

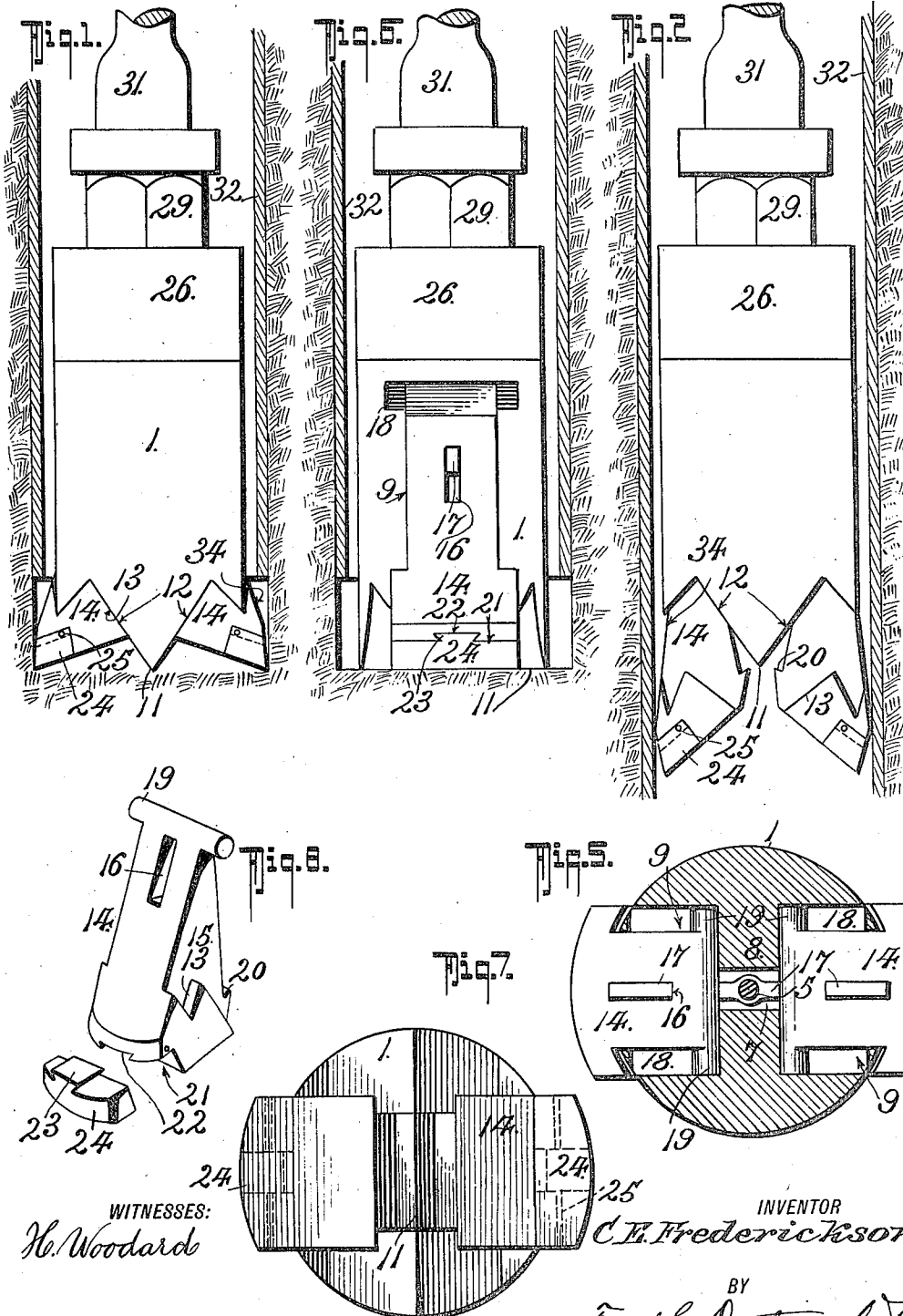
C. E. FREDERICKSON.
UNDERREAMER.

APPLICATION FILED SEPT. 19, 1911.

Patented Nov. 26, 1912.

1,045,274.

3 SHEETS-SHEET 1.



WITNESSES:
H. Woodard

P. M. Greenwell

INVENTOR
C. E. Frederickson

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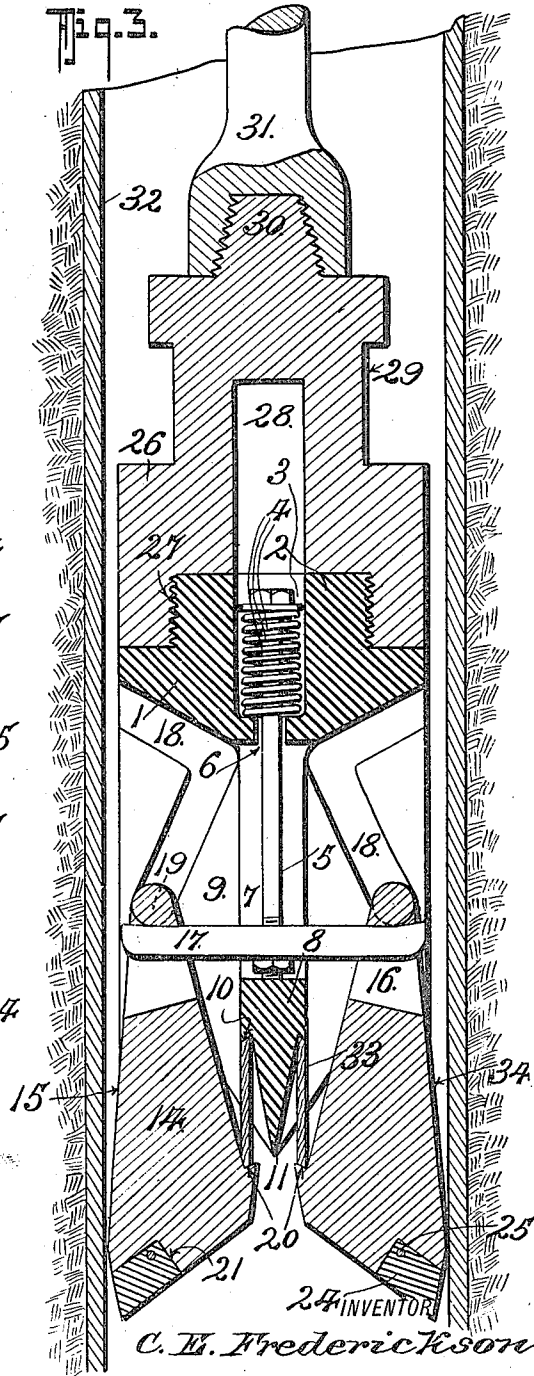
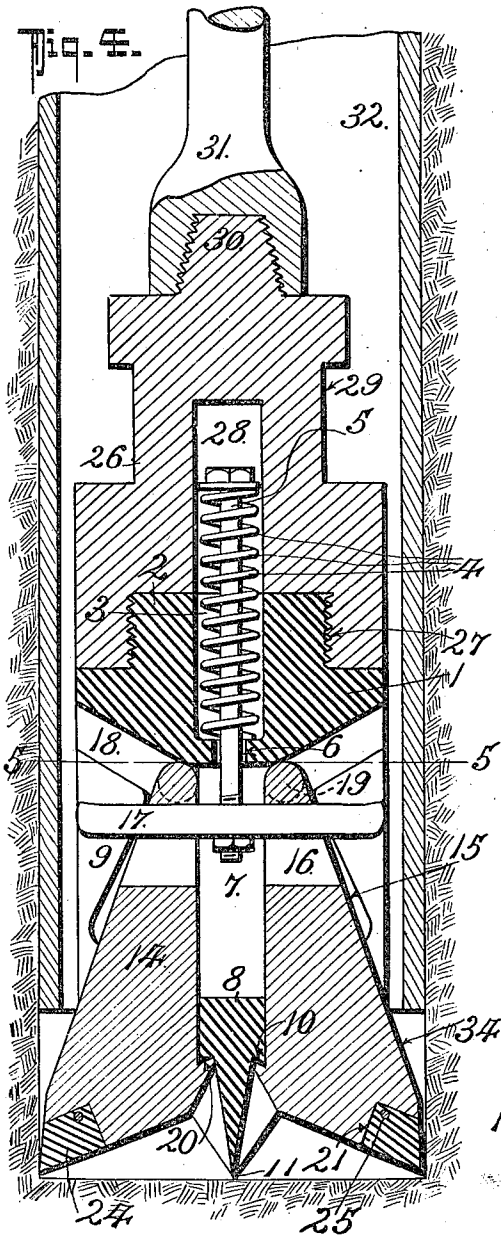
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3 SHEETS-SHEET 2.

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WITNESSES:
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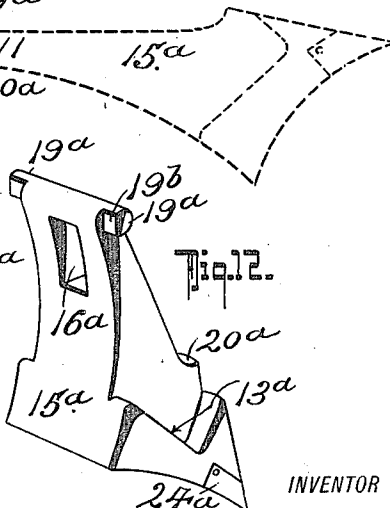
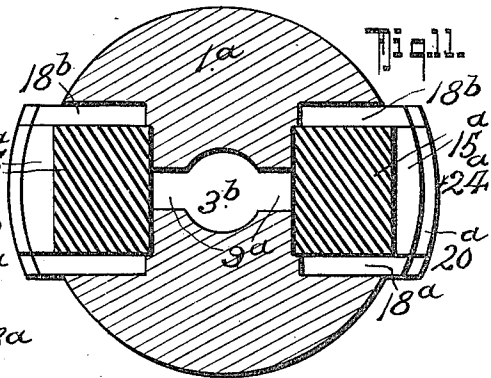
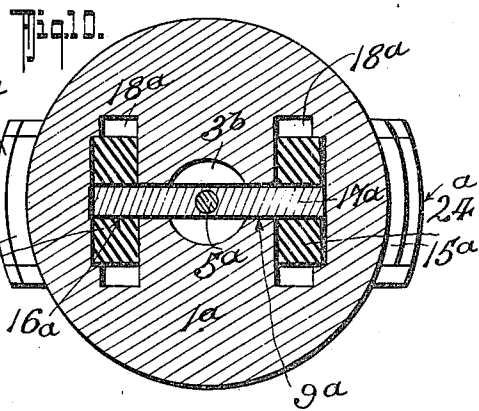
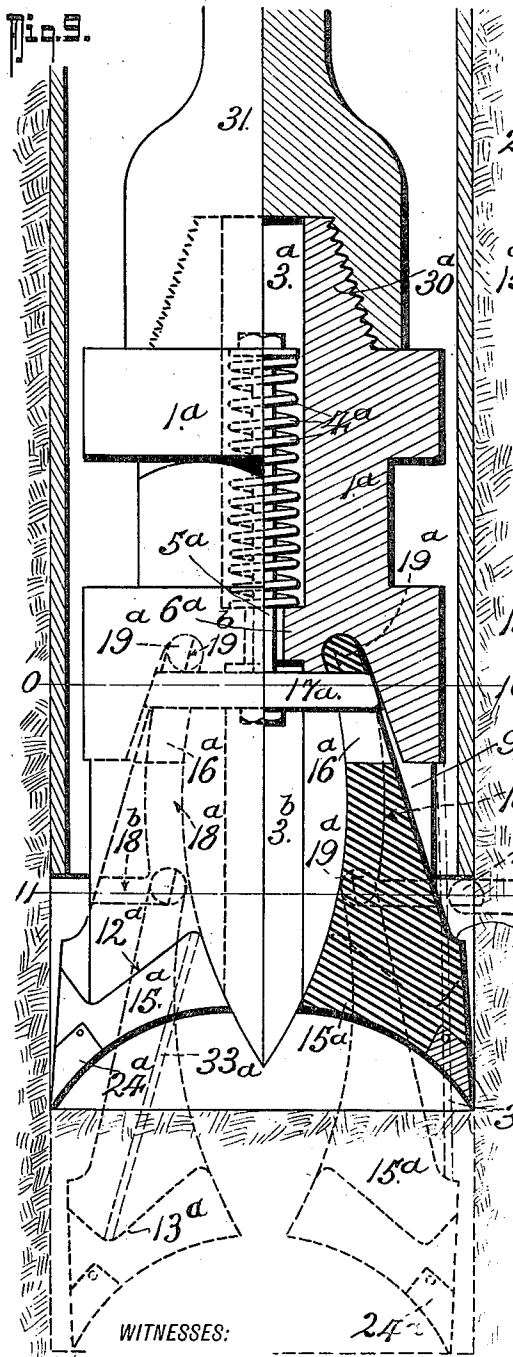
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

CLAYTON E. FREDERICKSON, OF SAN FRANCISCO, CALIFORNIA.

UNDERREAMER.

1,045,274.

Specification of Letters Patent.

Patented Nov. 26, 1912.

Application filed September 19, 1911. Serial No. 650,110.

To all whom it may concern:

Be it known that I, CLAYTON E. FREDERICKSON, of San Francisco, in the county of San Francisco and State of California, have invented a certain new and useful Improvement in Underreamers, of which the following is a specification.

My invention is an improved tool for use in drilling and boring oil wells.

In practice a well tube or casing is forced into the well, and in order that the casing or tube may pass down, the well must be reamed out below the tube as it moves downwardly. In accomplishing this act, the tools employed, not infrequently become jammed, broken, and lost, thereby rendering the operation of well drilling both uncertain and expensive, and furthermore delaying the operations until the "lost" tool is recovered and removed from the well, or drilled into metallic dust or driven into a soft formation outside of the wall of the well.

It is therefore the principal object of the present invention to provide a reaming tool that can be readily admitted or withdrawn through the well casing without delay, and without danger of jamming the tool in the casing.

The invention also consists in constructing the upper ends of the cutters with trunnions and forming slots or pockets in the supporting body, providing such body with grooves that communicate with the pocket and placing the cutters in position by inserting the trunnion end of the cutters—first in the main body and pushing the same into place, and then turning the cutters on their trunnions and dropping or forcing them into the grooves and final resting place for the cutters.

The invention also includes a structure which has provisions whereby in the event of any accident by breaking the cross-key or actuating rod or spring, the cutters will drop down the grooves in which the trunnions are located, until the trunnions rest at the bottom of the grooves, thus making it impossible for the cutters to escape from the main body in case of accident.

In applying my invention, I provide a body having cutter receiving chambers or pockets in which the cutters are so located and mounted as to protect the cutting edges

beyond the diameter of the body when in use to under-ream or undercut the well wall beneath the descending tube. The body and cutters are interlocked when in operation, in such manner however, that upon exerting an upward pull on the body, the cutters will unlock and telescope or fold into the body to enable the reamer to be withdrawn through the tube whenever such action may be necessary or advisable. The cutters are also provided with removable cutting points to facilitate repairs, and means are provided to hold the cutters and body in their proper interlocked relation during the operative function of the tool and thus prevent accidental disconnections taking place between the cutters and the body.

In its more subordinate nature, the invention includes those novel details of construction, combination and arrangement of parts, all of which will be first fully described and then be specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which,

Figure 1 is a central vertical longitudinal section of the lower end of a well tube, showing the invention in use, the reamer being shown in elevation. Fig. 2 is a side elevation of the tool with the parts in the folded or telescoped position. Fig. 3 is a vertical section with the parts positioned as in Fig. 2. Fig. 4 is a vertical section with the parts in their operative position. Fig. 5 is a cross section on the line 5—5 of Fig. 4. Fig. 6 is an elevation at right angles to Fig. 1. Fig. 7 is an inverted plan view of the parts shown in Fig. 4. Fig. 8 is a detail view of one of the cutters showing the removable cutter point. Fig. 9 is a view partly in elevation and partly in central vertical longitudinal section of another form of the invention. Fig. 10 is a cross section on the line 10—10 of Fig. 9. Fig. 11 is a cross section on the line 11—11 of Fig. 9. Fig. 12 is a detail perspective view of one of the cutters used in the latter form of the invention.

In the drawings in which like numerals and letters of reference indicate like parts in all of the figures; 1 designates the main portion of the body, which has a threaded boss 2 and is bored at 3 to receive the spring 4 that surrounds the stem 5. The stem 5 projects into a bore 6, that communicates

with the slot 7 which passes through the web 8, the web 8 separating the two cutter chambers 9—9. Near its lower end, the web 8 has shoulders 10, and the extreme lower end of the body 1 is V-shaped as at 11 and is provided with an inverted V-shaped recess 12 at each side of the central V-shaped portion 11 to receive the correspondingly shaped head 13 of the cutters 14. Each cutter 14 consists of a body web 15, that is slotted at 16 to receive the cross key 17 which is secured to the lower end of the rod 5 and passes through the slot 7. The side walls of the cutter chambers 9 are provided with L-grooves 18, one end of each of which opens out at the side of the body, while the other end is "blind" as best indicated in Fig. 4. The grooves 18 receive the trunnion bearings 19 of the cutters 14. Each cutter 14 has a shoulder 20 that opposes the corresponding shoulder 10, for a purpose hereinafter clearly set forth. Each cutter 14 also has a "point" receiving recess 21, the upper wall of which is provided with a dove tail slot 22 to receive the dove tail 23 of the removable "point" 24. The "point" 24 is held in place by a pin 25 that passes through the cutter head 13 and the dove tail 22 as best shown in Fig. 4.

26 is a union-cap which is provided with a threaded pocket 27 for the boss 2, and it also has a bore 28 that communicates with the pocket and receives the spring 4 and the rod 5. The union-cap 26 has a nut face 29 and a threaded pin 30 to screw into the operating stem or rod 31.

Operation: The well tube 32 having been started into the well opening, the reamer is let down into position. This is accomplished by pulling the cutters 14 downwardly until the trunnions 19 rest in the "blind" ends of the grooves 18, at which time they are folded in to lie within the diameter of the body end of the reamer, and they are held in this position against tension of the spring 4 by breakable pieces 33, of wood or other similar material, that are placed between the shoulders 10 and 20 as best indicated in Fig. 3. The tool is then lowered through the well tube 32, and when the cutters engage the bottom of the well opening the rods 33 will break, and permit the spring 4 to draw the cutters into the operative position indicated in Fig. 4, the spring 4 being aided in this function by the weight of the body 1 and its carried parts. When it is desired to remove the tool from the well, it is only necessary to draw up on the stem 31, when the inclined faces 34 of the cutters will engage the lower end of the well tube and be forced to telescope into the diametrical dimension of the body 1, and thereby readily pass through the well tube without danger of sticking or jamming.

In Fig. 9 *et seq.*, I have shown another, and perhaps simpler form of the invention. In this form the body 1^a is provided with the threaded pin 30^a to receive the stem or rod 31, and the union-cap 26 is omitted. The body 1^a is bored, at 3^a—3^b, to receive the spring 4^a and the rod 5^a. The bore has a restricted portion 6^a to form the spring abutment. As in the form shown in Figs. 1 to 8 inclusive, so in this form, the body 1^a has cutter pockets 9^a and trunnion receiving grooves 18^a—18^b, one end of each groove being "blind" and the other end open at the outside of the body. The open arm 18^b of each groove is of less width than the diameter of the trunnion 19^a, so as to retain the cutter 15^a and prevent its dropping out or becoming disconnected from the body 1^a accidentally. In order that the cutters may be entered into position, the trunnions are flattened or cut away as at 19^b, so that they may be inserted, as indicated in heavy dotted lines in Fig. 9. Each cutter 15^a has interlocking faces 13^a to engage corresponding faces 12^a on the body 1^a, and each cutter has a removable cutting point 24^a as indicated in Figs. 9 and 12. The cross-key 17^a enters the slots 16^a of the cutters, so that the force of the spring 4^a will be applied thereto to hold the cutters in their normal positions, as shown in full lines in Fig. 9. The cutters may have shoulders 20^a, against which the breakable spacers 33^a may be set, or the spacers may be set between the interlocking members 13^a and 12^a, as indicated in dotted lines in Fig. 9, if desired. The operation of this form of my invention is essentially the same as that of the first described form, and will be readily understood by reference to the drawings, and therefore a detail description of the operation of the same is believed to be unnecessary.

From the foregoing description taken in connection with the accompanying drawings, it is believed the complete construction, operation and advantages of the invention will be manifest to those skilled in the art, and I desire it understood, that the forms disclosed in the drawings are the preferred arrangements, although, I do not wish to be limited thereto.

What I claim is:—

1. In an under-reamer, a body portion having radial chambers, the side walls of which are provided with grooves whose lower extremities are "blind," cutters mounted in said chambers and having trunnions to enter said grooves, said body portion at its lower extremity having an interlocking face, said cutters each having interlocking faces to interlock with said body face, and means continuously tending to hold said cutters interlocked with said body.
2. In a reamer, a body having radially dis-

posed cutter receiving chambers, the side walls of said chambers having L-grooves, one end of each of which opens outwardly and the other end is "blind," cutters having body portions held in said chambers and including trunnions mounted in said grooves, said cutters having heads, a cross key passing through said cutters and a spring actuated rod device connecting with said key and continuously tending to move said cutters upwardly to bring said cutter heads into engagement with the under-face of said body, the cutter heads and said body-face having interprojecting portions.

3. In an under-reamer, a body portion having radial chambers, the side walls of which are provided with grooves whose lower extremities are "blind," cutters mounted in said chambers and having trunnions to enter said grooves, said body portion at its lower extremity having an interlocking face, said cutters each having interlocking faces to interlock with said body face, and means continuously tending to hold said cutters interlocked with said body, said cutters being foldable into the diametric dimensions of said body and means for holding said cutters in their folded position against the tension of said continuously acting cutter moving means.

4. In a reamer, a body having radially disposed cutter receiving chambers, the side walls of said chambers having L-grooves, one end of each of which opens outwardly and the other end is "blind," cutters having body portions held in said chambers and including trunnions mounted in said grooves, said cutters having heads, a cross key passing through said cutters and a spring actuated rod device connecting with said key and continuously tending to move said cutters upwardly to bring said cutter heads into engagement with the under-face of said body, the cutter heads and said body-face having interprojecting portions, said cutters being foldable into the diametric dimensions of said body, and means for holding said cutters in their folded position against the tension of said continuously acting cutter moving means.

5. In an under-reamer for oil wells, a main body having a pair of oppositely disposed radial chambers or pockets, cutters mounted in said pockets and having projecting heads, each of said cutter heads and said body having interlocking portions to register with one another when said cutters are in their working positions, and spring actuated means for holding said cutters in their working positions, said main body having grooves, and said cutters having portions projecting into said grooves, said body and grooves including provisions cooperating with said projecting portions to retain said cutters in connection with said body inde-

pendently of said spring actuated means, at all times, substantially as shown and described.

6. In an under-reamer for oil wells, a body having a plurality of radial chambers, a cutter pivotally and longitudinally movably mounted in each of said chambers, said body having its lower face provided with cutter interlocking portions, each of said cutters having interlocking heads for engaging the respective interlocking portions, and a single means connecting all of said cutters and continuously tending to move said cutters into said pockets with their interlocking portions into interlocked relation with said body interlocking portions, said body having grooves of substantially L-shape in elevation, and said cutters having trunnions to enter said grooves, the entrant ends of said grooves being of less width than the remaining portions of the respective grooves, and said trunnions having a dimension corresponding with the entrant portion of the respective grooves in virtue of which said cutters may be inserted when held in one position and retained in connection with said body when held in another position.

7. In an under-reamer, a body portion having a cutter chamber, the side walls of which are provided with grooves, a cutter mounted in said chamber and having trunnions to enter said grooves, said body portion and said cutter having interlocking faces, and means continuously tending to hold said cutter interlocked with said body, said grooves and said trunnions cooperating to hold said cutter connected with said body, and said grooves having provisions to retain said cutter in connection with said body irrespective of said means that continuously tends to hold said cutters interlocked with said body.

8. In an under-reamer, a body having a cutter receiving chamber opening at the side, the side walls of said chamber having grooves, one end of each of which opens outwardly and the lower end is "blind," a cutter having a body portion held in said chamber and including trunnions mounted in said grooves, said cutter having a head, said cutter-head and said body having interprojecting portions to interlock said cutter and body, and yieldable means for holding said cutter interlocked with said body.

9. In an under-reamer, a body having a cutter receiving chamber opening at the side, the side walls of said chamber having grooves, one end of each of which opens outwardly and the other end is "blind," a cutter having a body portion held in said chamber and including trunnions mounted in said grooves, said cutter having a head, said cutter-head and said body having interprojecting portions to interlock said cutter and body, and yieldable means for hold-

ing said cutter interlocked with said body, said body grooves having provisions for retaining said cutter in connection with said body upon failure of said last named means to act.

5 10. In an under-reamer a supporting body having a cutter chamber, a cutter removably held in said chamber, resilient means for retaining said cutter in operative position, and a single device for positively
10 connecting said cutter to said body and for retaining said cutter in connection with said body in the event that said resilient retaining means becomes broken or inoperative.

15 11. In an under-reamer a supporting body having a cutter chamber, a cutter removably held in said chamber, resilient means for retaining said cutter in operative position, and a single device for positively
20 connecting said cutter to said body and for retaining said cutter in connection with said body in the event that said resilient retaining means becomes broken or inoperative, a
25 removable cutter point for said cutter and means for removably securing said cutter point in position.

30 12. In an under-reamer for wells, a body portion having radial chambers, cutters pivotally and slidably mounted at one end in said chambers, said body portion having a central peak portion and side interlocking projections, said cutters each having interlocking portions to coöperatively engage

said peak portion and said interlocking projections of said body portion, said peak portion extending below the plane of the lower edges of said side interlocking projections, and means continuously tending to hold said cutter interlocking portions interlocked with the corresponding parts of said body, the lower faces of said cutters lying in planes extending from said central peak portion and diverging downwardly and laterally therefrom when said cutters are in their cutting positions, substantially as shown and described.

13. In an under-reamer for wells, a body portion having a central peak portion and side interlocking projections merging with said central peak portion, said central peak portion extending downwardly beyond said side interlocking projections, cutters mounted on said body and having interlocking portions to coöperatively engage said peak portion and said side interlocking projections, the cutting points of said cutters when in their operative position and the end of said peak portion lying in substantially the same transverse plane, the bottom faces of said cutters extending from the cutting points toward said peak portion and converging upwardly thereto substantially as shown and described.

CLAYTON E. FREDERICKSON.

Witnesses:

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W. E. HETTMAN.