

E. DOUBLE.  
UNDERREAMER.

APPLICATION FILED OCT. 13, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. I

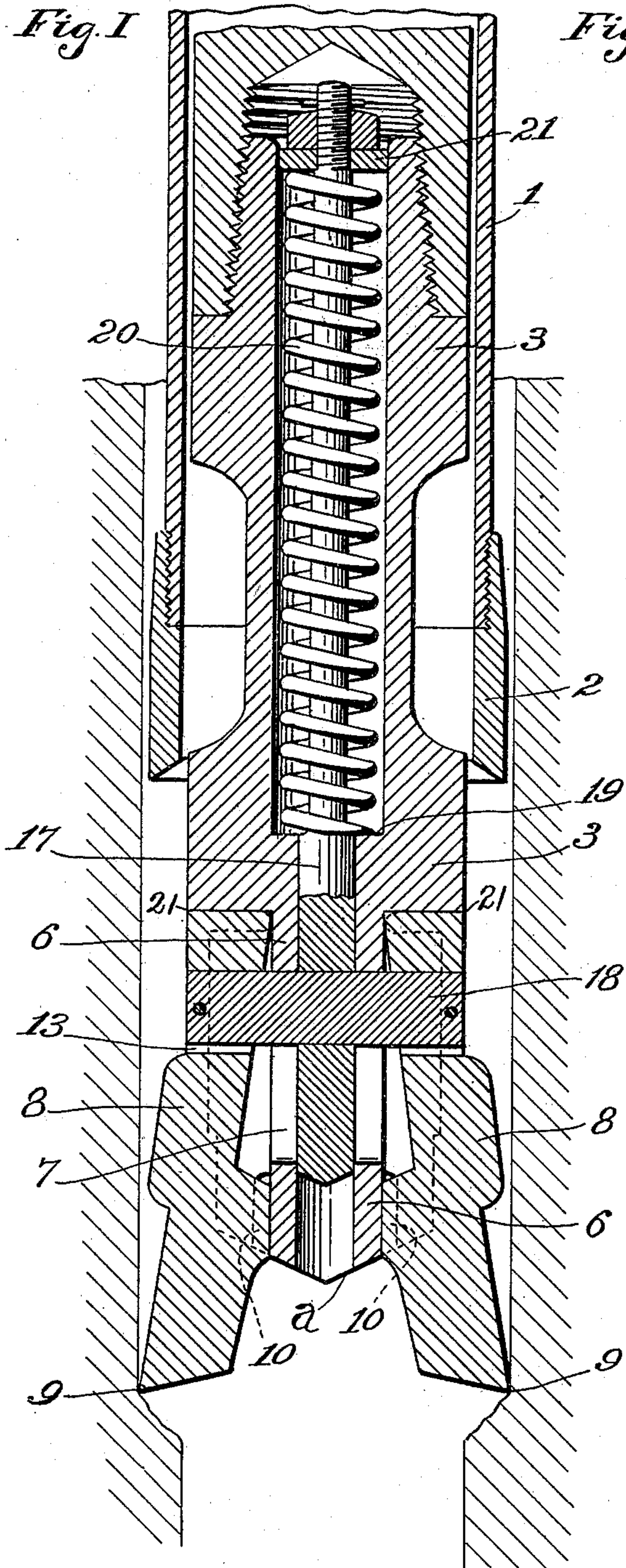
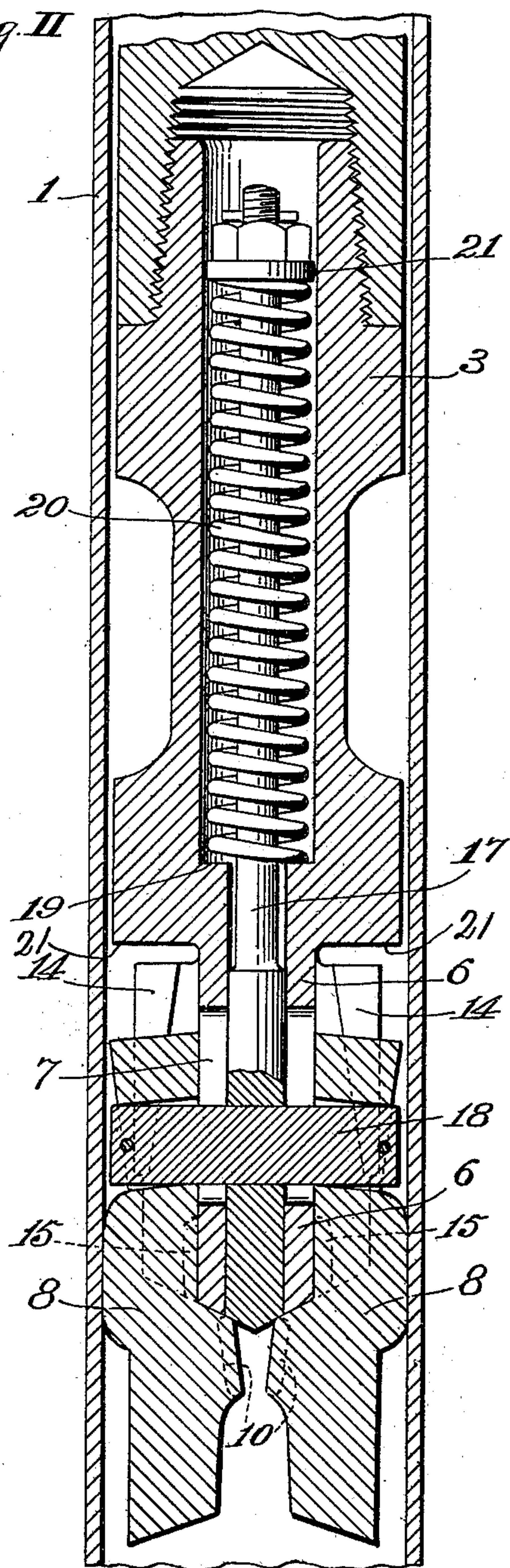


Fig. II



Witnesses  
C. C. Holly.  
G. T. Hackley

Inventor  
Edward Double  
by Townsend Bros.  
his atty.



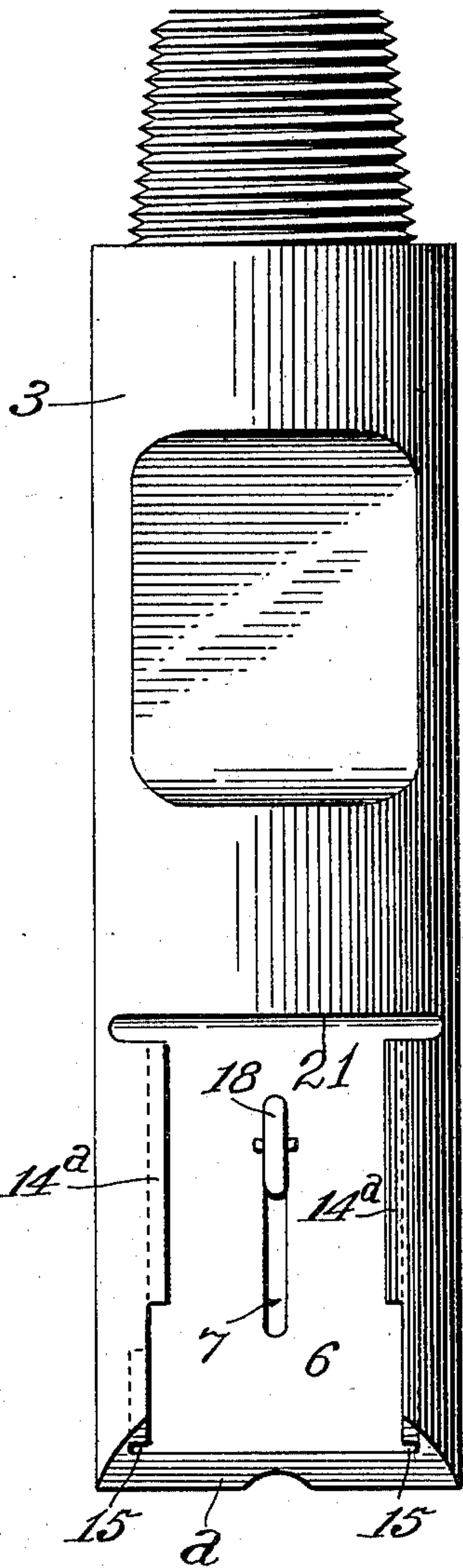
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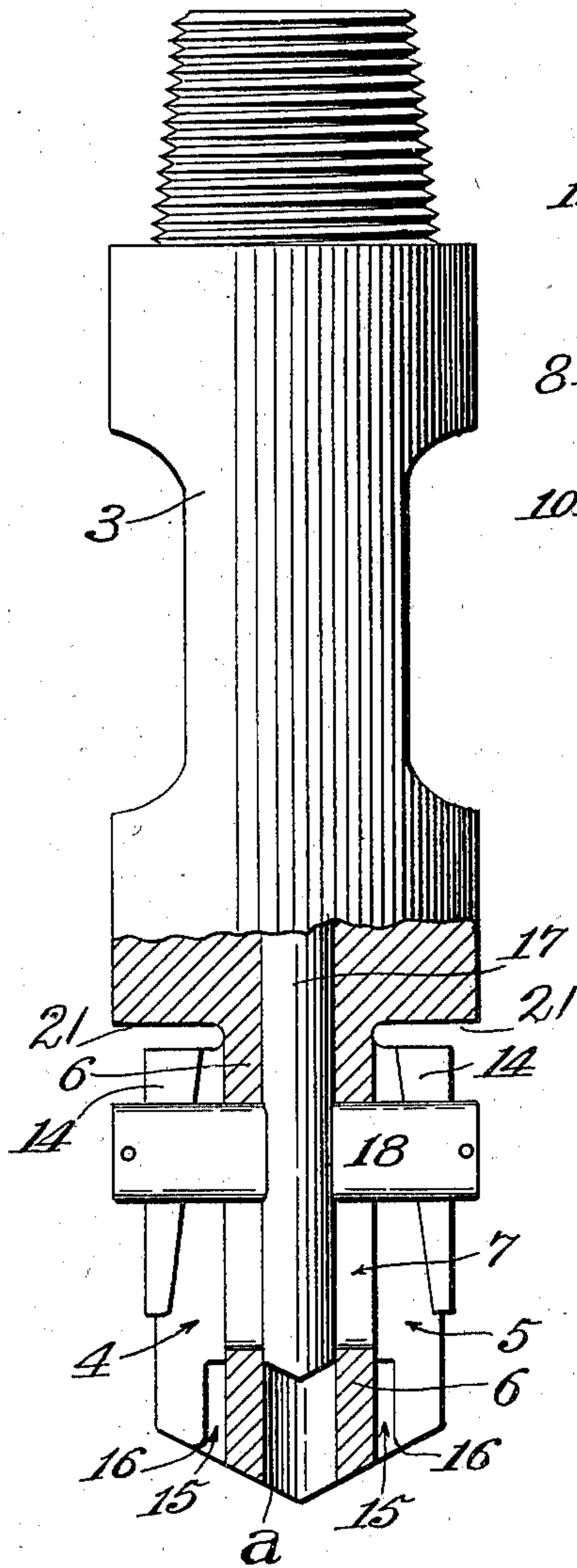
NO MODEL.

2 SHEETS—SHEET 2.

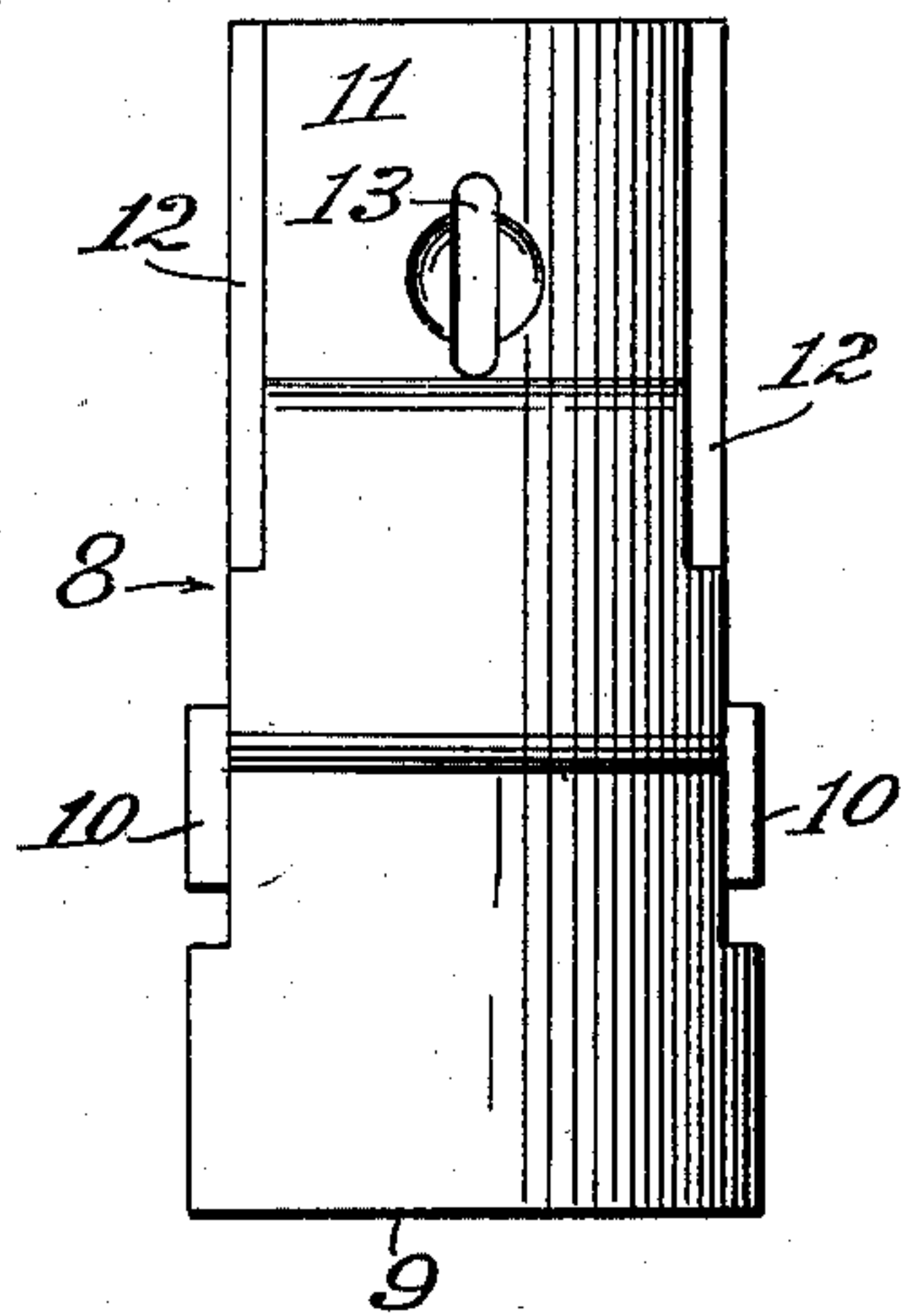
*Fig. III*



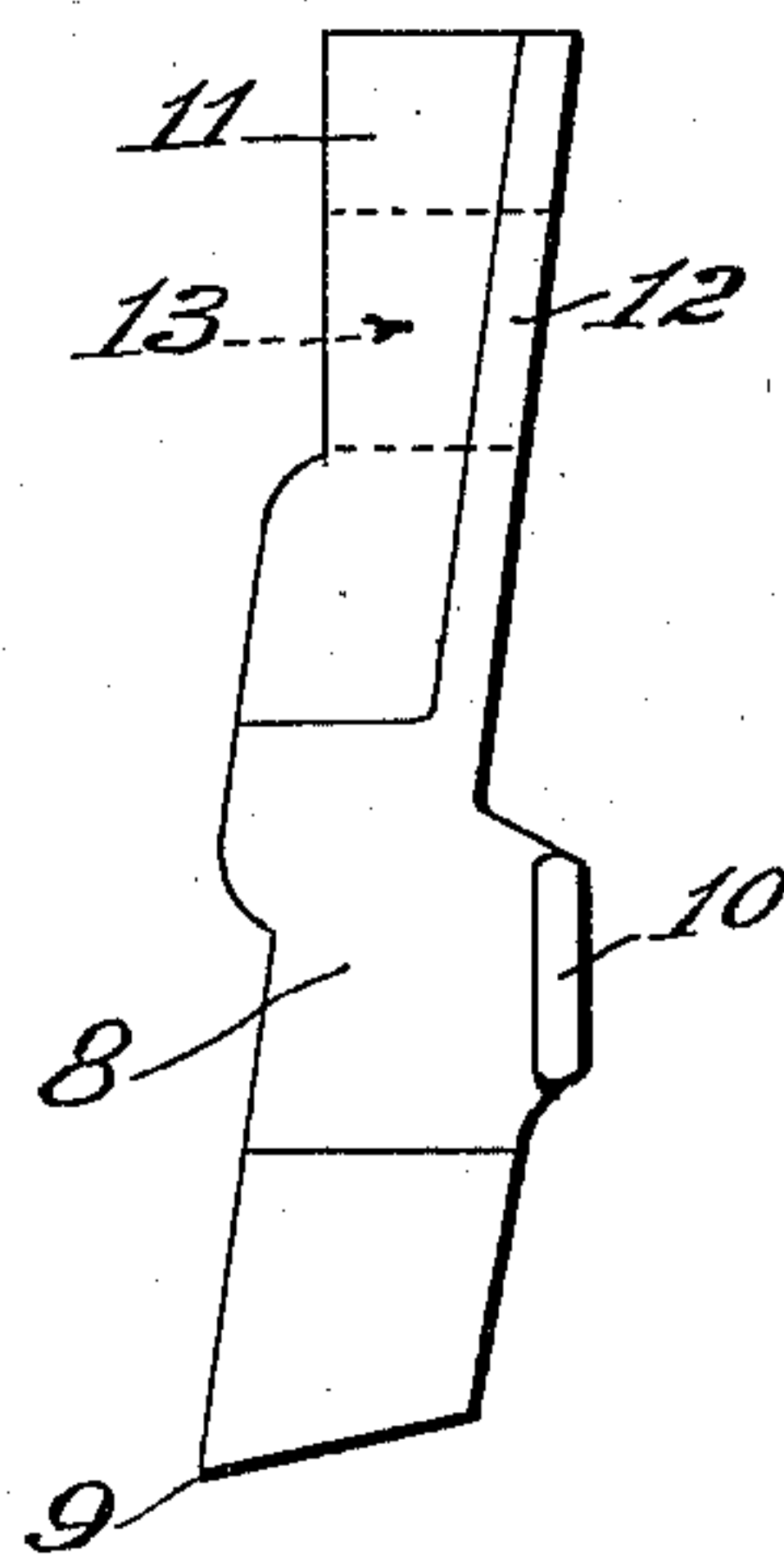
*Fig. IV*



*Fig. V*



*Fig. VI*



Witnesses

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# UNITED STATES PATENT OFFICE.

EDWARD DOUBLE, OF LOS ANGELES, CALIFORNIA.

## UNDERREAMER.

SPECIFICATION forming part of Letters Patent No. 748,054, dated December 29, 1903.

Application filed October 13, 1902. Serial No. 127,171. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD DOUBLE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Improvement in Underreamers, of which the following is a specification.

This invention relates to underreamers, and particularly to that class of underreamers described in my application filed October 26, 1901, Serial No. 80,144, and has for its object the further improvement of such underreamers, and particularly the minimizing the liability of the slips or reaming-bits breaking, due to the localization of the strain thereon upon weakened portions.

In operating underreamers considerable difficulty has been experienced, caused by the slips breaking. This was due primarily to the manner in which the slips were attached to the mandrel, the usual construction being to attach the slips by means of a key connected to their upper ends. The slips were usually slotted at their upper ends to receive the key, and therefore were weak at this point and very apt to break, inasmuch as this weak point was situated at the end farthest away from their cutting edges. The strains undergone by the slips were such as to tend to spread the slips apart and owing to the great leverage produced by the length of the slip between its weak portion where it was supported and its cutting edge were frequently broken.

Another object of my invention is to provide for strengthening the slips at a point as near their cutting edges as possible, so as to relieve the weak portion of as much stress as possible.

A further object is to combine such strengthening means with such mandrel and reaming bits or slips in simple, cheap, and durable manner, avoiding increase in number of parts and the production of devices requiring close fit or adjustment.

To these ends my invention consists in the constructions and combinations of parts hereinafter described, and particularly pointed out in the claims.

Referring to the drawings, Figure I is a longitudinal sectional view showing an underreamer embracing my invention in oper-

ative position in a well-casing, the well-casing being shown in place. Fig. II is a view similar to Fig. I, showing the cutting ends of the slips drawn together and the underreamer entirely within the well-casing. Fig. III is a side elevation of the mandrel. Fig. IV is a view looking at the side of Fig. III, the lower part of the mandrel being in section. Fig. V is a front elevation of the slip. Fig. VI is a side elevation of the slip.

1 designates the ordinary well-casing, to the bottom of which is screwed a shoe 2.

3 is a hollow arbor provided at its lower end with opposite recesses 4 and 5, which are separated by a web 6, which is provided with a central elongated slot 7. The lower end of the arbor is formed with a blunt tapering point *a*. The tapering under faces of this point *a* form the spreading-surfaces for tilting the bits, and the straight parallel sides thereof form the surfaces against which the bits rest when in position for underreaming.

8 designates slips which lie in the opposite recesses 4 and 5. The bottom of each slip is inclined to form a cutting edge 9. Each slip is provided with a pair of elongated lugs 10, which lie as near the cutting edge as possible and extend longitudinally of the slip and project laterally from the sides thereof, as shown best in Fig. V. The opposite sides of the upper end of each slip is provided with a ridge 12, which extends substantially longitudinally of the slip, but at an angle to the line of the lug 10. Each slip is also provided at its upper end with a lateral slot 13, which slot, as shown, is somewhat larger than the end of the key 18 to permit the slip or bit to tilt thereon, as illustrated in the drawings.

Referring to Fig. III, 14 designates a pair of opposite elongated lugs. The inner face of each lug converges at its upper end toward the web 6. A pair of lugs 14<sup>a</sup> is provided on the opposite side of the mandrel. The lower end of the mandrel is provided on each side of the web 6 with a pair of opposite grooves 15, which lie close to and parallel with the web 6, the lower outside corner of each groove 15 being slightly rounded, as at 16. The grooves 15 extend up the mandrel a short distance only. 17 is rod which extends through the center of the mandrel and having a pointed lower end. The rod is provided at a short



distance from its lower end with a slot, through which a key 18 passes. The hollow mandrel 3 is provided with an internal shoulder 19. 20 is a coil-spring which lies within the hollow mandrel, encircling the rod 17 and its lower end resting upon the shoulder 19. The upper end of the rod is provided with a washer and nut 21, which confines the upper end of the spring. The slips or reaming-bits lie in the opposite recesses 4 and 5, and the key 18 passes through the perforations 13 in each slip. The function of the spring 20 is to hold the rod 17 in a raised position, as shown in Fig. I, with the slips tilted into operative position, their upper ends resting against the upper faces of the recesses 4 and 5. When the slips are in this position, the lugs 10 lie within the grooves 15, and the slips are thus firmly held and prevented from spreading outwardly and the strain upon the weaker part of the slips reduced. The upper portions or ends of the slips or bits when in position for underreaming bear against the shoulders or abutments 21 of the arbor or mandrel 3 above the recesses 4 and 5. These abutments 21 have sufficient stock to withstand the severe strain thereon when the tool is in use in underreaming.

When it is desired to insert the underreamer into the well-casing, the rod 17 may be depressed, thereby compressing the spring 20 and dropping the slips over the lower end of the web 6, which allows the slips to be tilted, so that their cutting edges are drawn together a sufficient distance to allow the underreamer to be inserted into the pipe. When the slips are in the position shown in Fig. I, the ridges 12 of the slips contact with the inclined faces of the lugs 14, which serves to hold the upper end of the slips from dislodgment and also relieving the key from any appreciable strain, as the stresses are borne almost entirely by the lugs 10 and ridges 12 and also, of course, by the top end of each slip, which bears against the upper faces of each recess 4 and 5.

The lower end of each groove 15 is slightly rounded to allow the lugs 10 to readily enter without danger of catching upon the corner. For the same reason each end of the lug 10 is also preferably rounded, as shown in Fig. VI.

It should be understood that I contemplate making such changes and alterations in the specific construction of my invention as would be included within the scope of the claims.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In an underreamer, the combination, with a hollow mandrel, of a spring-actuated rod slidably mounted therein and provided with a key or head at its lower end, tilting slips freely and detachably connected with said key or head, and means bracing said slips at the lower end of the mandrel.

2. In an underreamer, the combination, with a hollow mandrel, of a spring-actuated rod slidably mounted therein and provided

with a key or head, slips or bits tiltingly carried thereby, means for spreading said bits as the same are drawn up by said rod, and means bracing said slips at their lower ends.

3. In an underreamer, the combination, with a mandrel provided with a central bore, a central depending bar having spreading-faces at its lower end, and shoulders against which the upper ends of the slips bear when in position for underreaming, of a spring-actuated rod slidably mounted in said bore and provided with a key or head, reaming-slips tiltingly carried thereby, and means bracing said slips at their lower ends.

4. In an underreamer, in combination, a hollow mandrel, provided with a slotted extension, a spring-actuated slip-operating rod provided with a key, tilt slips or bits provided with key-seats to be engaged by said pivot-key, said key-seats being somewhat larger than the key to allow the slips to tilt, said slips provided with inwardly-projecting shoulders, said slotted extension provided with surfaces adapted to tilt said slips and hold the same in expanded position, and means bracing said slips at their lower ends.

5. In an underreamer, in combination, a hollow mandrel with a hollow slotted extension, said extension having opposite parallel bearing-faces, a slip-carrying rod in said mandrel, reaming-slips, said slips being provided with key-seats, a key or head on said rod, each end of said head or key lying in a key-seat, and the key-seat in said slip being somewhat larger than the key to allow the slips to partake of a tilting action, and means bracing said slips at their lower ends.

6. In an underreamer, in combination, a mandrel furnished with a hollow slotted extension, the lower end of which slopes upward at the edges, tilt-slips slidably connected with the mandrel and furnished on their inner faces with projections, the faces of which slide upon the extension of the mandrel, a spring-actuated rod slidably arranged in said mandrel, means connecting the slips with the rod, and means for bracing the slips at their lower ends.

7. In an underreamer, in combination, a mandrel, provided with a centrally-depending transversely-slotted bar or web and with spreading-faces at its lower end, reaming-slips, means for bracing the slips at their lower ends in said slotted extension, and automatic means for tiltingly carrying and supporting said slips independently of each other adapted to normally hold said slips in position for underreaming.

8. In an underreamer, in combination, a hollow mandrel, provided with a slotted extension, a spring-actuated rod slidably mounted therein, a key or head provided on said rod, expansible reaming-slips tiltingly carried upon and operated by said key, spreading-faces on said mandrel against which said bits operate, and means preventing the



lower ends of the bits tilting outward from their operative position after such bits have been drawn up by said rod.

9. In an underreamer, in combination, a hollow mandrel provided with a slotted extension, a spring-actuated rod slidably mounted therein and provided with a slip carrying and operating key or head, expansible reaming-bits tiltingly carried thereby and provided with inwardly-projecting shoulders, said mandrel provided with spreading-faces, and means on said slips coöperating with means on said mandrel, when said slips are in position for underreaming, to hold the lower ends of said slips from tilting.

10. In an underreamer, in combination, a hollow mandrel provided with a slotted extension, a spring-actuated rod slidably mounted therein and provided with a slip carrying and operating key or head, expansible reaming-bits tiltingly carried thereby and provided with inwardly-projecting shoulders, said mandrel provided with spreading-faces, the lower end of said mandrel provided with elongated grooves, and said slips provided with elongated lugs projecting into said grooves.

11. In an underreamer, in combination, a hollow mandrel provided with a slotted extension, a spring-actuated rod slidably mounted therein and provided with a slip carrying and operating key or head, expansible reaming-bits carried thereby and provided with inwardly-projecting shoulders, said mandrel provided with spreading-faces, said mandrel provided at its lower end with a pair of opposite recesses, a pair of elongated lugs on the lower end of said mandrel projecting over a portion of each side of the recess, the extreme lower end of said mandrel being provided with opposite pairs of grooves, each of said slips provided with ridges which lie against said lugs, and a pair of lugs on each slip projecting into said grooves.

12. In an underreamer, in combination, a hollow mandrel provided with a transversely-slotted extension, a spring-actuated rod slidably mounted therein, a key or head provided on said rod playing in said transverse slot, expansible reaming-slips tiltingly carried upon and operated by said key, spreading-faces on said mandrel against which said bits operate, said mandrel provided at its lower end with a pair of oppositely-positioned open-ended grooves, and each of said slips provided with lugs projecting into said grooves.

13. In an underreamer, the combination, with a hollow mandrel provided with spreading-surfaces, of a spring-actuated slip-carrying rod slidably mounted therein and provided with a slip-carrying key or head, slips pivotally mounted upon and carried by said key or head and having portions adapted to contact with said spreading-surfaces, and means bracing said slips at their lower ends.

14. In an underreamer, the combination, with a hollow mandrel provided at its lower

end with spreading-surfaces and provided with abutments, of a spring-actuated slip-carrying rod slidably mounted therein and provided with a slip-carrying key or head, slips pivotally mounted upon and carried by said key or head, said slips provided with portions adapted to contact with said spreading-surfaces and with portions to contact with said abutments when the slips are in position for underreaming and means for bracing the slips at their lower ends.

15. In an underreamer, the combination, with a hollow mandrel provided at its end with spreading-surfaces and provided with abutments and with elongated lugs, and a slotted extension, of a spring-actuated rod slidably mounted therein, a key or head on said rod, slips or bits tiltingly mounted upon and carried by said key or head, said slips provided with portions adapted to contact with said spreading-surfaces and with portions to contact with said abutments when the slips are in position for underreaming and with portions adapted to contact with said elongated lugs, and means for bracing said slips and preventing the same tilting outward when in position for underreaming.

16. In an underreamer, the combination, with a hollow mandrel provided with a slotted extension, said mandrel provided with elongated lugs and spreading-surfaces, a spring-operated member slidably mounted in said mandrel, a key or head for said rod, reaming-bits tiltingly mounted on said key or head and carried thereby, said bits provided with portions adapted to contact with said lugs, and means for bracing said slips and preventing the same tilting outward when in position for underreaming.

17. In an underreamer, in combination, a mandrel furnished with shoulders or abutments and with a slotted extension beyond said shoulders or abutments and with dovetail ways on opposite sides of said extension, dovetail tilt slips or bits for said ways furnished with transverse perforations or seats; a spring-actuated rod sliding in said mandrel and furnished with a key or head, the ends of which project into said perforations or seats, said slotted extension provided with grooves and said bits or slips provided with lugs or projections adapted to engage in said groove when in position for underreaming thereby bracing said bits or slips against lateral strain, and means at the lower end of said slotted extension for spreading the bits or slips.

18. In an underreamer, dovetail slips furnished with key-seats respectively on their inner faces; a rod furnished with a key-seat; a key for said key-seats; a mandrel in which the rod plays constructed with a slotted extension and tapering dovetail slipways which open laterally just above the lower end of the bottom of the slot in the extension, to allow the key to be inserted in the slot and key-seats only when the key-seats are flush with the lower end of the slot, said slotted extension



sion provided with grooves, and said slips provided with lugs or projections adapted to engage in said grooves when in position for underreaming thereby bracing said bits or slips against lateral strain.

19. In an underreamer, in combination, a hollow mandrel provided with abutments and with a slotted extension projecting below said abutments and provided with opposite recesses, a spring-actuated rod slidably mounted in said mandrel and provided with bit or slip carrying means, reaming bits or slips tiltingly carried by said means and adapted to bear against said abutments, each of said bits provided with ridges adapted to work in respective recesses, said slotted extension provided with bit or slip spreading means and with grooves or slots, said bits or slips provided with portions adapted to engage in said grooves or slots when the bits are in position for underreaming.

20. In an underreamer, in combination, a

hollow mandrel provided with a slotted extension having opposite recesses, a spring-actuated rod slidably mounted in said mandrel and provided with bit or slip carrying means, reaming bits or slips tiltingly carried by said means, each of said bits or slips provided with ridges adapted to work in respective recesses, said slotted extension provided at its end with spreading-surfaces and with grooves or slots, said bits or slips provided with lugs or projections adapted to engage in said grooves or slots when the bits are in position for underreaming.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Los Angeles, in the county of Los Angeles and State of California, this 4th day of October, 1902.

EDWARD DOUBLE.

Witnesses:

JAMES R. TOWNSEND,  
A. E. WROTH.