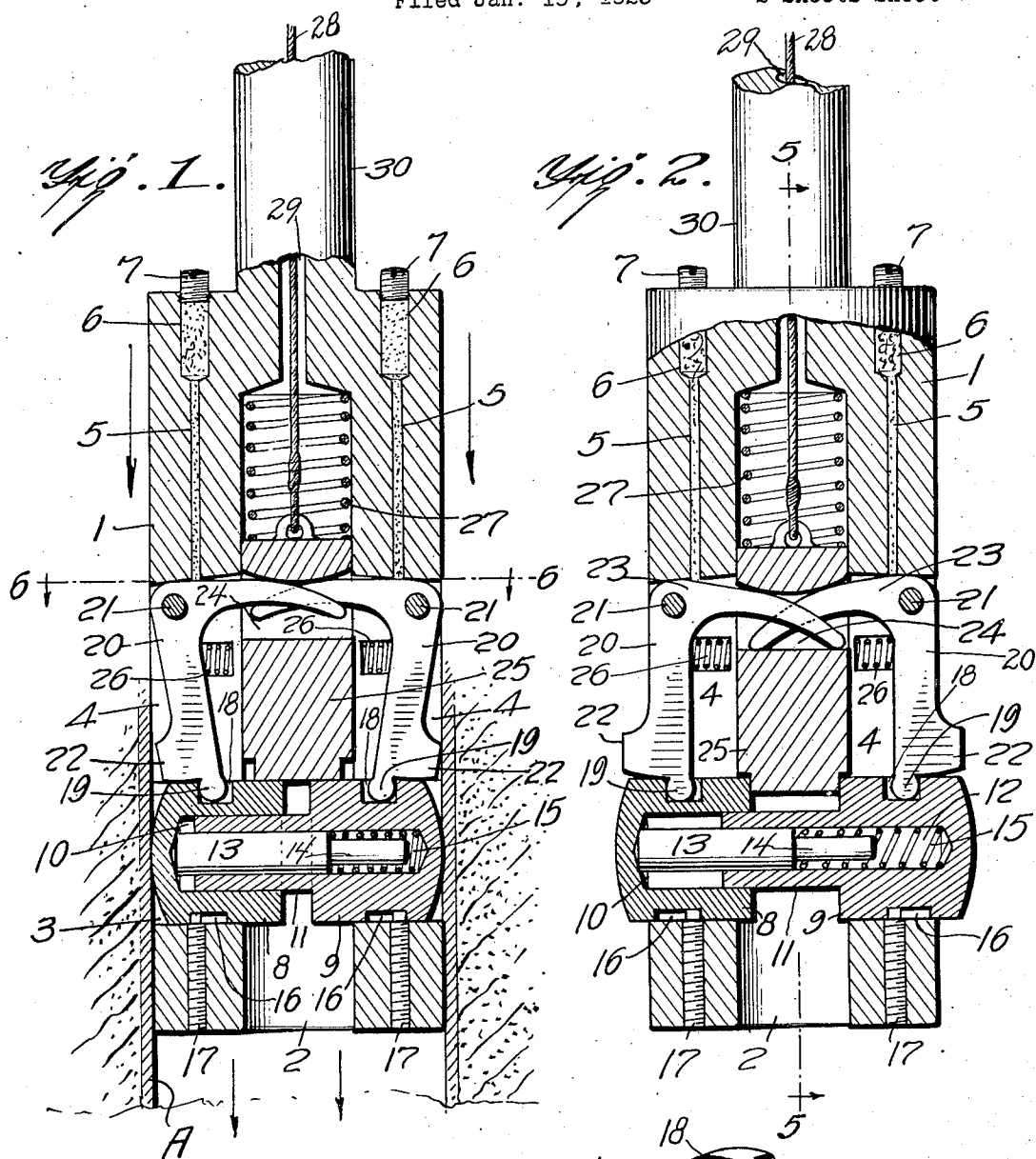
1,471,808

J. D. RUSS

UNDERREAMER

Filed Jan. 19, 1923

2 Sheets-Sheet 1



Inventor

JOHN D. RUSS,

By

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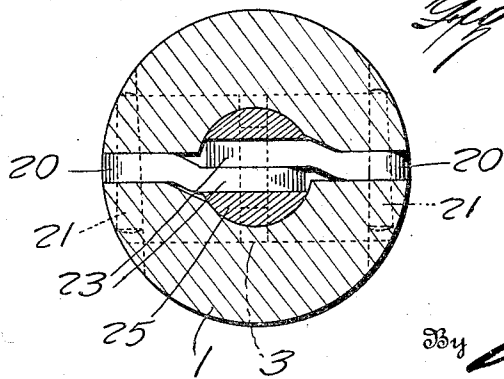
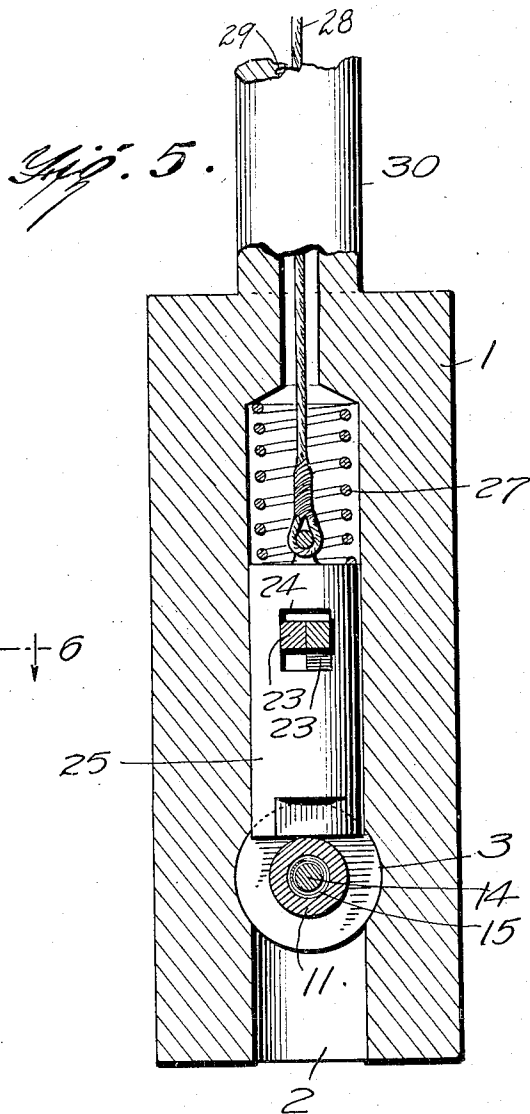
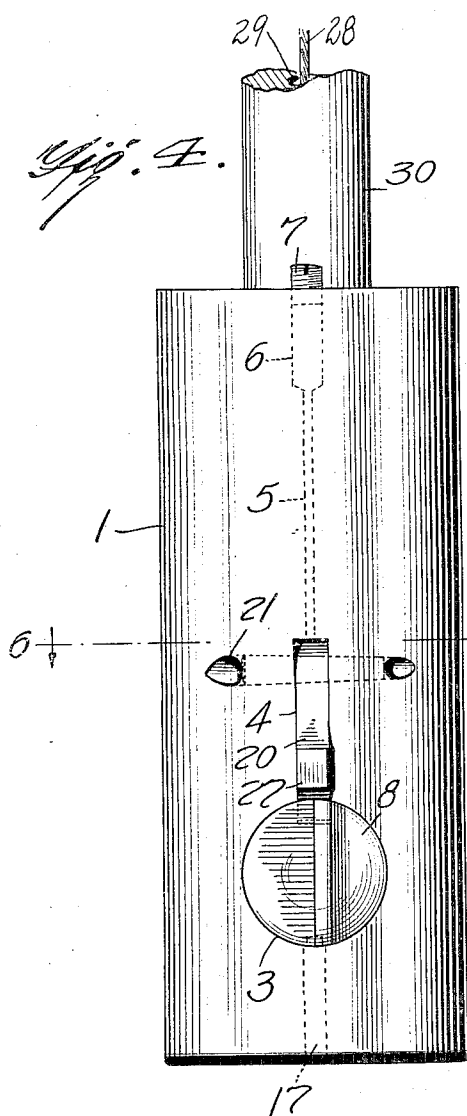
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UNDERREAMER

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE.

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## UNDERREAMER.

Application filed January 19, 1923. Serial No. 613,719.

*To all whom it may concern:*

Be it known that I, JOHN D. RUSS, residing at Spencer, county of Roane, State of West Virginia (whose post-office address is Spencer, W. Va.), a citizen of the United States, have invented certain new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to well-drilling machinery and, particularly, to devices intended for under-reaming, that is, reaming out or enlarging the well-hole in order to permit the casing to be lowered farther down.

In certain localities in this and foreign countries, where the operation of drilling oil, gas, or artesian wells is carried on, broken and cavey strata of rock must be drilled through, and these formations are encountered at various depths. Where such a formation is reached in the usual method of drilling, further attempt to drill the hole deeper in the usual way is useless, due to the caving in of rock and other substances around the drilling tools, thus retarding the action thereof. A line of casing or pipe must then be put into the well to afford protection for the tools, in the further effort to complete the well to the required depth; this can only be accomplished by the alternate use of the drilling tools and an under-reamer operating through said line of casing or pipe.

An under-reamer of the expansible type comprises a body or stock adapted to be attached to or otherwise carried by the drilling-stem or shaft, and supporting one or more bits or dogs having cutting edges, the bits being adapted to be compressed or retracted to the internal diameter of the reamer body and to automatically expand or distend as they are passed down through and out of the casing or pipe, and thus present a cutting surface of sufficient diameter to permit the casing being lowered as the operation of under-reaming proceeds.

My invention has for its basic object to provide an under-reamer, of the expansible type, which is of simplified construction and which produces improved results, and which, generally stated, comprises a cylindrical stock carrying a pair of radially-movable bit-carrying members associated with means for automatically moving said mem-

bers radially outward when they pass beneath the lower end of the casing, in combination with means for automatically locking said members in expanded position during the underreaming operation.

The invention, in its preferred form, will be better understood by a consideration of the accompanying drawings, forming part of this specification, in connection with the detailed description of the construction and operation hereinafter appearing.

The different views of the under-reamer, shown in the drawings, may be briefly described as follows:

Figure 1 is a view in longitudinal section of my under-reamer, the drill-stem being shown in elevation; the movable parts carried by the under-reamer stock being shown in the positions which they occupy when the stock is being projected downward in the well-casing and before the bit-carrying members pass beneath the lower end thereof;

Figure 2 is a similar view, showing, however, the movable parts carried by the under-reamer stock in the positions which they occupy when the bit-carrying members have passed out of the lower end of the well-casing;

Figure 3 is a collective detail view, in perspective, of the bit-carrying members and the plunger and spring carried axially by said members;

Figure 4 is a view in side elevation of the under-reamer;

Figure 5 is a sectional view on the plane of the section line 5—5, Fig. 2; and

Figure 6 is a transverse section on the plane of the section-line 6—6, Fig. 4, looking in the direction of the arrows indicated thereon.

Referring, now, in detail to the drawings:

1 designates the under-reamer stock, which, as usual, is cylindrical, as shown, and which is provided with an axial bore 2 intersected, toward one end thereof, by a diametric rectilinear opening 3; with diametrically oppositely disposed slots 4, 4; and with lubricant-ports 5, 5 extending longitudinally and provided, at one end thereof, with enlarged portions 6, 6 closed at the outer ends by screw-caps or plugs 7, 7.

Slidably disposed in the opening 3 are a pair of radially movable, bit-carrying members 8, 9, the member 8 being provided with

an axial socket 10, and the member 9 with an axially-projecting stem 11 fitting and movable in said socket. The stem is provided with a longitudinal bore 12, receiving a  
 5 plunger 13 having an axially projecting stem 14, encircling which and bearing at its ends against the inner end of said plunger and the end wall of said bore 12 is a coiled spring 15, functioning to maintain  
 10 one end of the plunger 13 in constant contact with the end wall of the socket 10 in the bit-carrying member 8, and to force said members 8 and 9 away from each other, when said spring is under compression. Each  
 15 of said members 8 and 9 is provided with a longitudinally-extending groove 16, receiving the end of a screw 17 threaded into one end of the stock 1, whereby the movement of said members 8 and 9 toward and  
 20 away from each other is limited.

It may be here stated that the exterior end surfaces of the members 8 and 9 may be formed to provide cutters, in which case the cutters would be integral with the mem-  
 25 bers 8 and 9, or said ends may have secured to them bits or cutters, in any preferred manner.

Each of the members 8 and 9 is provided, diametrically opposite the groove 16, with  
 30 a peripheral recess 18, receiving the toe 19 laterally carried by a lever 20 received in the slot 4 and suspended on the pivot pin 21 carried by the stock 1 and provided, toward the end thereof opposite such pivoted  
 35 end, with an outward-projecting cam portion 22. Each lever 20 is provided, at the pivotal end thereof, with an angular finger 23 projecting into a diametric opening or slot 24 in a mandrel 25 slidable in the bore  
 40 2 of the stock 1. A coiled spring 26 may be associated with each lever 20, and, as shown in the drawing, this spring is carried within the stock 1 and bears, at one end thereof, against the inner longitudinal face  
 45 of the lever, tending to swing the latter outward on its pivot 21.

A coiled spring 27 is disposed in the bore 2, at the inner end thereof, and bears, at one end, against the end wall of said bore  
 50 end, at its other end, against the adjacent end of the mandrel 25, tending to force the mandrel constantly downward.

In operation, to insert the stock 1 in the top of the well-casing A, the levers 20, 20  
 55 are forced inward from the position thereof shown in Fig. 1, and this may be accomplished either by forcibly bearing against the outer longitudinal faces of said levers  
 60 by the hands of the operator, or by pulling on a cord 28, which may be provided, and which, in such case, will be attached to one end of the mandrel 25, the rope passing out  
 65 through an axial bore 29 in the shaft or rotatable spindle 30, which is driven from

any suitable source of power, as usual. It will be recognized that, as the levers 20, 20 are forced inward, as indicated, by the hands of the operator, the lever-fingers 23, 23 are  
 70 rocked upward, these, in turn, forcing the mandrel 25 upward, withdrawing the lower end of the latter from between the members 8, 9. Owing to the play of the toes 19 of the levers 20 in the recesses 18,—the levers having a lost-motion connection with  
 75 said members 8, 9,—the first inward pressure by the hands of the operator against the levers 20, 20 causes the fingers of the levers to force the mandrel 25 upward to remove the lower end thereof from a position between the members 8, 9; thereupon,  
 80 further pressure against said levers causes the toes 19 to strike the inner end walls of the recesses 18, 18 in the members 8, 9 and thus force the latter toward each other  
 85 against the influence of the spring 15. The movable parts are now in the position shown in Fig. 1, which may be called the retracted position of said parts; and the stock 1 may be forced down the well-casing A. Now,  
 90 as soon as the members 8, 9 pass out from the lower end of the well-casing, into the cavity which is formed by jacking up the well-casing, the spring 15 functions to move the members 8, 9 away from each other into  
 95 what may be called their expanded position; and, as soon as the members 8, 9 separate sufficiently to permit the plunger or mandrel 25 to pass between them, the spring 27 forces the mandrel 25 downward with its lower  
 100 end between the members 8, 9.

When it is desired to withdraw the under-reamer, the stock 1 is drawn upward in the usual way, and the upper curved cam edges of the projections 22 of the levers 20,  
 105 20 riding into contact with the lower end of the well-casing A, said levers are progressively forced inward, the first movement inward of said levers forcing the mandrel 25 upward so that its lower end is removed from between the members 8, 9, continued movement of the levers inward causing the toes 19 of said levers to bear forcibly  
 110 against the inner end wall of the recesses 18 in the members 8, 9, thereby forcing said members 8, 9 inward or toward each other.

While I have shown and described the spring 27 for forcing the mandrel 25 downward, it is to be understood that this spring is not, in fact, essential, and, therefore, may be eliminated, and the force of gravity be  
 115 depended upon to move the mandrel from the position shown in Fig. 1 to the position shown in Fig. 2, when the cutter-bearing members 8 and 9 move apart sufficiently to permit the mandrel to pass therebetween. When the spring 27 is not used, the mandrel  
 120 25 should be of sufficient weight to permit it to drop quickly between the members 8 and 9 when the latter are moved apart.

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

1. In an under-reamer, the combination  
5 of a tubular stock, a pair of cutter-bearing  
members slidable diametrically in said stock  
and adapted to move outward away from  
each other, so as to project beyond the  
circumference of said stock, a spring-  
10 pressed mandrel automatically positionable  
between said members after outward move-  
ment thereof, and lever-connections between  
said mandrel and said members and each  
having a cam projection engageable with  
15 the lower end of a well-casing.

2. In a under-reamer, the combination  
of a tubular stock, a pair of cutting-bearing  
members slidable diametrically in said stock  
and adapted to move outwardly away from  
20 each other, so as to project beyond the cir-  
cumference of said stock, a mandrel posi-  
tionable between said members after out-  
ward movement thereof, and lever-connec-  
tions between said mandrel and members.

3. In an under-reamer, the combination  
25 of a tubular stock, a pair of cutter-bearing  
members slidable diametrically in said stock  
and adapted to move outwardly away from  
each other, so as to project beyond the cir-  
30 cumference of said stock, a slotted mandrel

positionable between said members after  
outward movement thereof, and levers car-  
ried by said stock and projecting into the  
slot of said mandrel and engageable with  
said members.

4. In an under-reamer, the combination  
35 of a tubular stock, a pair of cutter-bearing  
members slidable diametrically in said stock  
and adapted to move outward away from  
each other, so as to project beyond the cir-  
40 cumference of said stock, each of said mem-  
bers having a peripheral recess, a slotted  
mandrel positionable between said members  
after outward movement thereof, and levers  
carried by said stock and projecting into the  
45 mandrel-slot and into said recesses of said  
members.

5. In an under-reamer, the combination  
of a tubular stock, a pair of telescoping, cut-  
ter-bearing members slidable diametrically  
50 in said stock and adapted to move outward  
away from each other, so as to project be-  
yond the circumference of said stock, spring  
means for forcing said members outward,  
and a mandrel automatically positionable  
55 between said members after outward move-  
ment thereof.

In testimony whereof I hereunto affix my  
signature.

JOHN D. RUSS.