No. 862,317. PATENTED AUG. 6, 1907.

E. DOUBLE.

UNDERREAMER.

APPLICATION FILED SEPT. 10, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

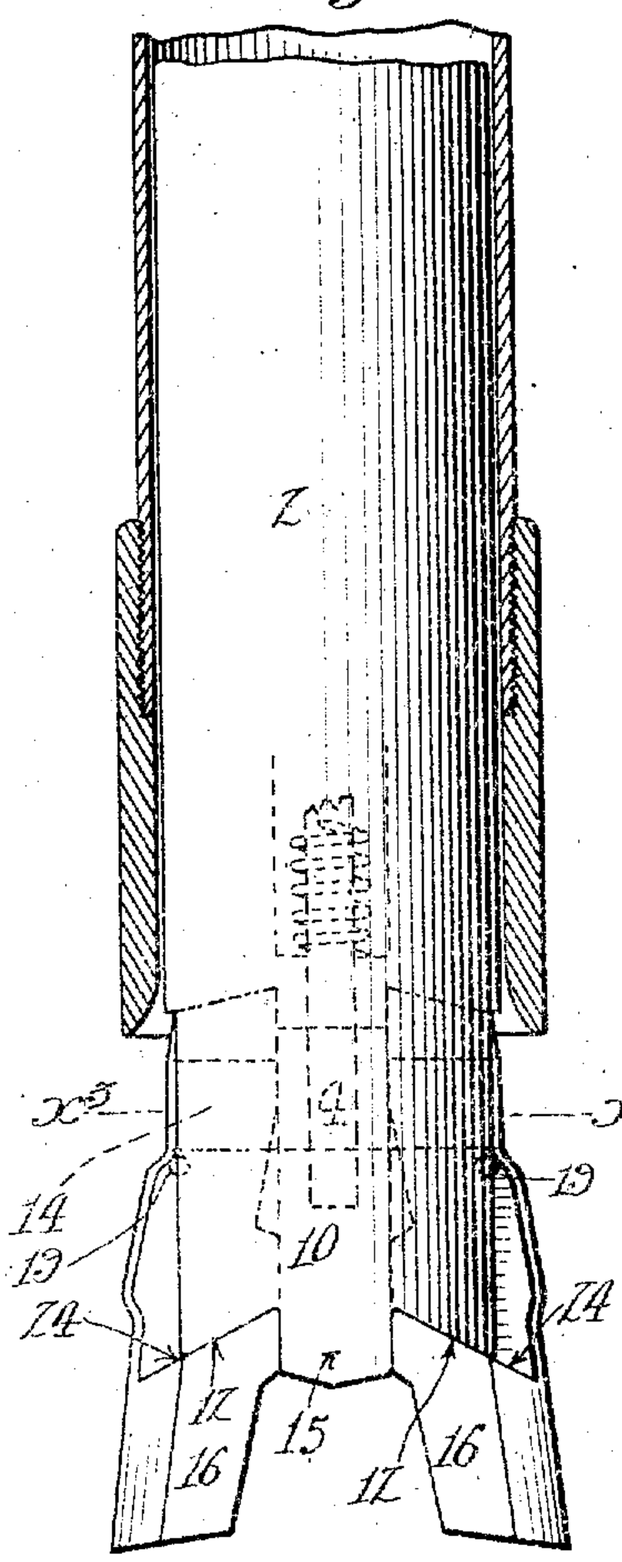


Fig. 2.

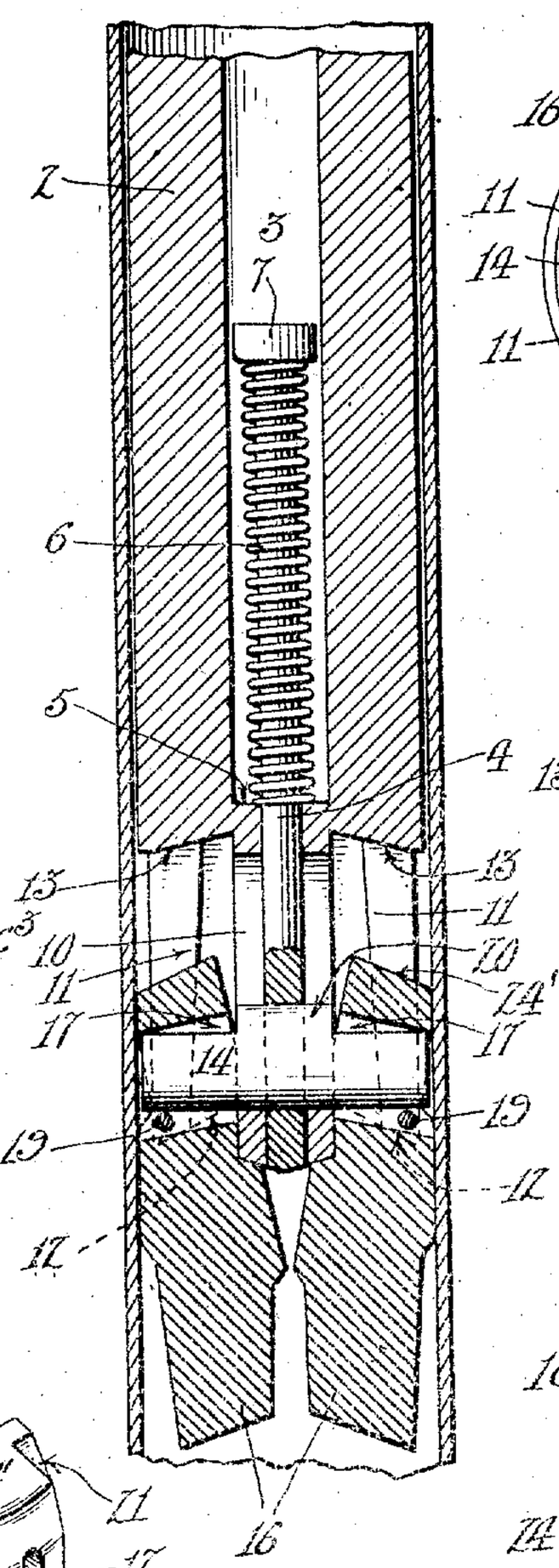


Fig. 3.

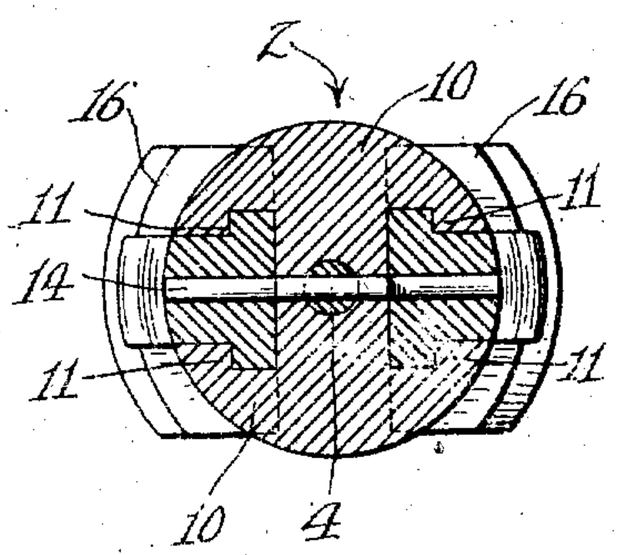


Fig. 4.

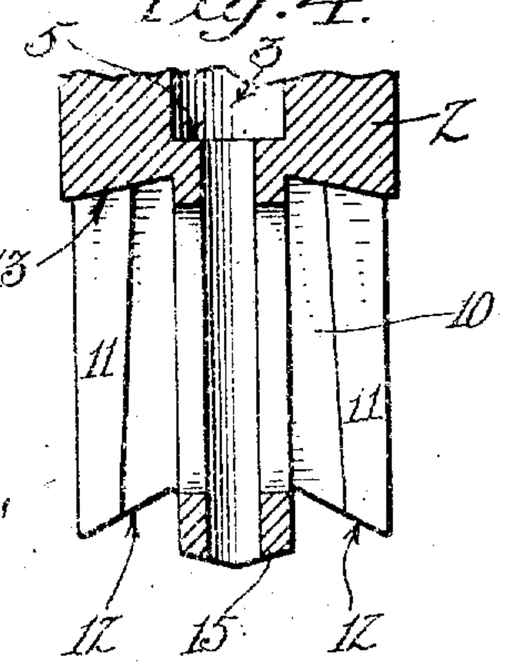


Fig. 5.

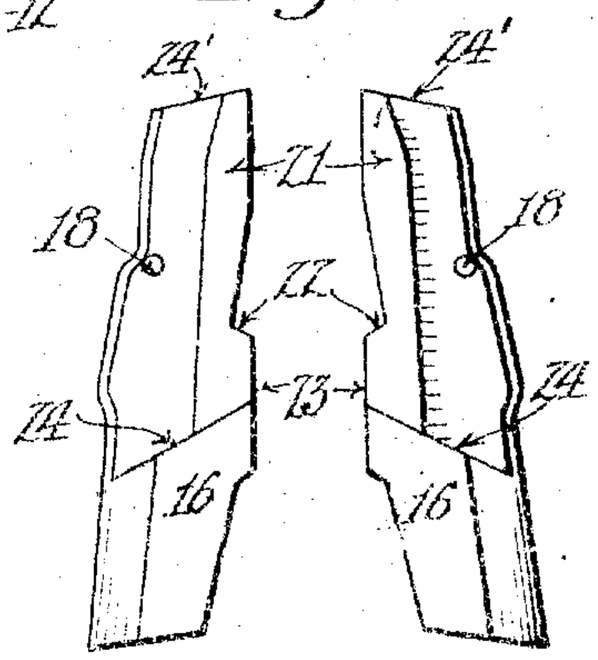
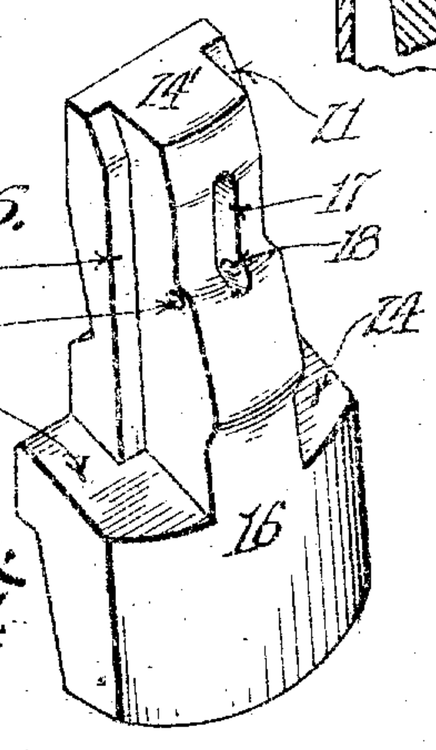


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 7.

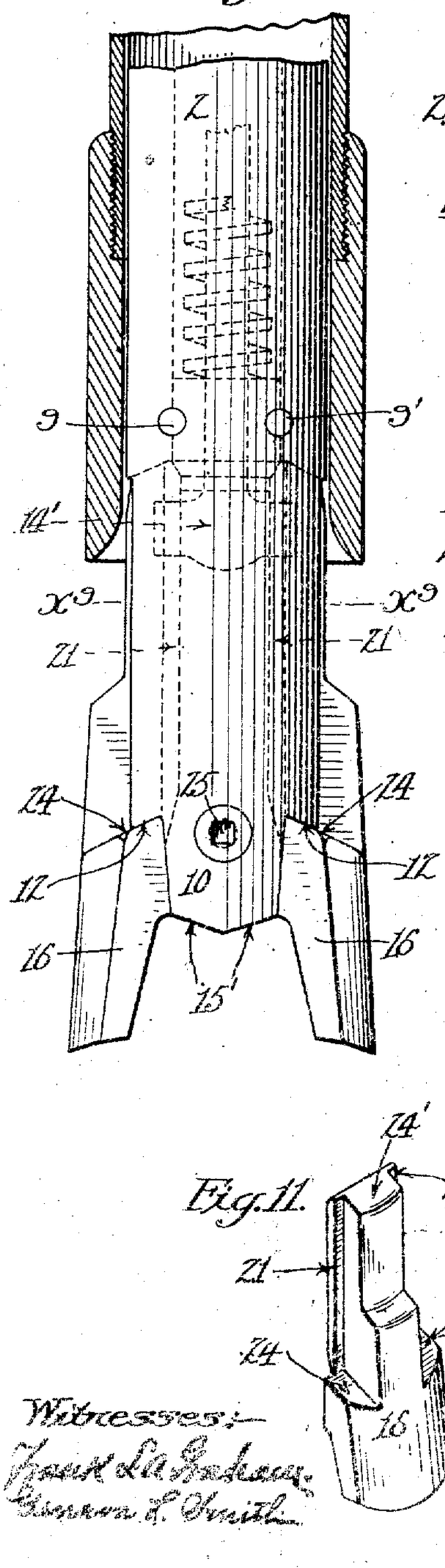

Fig. 8.

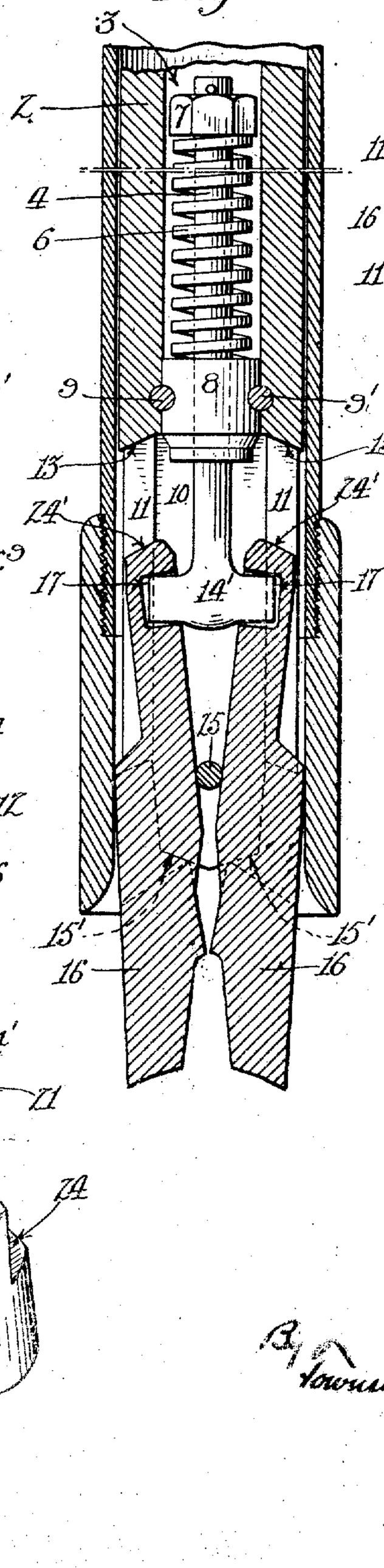

Fig. 9.

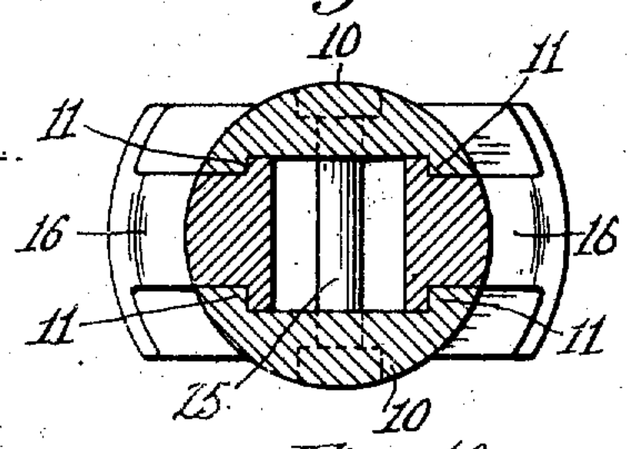

Fig. 10.

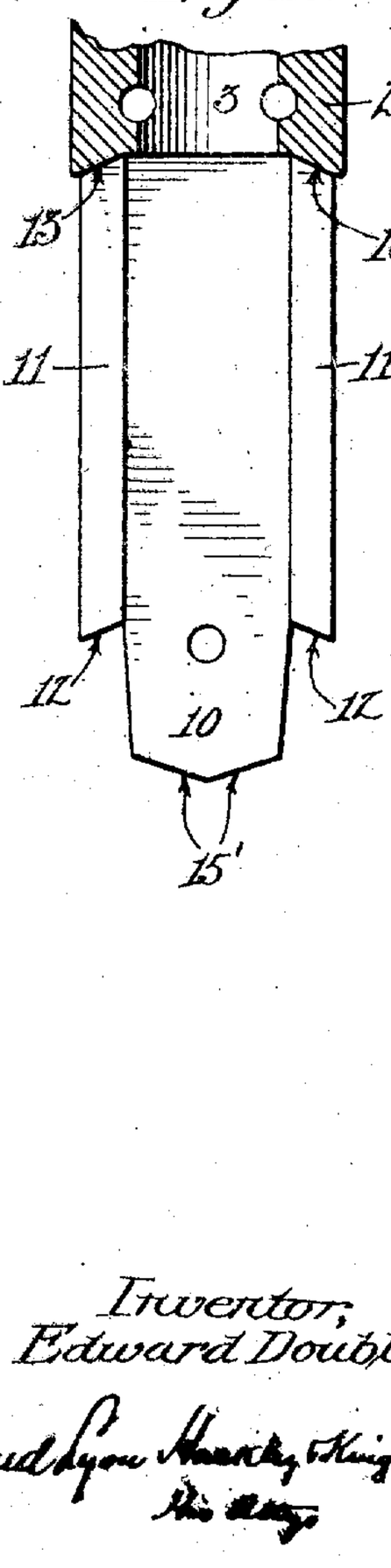

Fig. 11.

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His Attys.

UNITED STATES PATENT OFFICE.

EDWARD DOUBLE, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER.

No. 862,317. Specification of Letters Patent. Patented Aug. 6, 1907.

Application filed September 10, 1906. Serial No. 334,045.

To all whom it may concern:

Be it known that I, EDWARD DOUBLE, a citizen of the United States of America, residing in the city of Los Angeles, in the county of Los Angeles, State of California, have invented certain Improvements in Underreamers, of which the following is a specification.

This invention relates to underreamers for enlarging the bore of wells to permit the lowering of casing.

The object of this invention is to provide an underreamer which, when expanded to working position, shall possess the maximum strength, and in which the shock or impact shall be taken up by heavy solid portions of the body and bits or jaws and entirely removed from those portions of the reamer necessarily weakened to permit the jaws to expand and contract when the tool is lowered into and raised out of the well hole.

A further object of the invention is to render the expansion and contraction of the jaws certain and eliminate all possibility of the loss of the moving elements or parts in the well hole.

Preferably my improved underreamer comprises a body or mandrel having a central bore or chamber providing an open chamber within which longitudinally movable jaws or bits may tilt or swing to permit of their pivotal movement in expanding or contracting, and a hollow slotted extension or lower end, the two sides or wings of which are provided with shoulders forming dovetail ways, terminating at their upper or inner ends in inwardly inclined abutments on the mandrel proper, a spring actuated rod mounted in said bore or chamber, and jaws or bits pivotally mounted on said rod and provided with dovetail shoulders adapted to travel along said dovetail ways of the wings of the mandrel, and with portions adapted to contact with the lower end of the mandrel and thereby expand, the upper ends of the shanks of said bits or jaws having inwardly inclined surfaces corresponding to and adapted to bear upon said inwardly inclined abutments when the jaws are expanded, inwardly inclined shoulders being provided on the bits to bear against the corresponding inclined abutments formed at the extreme end of said slotted extension or lower end of the mandrel.

The invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification and in which:—

Figure 1 is a side elevation of an underreamer embodying my invention, the same being shown with the bits or jaws projecting out of a well casing and in expanded position, the upper end of the mandrel being broken away. Fig. 2 is a longitudinal sectional view of an underreamer embodying my invention, the same being shown within a well casing. Fig. 3 is a sectional plan view on the line x^3—x^3 of Fig. 1. Fig. 4 is a longitudinal sectional view of the mandrel, the upper portion of which is broken away, the view showing particularly the interior dovetail ways on the inner faces of one side or wing of the hollow extension or slotted end of the mandrel, and the inclined abutments at the inner or upper end of the dovetail ways and the inwardly inclined abutments at the extreme lower end of the mandrel. Fig. 5 shows side elevations of the jaws or bits, Fig. 6 is a perspective view of one of the jaws or bits. Fig. 7 is a side elevation of another embodiment of my invention, the same being shown with the bits or jaws in expanded position outside the well casing, the upper end of the mandrel being broken away. Fig. 8 is a longitudinal sectional view of the underreamer of Fig. 7. Fig. 9 is a sectional plan view taken on the line x^9—x^9 of Fig. 7. Fig. 10 is a longitudinal sectional view of the mandrel, the upper portion of which is broken away, the view showing particularly the interior dovetail ways on the inner faces of one side or wing of the hollow extension or slotted end of the mandrel, and the inclined abutments at the inner or upper ends of the dovetail ways and the inwardly inclined abutments at the lower end of the mandrel. Fig. 11 is a perspective view of one of the bits or jaws of Figs. 7—9.

In the drawings, 2 represents the mandrel proper which is provided with the usual screw threaded pin (not shown) at its upper end to screw into the socket of the "sub."

3 represents the central chamber or bore in which the spring actuated rod 4 is mounted. This bore terminates, preferably in a shoulder 5 (Figs. 2 and 3) against which the spring 6 coiled about the rod 4, bears the rod 4 operating through a reduced opening or bore. The upper end of the spring 6 bears against the head 7. (It is of course understood that the head 7 if desired may be in the form of a nut screwed onto the end of the rod 4). In Figs. 7 and 8 I have shown a block 8 which is removably held in the lower end of the bore 3 by dowel pins 9, 9′, this block being provided with a central bore through which the rod 4 operates. Slightly below this shoulder 5, (Figs. 1, 2 and 4) or block 8, (Figs. 7, 8 and 10) I provide a hollow slotted extension of the mandrel proper, forming however an integral part and the lower end of the mandrel of the reamer. This extension has two similar sides or wings 10, provided on their inner faces with dovetail ways 11. These dovetail ways 11 are preferably inclined as shown in Figs. 1, and 4. These wings terminate in inwardly inclined shoulders or abutments 12 and similar inwardly inclined shoulders or abutments 13 are on the end of the mandrel proper at the upper ends of the dovetails 11 and between the wings or sides of the hollow extension.

In Figs. 1 and 2 I have shown the rod 4 as provided with a separate head or key 14, which in Figs. 7 and 8 the head or key 14′ is shown integral with the rod 4. I prefer however to use the removable head or

key 14 and to provide an integral bar 15 bridging between the sides or wings 10 of the hollow extension, thus forming a shoulder preventing the loss of the rod 4 from the underreamer if the head 7 should break or if the nut (if used in place of the integral head) should unscrew and become detached. This also prevents the simultaneous loss of the bits in the well hole, as hereinafter set forth. The lower surface of the bar 15 may be double inclined, as shown, to enable me to utilize this surface as a means for causing the expansion of the bits or jaws. Where such bar 15 is not provided the extreme ends of the wings 10 are each double inclined for this purpose, as shown at 15′ in Figs. 7 and 9.

The jaws or bits 16 are provided with sockets 17 somewhat larger than the head or key 14 to permit the pivotal movement or tilting of the bits or jaws. When a removable key 14 is used I p er to provide the bits with holes 18 located just above the line of the lower edge of the head or key 14, when in place, and to insert pins 19 through these holes. As shown in Fig. 2 the removable head or key 14 is provided with an offset or wing 20 on its upper edge. This offset projects above the sockets or key seats 17 and prevents the accidental slipping of the head or key 14 from the rod 4 and bits 16. In order to remove the bits from the reamer it is necessary to first drive out the pins 19.

The upper ends of the shanks are inclined, as at 24′, to correspond with the shoulders 13 and the sides of the shanks and provided with dovetail shoulders 21 to engage the dovetail ways 11 on the sides or wings 10 of the hollow slotted extension of the mandrel proper.

As shown in Figs. 1, 2, 3, 5 and 6, the bits 16 are provided with inclined expansion shoulders 22 and bearing faces 23, and as shown in Figs. 1—3, 5—9 and 11 with inclined shoulders 24 at the sides of the bits, the angle of inclination of these shoulders 24 corresponding with the inclination of the abutments 12 on the wings or sides 10 of the extension of the mandrel.

Preferably when the bar 15 is employed the same is extended up to the body portion of the mandrel proper, and is provided with a center bore in which the rod 4 operates, and also provided with a slot in which the head or key 14 works. Another advantage of this embodiment of my invention is that, as illustrated best in Fig. 3, when the bits are expanded the surfaces 23 bear upon the surfaces of the upward extension of the bar 15 and form substantially a solid bit or drill adapted to withstand the greater strains of underreaming.

With a construction, as shown in Figs. 7—10, wherein the bar 15 is not employed, the shoulders 24 are relied upon to cause the expansion of the bits as the same are drawn up by the spring 6 when the bits have passed out of the well casing, the shoulders 24 then riding up the inclined faces 15′ of the ends of the wings 10 of the extension of the mandrel. In this form a detachable cross piece 25, in the form of a bolt, passes through the wings 10 near their lower ends. This cross piece 25 serves as a brace for the sides or wings of the extension of the mandrel. It also prevents accidental removal or loss of the jaws should the nut 7 become loose or the rod 4 break.

By thus providing the shoulders or abutments 12, 13 inclined or beveled inwardly and upwardly and the corresponding inclined shoulders or surfaces 24, 24′ on the bits or jaws, the impact of the underreamer when at work causes the bits to be forced in towards the center of the mandrel and the strain to be taken at the points of greatest strength, avoiding all possibility of breaking the dovetails.

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

1. A bit or jaw, for an under reamer, having a body portion and a shank, the end of the shank beveled inwardly and upwardly, dovetail shoulders at the sides of the shank, inclined shoulders or abutments extending out laterally beyond the width of the shank and beveled to correspond with the bevel of the end of the shank, and an expansion surface on its inner face.

2. A bit or jaw, for an under reamer, having a body portion and a shank, the end of the shank beveled inwardly and upwardly, dovetail shoulders at the sides of the shank, inclined shoulders or abutments extending out laterally beyond the width of the shank and beveled to correspond with the bevel of the end of the shank, an expansion surface on its inner face, and a head or key seat opening at the inner surface of the shank.

3. A bit or jaw, for an under reamer, having a body portion provided with cutting edges and with an expansion surface or shoulder, and a shank provided with a head or key seat extending through the shank and with holes passing through the shank at the bottom of the key seat to receive key retaining pins.

4. A bit or jaw, for an under reamer, having a body portion provided with inwardly inclined abutments and expansion surface, and a shank having its upper end beveled to correspond with the inclination of said abutments, said shank provided with a key or head receiving seat or socket.

5. An underreamer bit having two inwardly and upwardly inclined shoulders and a bearing-face on the inner side of each of said shoulders.

6. An under reamer bit or jaw having two inwardly and upwardly inclined shoulders and a bearing-face on the inner side of each of said shoulders, and also provided with a socket for the seating of a key or head.

7. An under reamer bit or jaw having two inwardly and upwardly inclined shoulders and a bearing-face on the inner side of each of said shoulders and also provided with a socket for seating a key and with pin-holes at the lower edge of said socket adapted to receive pins to prevent the accidental loss of the key or head from said socket.

8. In an under reamer, a mandrel furnished with a hollow slotted extension, and bits tiltingly and slidingly connected with the mandrel and having their upper ends inwardly and upwardly inclined and also provided with shoulders or abutments inwardly and upwardly inclined, said extension having correspondingly inclined abutments between its wings or sides at its upper end and correspondingly inclined abutments at the lower ends of its wings or sides against which the upper ends and the inclined abutments of said bits bear when expanded.

9. In an under reamer, a mandrel furnished with a hollow slotted extension, and bits tiltingly and slidingly connected with the mandrel and having their upper ends inwardly and upwardly inclined and also provided with shoulders or abutments inwardly and upwardly inclined and also provided with dovetail shoulders, said extension having correspondingly inclined abutments between its sides or wings at its upper end against which the upper ends of the bits are adapted to bear when expanded and correspondingly inclined abutments at the lower ends of its sides or wings against which the inclined abutments of the bits bear when expanded, said mandrel extension provided with dovetail ways on the inner faces of its sides or wings coacting with the dovetail shoulders of the bits.

10. An under reamer mandrel having a central bore and a hollow slotted extension at its bottom, the wings or sides of said extension having dovetail ways on their inner faces and upwardly and inwardly inclined abut-

ments at their lower ends, inwardly and upwardly inclined abutments being formed between the sides or wings of the extension at the upper end thereof.

11. An under reamer mandrel having a central bore and a hollow slotted extension at its bottom, the wings or sides of the extension having inwardly and upwardly inclined abutments at their lower ends, inwardly and upwardly inclined abutments being formed at the upper end of said extension between the sides thereof.

12. An under reamer comprising a mandrel having a central bore and a lower extension consisting of two wings or sides having dovetail ways on their inner faces and having inwardly and upwardly inclined abutments at their ends, a spring actuated rod slidably mounted in the central bore of said mandrel and a head or key therefor, bits or jaws provided with seats or sockets for said key or head permitting said jaws to tilt on said key or head, said bits or jaws provided with dovetail shoulders and with inwardly and upwardly inclined abutments corresponding to and coacting with the dovetail ways and inclined abutments of said mandrel.

13. An under reamer comprising a mandrel having a central bore and a lower extension consisting of two wings or sides having dovetail ways on their inner faces and inwardly and upwardly inclined abutments at their ends, a spring-actuated rod slidably mounted in said central bore, a removable key or head therefor, bits or jaws provided with key-seats or sockets somewhat larger than said key permitting the jaws to tilt on said key, retaining pins passing through the jaws and through the lower portions of the key-seats and preventing the accidental slipping of the key from said rod and seats, said bits or jaws provided with dovetail shoulders and with inwardly and upwardly inclined abutments corresponding to and adapted to coact with the dovetail ways and inclined abutments of said mandrel.

14. An under reamer comprising a mandrel; bits slidingly mounted on opposite sides of a portion of said mandrel and furnished on their inner faces with key-seats, said key seats being somewhat larger than the key on the operating-rod, a spring-actuated operating-rod playing lengthwise of the mandrel and furnished with a key-seat, and a key having a wing or flange at its center mounted in said key-seat on said rod, said bits having retaining pins passing through their key-seats and preventing the accidental removal of said key from said rod or bits.

In testimony whereof, I have hereunto set my hand at Los Angeles California this 4th day of September 1906.

EDWARD DOUBLE.

In presence of—
FREDERICK S. LYON,
FRANK L. A. GRAHAM.