

No. 820,101.

PATENTED MAY 8, 1906.

E. DOUBLE.  
UNDERREAMER.

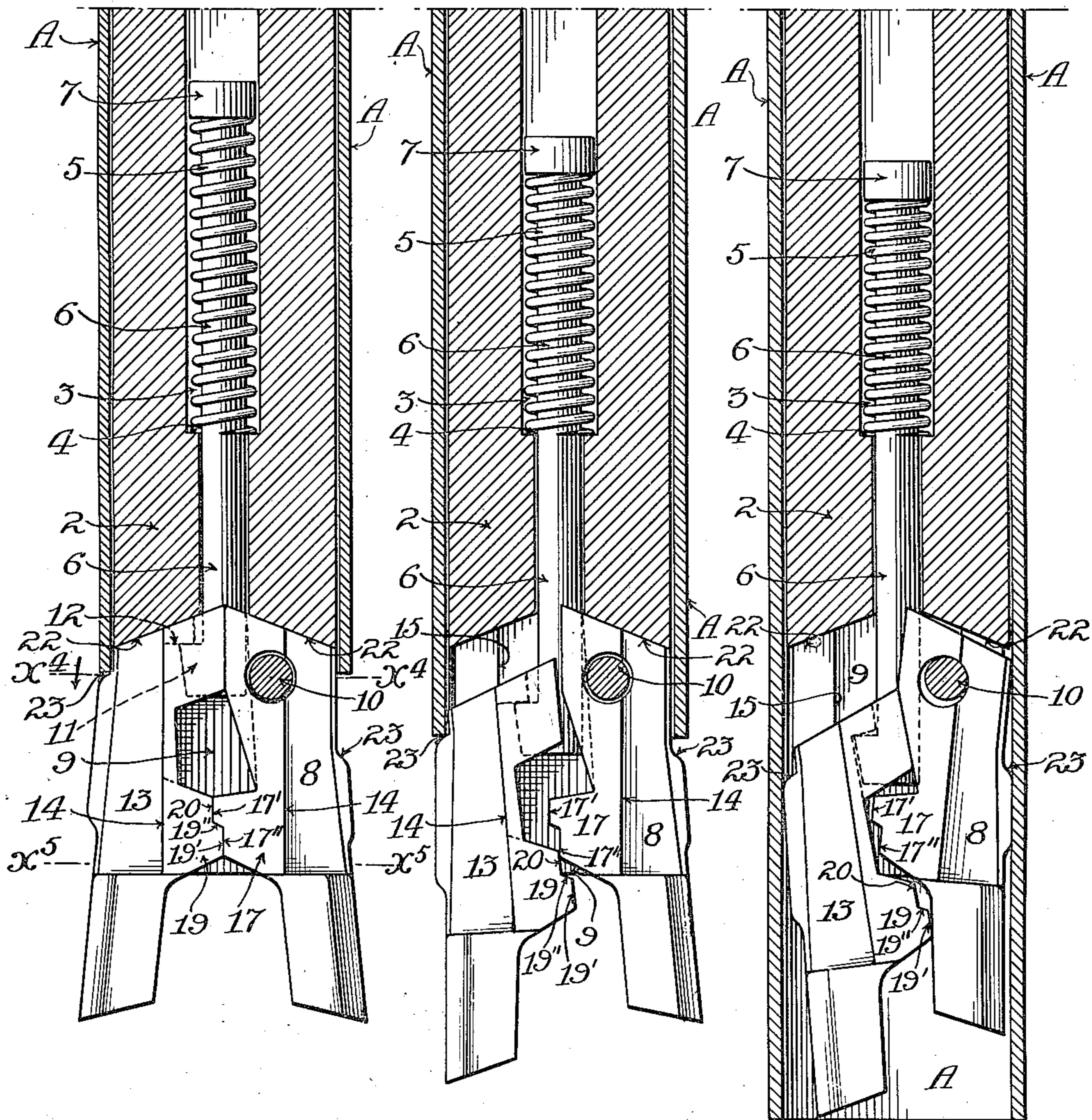
APPLICATION FILED MAR. 25, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

Fig. 2.

Fig. 3.



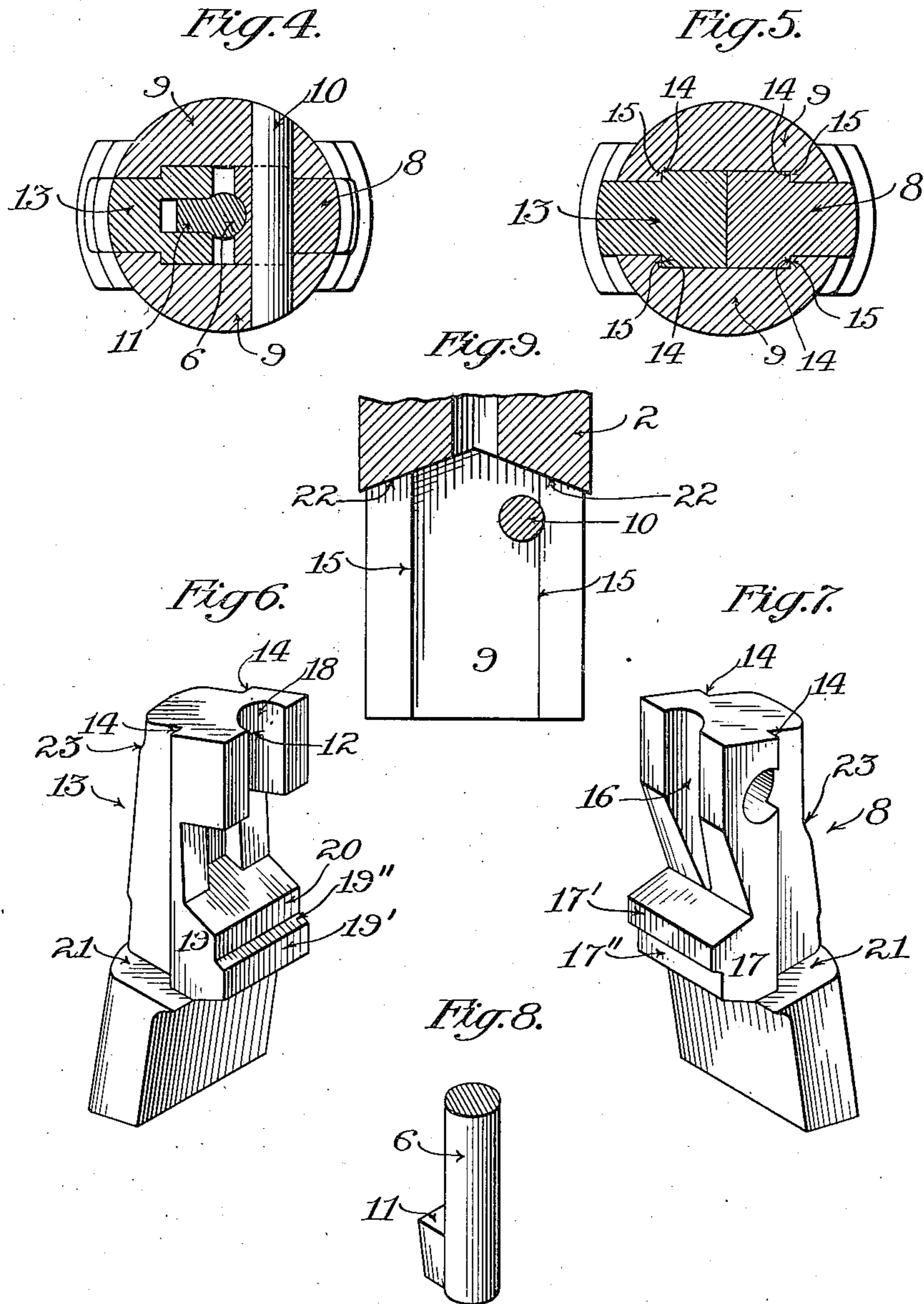
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2 SHEETS—SHEET 2.



Witnesses:  
Frank L. Graham  
George T. Hackley

Inventor,  
Edward Double.  
by Townsend Bros.  
his attys.

# UNITED STATES PATENT OFFICE.

EDWARD DOUBLE, OF LOS ANGELES, CALIFORNIA.

## UNDERREAMER.

No. 820,101.

Specification of Letters Patent.

Patented May 8, 1906.

Application filed March 25, 1905. Serial No. 251,981.

*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, State of California, have invented certain new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to underreamers for reaming out well-holes under casing either in drilling oil-wells or Artesian wells, and has for its principal object the provision of a device which shall be of extreme simplicity, maximum strength, and exceedingly positive and efficient in operation and in which all possibility of losing the reaming-bits in the hole is obviated.

The invention consists, broadly, in an underreamer characterized by having one of the reaming bits or jaws pivoted in the lower end of the mandrel and to the body of the mandrel and adapted to swing outward beyond the periphery of the mandrel when expanded and to close within the periphery of the mandrel when contracted, but held from longitudinal movement with respect to the mandrel, and a second reaming bit or jaw tiltingly mounted on a spring-actuated rod carried within the mandrel, the second jaw or bit adapted to longitudinal movement with respect to the mandrel, both bits provided with shoulders or surfaces on their inner faces, which upon longitudinal movement of said second jaw cause the expansion or contraction of the jaws or bits in the mandrel.

The invention consists, further, of an underreamer having a mandrel provided with a jaw pivoted in its lower end and held from longitudinal movement relative to the mandrel and having a second spring-actuated bit or jaw slidably connected with said mandrel, the expansion or contraction of the bits or jaws being effectuated by the contact of the inner surfaces of the jaws and not dependent upon any tilting surface on the mandrel.

The invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of an underreamer embodying my invention, the reaming-bits being shown in expanded position. Fig. 2 is a similar view showing the longitudinally-movable bit partially drawn down and in one of the positions it assumes in collapsing. Fig. 3 is a similar view showing the reaming-bits collapsed and within the well-casing. Fig. 4 is a cross-sectional

view on the line  $X^4 X^4$  of Fig. 1. Fig. 5 is a cross-sectional view on the line  $X^5 X^5$  of Fig. 1. Fig. 6 is a perspective view of the longitudinally-movable bit. Fig. 7 is a perspective view of the pivoted bit. Fig. 8 is a fragmental detail of the spring-actuated rod, showing the wing thereon for engaging in the longitudinally-movable bit or jaw. Fig. 9 is a fragmental longitudinal sectional view showing the abutments or shoulders at the mouths of the side slots of the slotted extension of the mandrel.

In Figs. 1, 2, and 3 of the drawings, A represents a well-casing, and 2 the mandrel of my underreamer, the upper end of which mandrel is provided with a stem of the ordinary form or construction for connecting with the "sub;" but as this connection is the usual screw-threaded connection I have not shown the same in the drawings. The mandrel 2 has the usual central bore, the upper portion 3 of which is enlarged to form a shoulder 4 as a seat for the coil-spring 5 of the spring-actuated rod 6. This spring 5 is coiled about the rod 6, and one end bears on the shoulder or seat 4—the other against a head 7 on the rod 6. The lower end of the mandrel 2 is in the form of a hollow slotted extension open at the bottom and forming a chamber into which the bits or jaws collapse. This extension is best shown in Fig. 9.

8 indicates the pivoted jaw or bit, pivoted in one of the side slots of the slotted extension 9 by a pin 10 passing through the walls of the mandrel and through the bit. This pivoted jaw 8 is thus held from longitudinal movement with respect to the body of the mandrel, but is free to tilt in and out of the side slot of the slotted extension 9.

The spring-actuated rod 6 has a wing or projection 11 adapted to engage in a seat 12 in the jaw or bit 13, the jaw or bit 13 being thus supported upon the rod 6 and movable longitudinally of the mandrel and of the pivoted jaw 8.

The jaws 8 and 13 are both provided with shoulders 14, which extend the length of the shanks of the jaws. These shoulders 14 are adapted to bear against shoulders 15, formed within the chamber of the slotted extension 9 and at the sides of the side slots thereof. By these means the bits or jaws 8 and 13 are held against lateral displacement, the construction and arrangement of the shoulders 14 and 15 being such as to permit the proper expansion of the bits into working position.

and to cause the shoulder 14 to bear on the shoulder 15 when the bits are expanded to such working position. The shoulders 15, while made of considerable width to secure the requisite strength, are located on the opposite walls of the mouths of the slots and form abutments against which the shoulders 14 of the bits contact or abut when in expanded position. These shoulders 15 thus hold the bits or jaws from being torn out laterally from the mandrel.

The inner face of the shank of the jaw 8 is cut away, as at 16, to permit the proper play of the rod 6, and the inner face of the jaw 8 is also provided with a contacting shoulder or abutment 17, which has a straight portion or face 17' and an undercut portion 17'' for the purpose hereinafter set forth.

The bit 13 is provided with cut-away portion 18, through which the rod 6 passes, and is also provided with a contacting abutment 19, having a straight inner face 19' and a slanting portion 19'', terminating in the face 20.

The jaws or bits 8 and 13 are provided with shoulders 21, adapted to contact with the ends of the slotted portion on the mandrel, so that the shock or impact of the blow in underreaming is divided between the ends of the slotted portion of the mandrel and the abutments 22, formed at the upper ends of the side slots of the slotted portion 9. As the abutments 22 are inwardly inclined and the upper edges or ends of the bits are correspondingly inclined, when the bits are in the expanded position, as shown in Fig. 1, the impact of the bits striking, when in use, is evenly distributed over all portions of the shoulders 32 of the mandrel, and the wings or projections on the inner faces of the upper ends of the shanks of the bits bearing against each other and the inner faces of the shoulders or abutments 17 19 bearing against each other form, in effect, a solid extension of the mandrel, thus providing great strength to withstand the impact of underreaming. It is thus seen that the shoulders 17 19 perform two functions: First, they form the means by which the bits are expanded and provide for the contraction or collapsing of the bits, and, second, provide bearing-surfaces, so that the bits bear against each other in underreaming.

The outer surfaces of the bits 8 and 13 are provided with a slanting abutment 23, adapted to contact with the end of the well-casing to cause the collapse of the bits.

The spring 5 normally holds the bits in the position of Fig. 1, which is their expanded or working position.

As shown in Fig. 6, the faces 17' 20 and the faces 17'' 19', respectively, of the bits 8 and 13 are in contact.

When the underreamer is drawn up into the well-casing, the shoulders 23 of the bit 13

first come in contact with the end of the casing, drawing down the spring-actuated rod and permitting the jaw 13 to assume the position of Fig. 3, the abutments 9 of the bit 13 having passed below the abutment 17 of the bit 8. When the underreamer is drawn up in the casing sufficiently to bring the shoulder 23 of the bit 8 into contact with the well-casing, the bit 8 is tilted into the position of Fig. 3. When the underreamer has been inserted in the casing in usual manner and lowered through the casing and below the same in the well-hole to underream therein, the spring-actuated rod 6 draws up the bit 13, bringing the abutment 19 thereof up along the abutment 17 of the bit 8, and the contacting surfaces of these abutments cause the bits to expand as the bit 13 is drawn to its upper or expanded position.

By thus pivoting one jaw of the underreamer in the slotted portion of the underreamer and holding the same against longitudinal movement relative to the mandrel and tiltingly mounting the other bit or jaw on the spring-actuated rod, I am enabled to do away with the necessity of providing means at the end of the mandrel for tilting the bits and at the same time to provide greater freedom of action in the expansion and collapsing of the bits, as well as securing greater strength and durability. By thus pivoting one bit or jaw on the mandrel by a fixed pivot which is immovable with respect to the mandrel I am enabled to do away with all links and other direct connections between the bits and provide for the longitudinal movement of the second bit or jaw moving the bits to expanded position, thus obviating the use of connections and small parts liable to break under the heavy strains and impact of underreaming. A further advantage lies in the fact that with this construction, even if the wing 11 of the spring-actuated rod should break, neither of the bits will be lost in the hole, as the pivoted bit 8 will retain the bit 13 in the slotted portion of the mandrel.

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

1. An underreamer characterized by a mandrel, a reaming bit or jaw pivoted in the lower end thereof and held from longitudinal movement with respect to the mandrel and a second reaming bit or jaw tiltingly and spring-actuatedly mounted in said mandrel to move longitudinally with respect to said mandrel and first-named jaw, the inner faces of said jaws provided with contacting surfaces for expanding said jaws.

2. An underreamer characterized by a mandrel, a reaming bit or jaw pivoted at the lower end of said mandrel and held against longitudinal movement with respect to the mandrel, a spring-actuated rod slidable in

said mandrel, and a second reaming bit or jaw tiltingly mounted on said spring-actuated rod and adapted to longitudinal movement with respect to said first-named jaw, the inner surfaces of said jaws contacting during the movement of said second jaw to expand said jaws.

3. An underreamer comprising a mandrel, a spring-actuated rod slidable longitudinally of said mandrel, a reaming bit or jaw tiltingly mounted on said spring-actuated rod and a second reaming bit or jaw pivoted on said mandrel, said bits or jaws provided with inner shoulders or surfaces adapted to contact to cause said jaws to expand when in one position, and to permit said jaws to collapse when in another position.

4. An underreamer comprising a mandrel, a spring-actuated rod slidable longitudinally in said mandrel, a reaming bit or jaw tiltingly mounted on said spring-actuated rod and a second reaming bit or jaw pivoted on said mandrel, said bits or jaws provided with inner shoulders or surfaces adapted to contact to cause said jaws to expand when in one position and to permit said jaws to collapse when in another position, said bits provided with shoulders for contacting with the end of the mandrel when in expanded position.

5. An underreamer comprising a mandrel having a hollow slotted extension, a spring-actuated rod slidable longitudinally in said mandrel, a reaming bit or jaw tiltingly mounted on said spring-actuated rod and adapted to project through one side of the slot of said mandrel, and a second reaming bit or jaw pivoted on said mandrel and projecting through the other side of said slot, said bits or jaws provided with inner shoulders or surfaces adapted to contact to cause said bits to expand and provided with shoulders adapted to contact with shoulders at the mouths of said slot.

6. An underreamer having a mandrel, a transversely-pivoted longitudinally-immovable jaw projecting from the bottom of said mandrel, a longitudinally-moving and transversely-pivoted jaw projecting from the bottom of said mandrel, and means for automatically moving said second jaw to cause said jaws to expand, said jaws provided with inner surfaces which bear against each other when the jaws are expanded.

7. An underreamer having a transversely-pivoted jaw and a longitudinally-moving and transversely-pivoted jaw, means for automatically moving said second jaw to cause said jaws to contact and thereby expand, said underreamer provided with inwardly-inclined abutments against which the ends of said jaws bear when in expanded position.

8. An underreamer having a mandrel, a transversely-pivoted longitudinally-immovable jaw projecting from the bottom of said mandrel, a longitudinally-moving and trans-

versely-pivoted jaw projecting from the bottom of said mandrel, means for automatically moving said jaws to expand and contract, said jaws provided with inner surfaces for contacting with each other to cause the jaws to expand and bearing against each other when the jaws are expanded, said mandrel provided with inwardly-inclined abutments against which the ends of said jaws bear when in expanded position.

9. An underreamer having a mandrel, a reaming bit or jaw pivoted at the lower end of said mandrel and held against longitudinal movement with respect to said mandrel, a spring-actuated rod slidable in said mandrel, a second reaming bit or jaw tiltingly mounted on said spring-actuated rod and adapted to longitudinal movement with respect to said first-named jaw, the inner surfaces of said jaws contacting during the movement of said second jaw to expand the jaws, portions of the inner surfaces of said jaws bearing against each other when the jaws are expanded, said jaws being provided with shoulders for contacting with the ends of said mandrel.

10. An underreamer comprising a mandrel having a slotted portion having shoulders at the sides of the mouths of the slots, a jaw transversely pivoted in and longitudinally immovable with respect to said mandrel, a longitudinally-moving jaw and means for moving said second jaw to cause said jaws to expand, said jaws having shoulders for contacting with said first-named shoulders when expanded.

11. An underreamer comprising a mandrel having a slotted lower portion having shoulders at the inner edges of the mouths of said slots, a jaw transversely pivoted in and longitudinally immovable with respect to said mandrel, a longitudinally-moving jaw, and means for moving said second jaw to cause said jaws to expand, said mandrel having inwardly-inclined abutments against which the jaws bear when in expanded position and said jaws having shoulders for contacting with the first-named shoulders.

12. An underreamer having a mandrel, a transversely-pivoted longitudinally-immovable jaw projecting from the bottom of said mandrel, a longitudinally-moving and transversely-pivoted jaw projecting from the bottom of said mandrel, means for automatically moving said jaws to cause said jaws to expand and contract, said jaws provided with shoulders for abutting against the end of the mandrel when said jaws are expanded.

13. An underreamer having a mandrel provided with depending portions, a transversely-pivoted jaw and a longitudinally-moving and transversely-pivoted jaw, said jaws being free of connections with each other, means for automatically moving said second jaw to cause said jaws to expand, and

shoulders on the sides of said jaws for abutting against said depending portions of said mandrel.

14. An underreamer having a mandrel provided with depending portions, a transversely-pivoted jaw and a longitudinally-moving and transversely-pivoted jaw, and means for automatically moving said second jaw longitudinally of said mandrel to cause said jaws to expand, said jaws provided with shoulders on their sides for abutting against depending portions of said mandrel, and with side shoulders on their shanks, and said mandrel provided with longitudinal shoulders against which said side shoulders bear when the jaws are expanded.

15. An underreamer having a mandrel, a transversely-movable longitudinally-immovable jaw, a longitudinally and transversely movable jaw, said jaws provided with shoulders or abutments on their inner faces, one of said jaws provided with a socket above such shoulder or abutment into which the shoulder of the other jaw projects when the jaws contract or collapse, and means for automatically moving said second jaw to expand said jaws.

16. An underreamer having a mandrel, a transversely-movable longitudinally-immovable jaw, a longitudinally and transversely movable jaw, said jaws provided with shoulders or abutments on their inner faces, one of said jaws provided with a socket above such shoulder into which socket the shoulder of the other jaw projects when the jaws contract or collapse, and means for automatically moving said second jaw to expand said jaws, said mandrel provided with longitudinal shoulders and said jaws provided with longitudinal shoulders abutting thereagainst when said jaws are expanded.

17. An underreamer having a mandrel, a transversely-movable longitudinally-immovable jaw, a longitudinally and transversely movable jaw, said jaws provided with shoulders or abutments on their inner faces, one of said jaws provided with a socket into which the shoulder of the other jaw projects when the jaws contract or collapse, and means for automatically moving said second jaw to expand said jaws, said jaws provided with longitudinal shoulders and with horizontal shoulders, said mandrel provided with longitudinal shoulders and with depending portions against which respectively said jaw longitudinal and horizontal shoulders abut when said jaws are expanded.

18. An underreamer having a mandrel open at its lower end, a jaw pivoted upon and in said mandrel and projecting from the lower end thereof, a spring-operated longitudinally-moving jaw carried in said mandrel and projecting from the lower end thereof, said bits contacting upon the movement of said second jaw to expanded position, to ex-

pand the bits; said pivoted jaw having means coacting with said second jaw and preventing said second jaw passing out said mandrel.

19. An underreamer having a mandrel provided with a hollow slotted extension at its lower end, the end of said extension being open, a jaw pivoted within said mandrel and projecting from the lower end thereof, a longitudinally-moving jaw tiltingly supported within said mandrel, means for automatically moving said second jaw to expand said jaws, said pivoted jaw having means coacting with said second jaw and preventing said second jaw passing out the end of said hollow extension, said hollow extension provided with longitudinally-extending shoulders, and said jaws extending laterally through the sides of said slotted extension, and provided with longitudinal shoulders contacting with said first-named longitudinal shoulders when the bits are in expanded position.

20. An underreamer having a mandrel, a jaw pivoted on said mandrel, a second jaw, and automatic means, whereon said second jaw is pivotally carried for normally holding said second jaw in raised or expanded position, said jaws free from each other and expanding upon the upward movement of said second jaw.

21. An underreamer having a mandrel, a jaw pivoted on said mandrel, a second jaw sliding longitudinally of said mandrel, automatic means whereon said second jaw is tiltingly mounted, said jaws free of each other and normally held expanded by said means operating said second jaw.

22. An underreamer characterized by a mandrel, a reaming bit or jaw pivoted on said mandrel and held from longitudinal movement with respect thereto and a second jaw free from said first jaw and tiltingly and spring-actuatedly mounted in said mandrel to move longitudinally with respect to said mandrel and first-named jaw, said jaws expanding during said movement.

23. An underreamer characterized by a mandrel, a reaming bit or jaw pivoted on said mandrel and projecting from the lower end thereof and held from longitudinal movement with respect thereto and pivotally movable transversely thereof, and a second reaming bit tiltingly and spring-actuatedly mounted within said mandrel to move longitudinally with respect to the mandrel and first-named jaw, said jaws expanding during said movement.

24. An underreamer having a mandrel, a jaw transversely pivoted on said mandrel, and a longitudinally-moving and transversely pivoted jaw, and means for automatically moving said second jaw causing said jaws to expand, said jaws abutting against each other within said mandrel when in expanded position.

25. An underreamer having a hollow man-

drel, a transversely-pivoted jaw, a longitudi-  
nally-moving and transversely-pivoted jaw,  
and automatic means for moving said second  
jaw to cause said jaws to expand, the inner  
5 surfaces of said jaws bearing against each  
other in expanded position.

In testimony whereof I have hereunto set

my hand, at Los Angeles, California, this  
11th day of March, 1905.

EDWARD DOUBLE.

In presence of—

W. S. BOYD,

JOSEPH STREETON.