G. A. HUMASON.

COMBINED UNDERREAMER AND BIT.

APPLICATION FILED JUNE 6, 1914.

1,171,790.

Patented Feb. 15, 1916.

4 SHEETS—SHEET 1.

Fig. 1

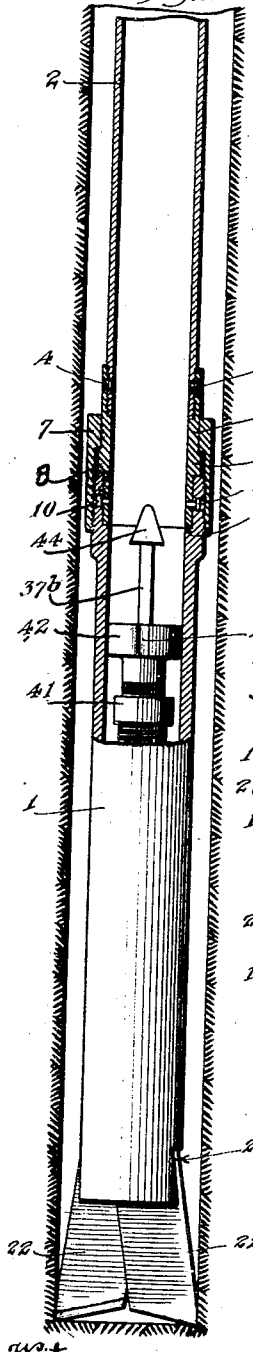


Fig. 2

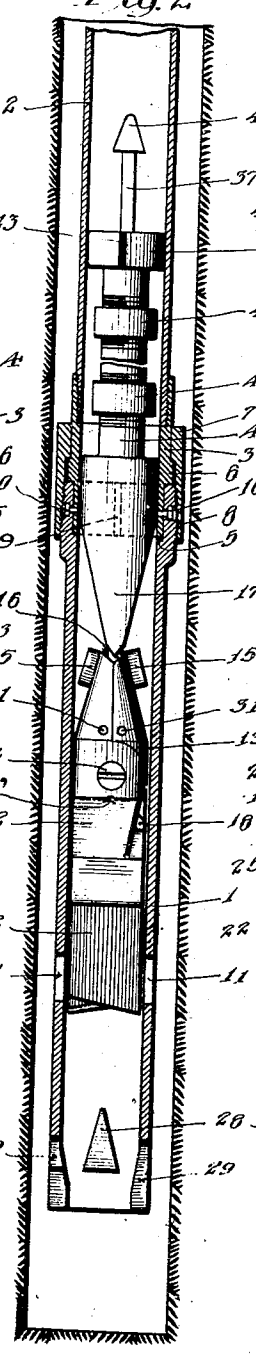


Fig. 3

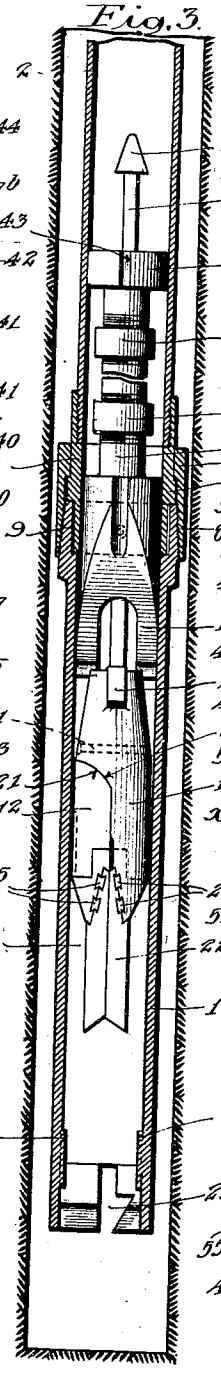


Fig. 9

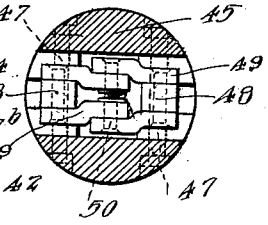


Fig. 10.

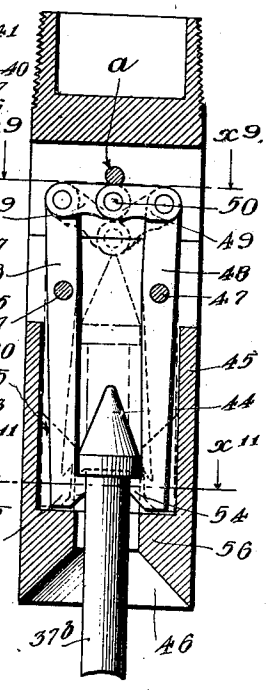
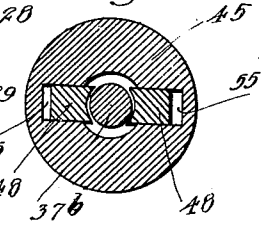


Fig. 11



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by Frank Bacaley

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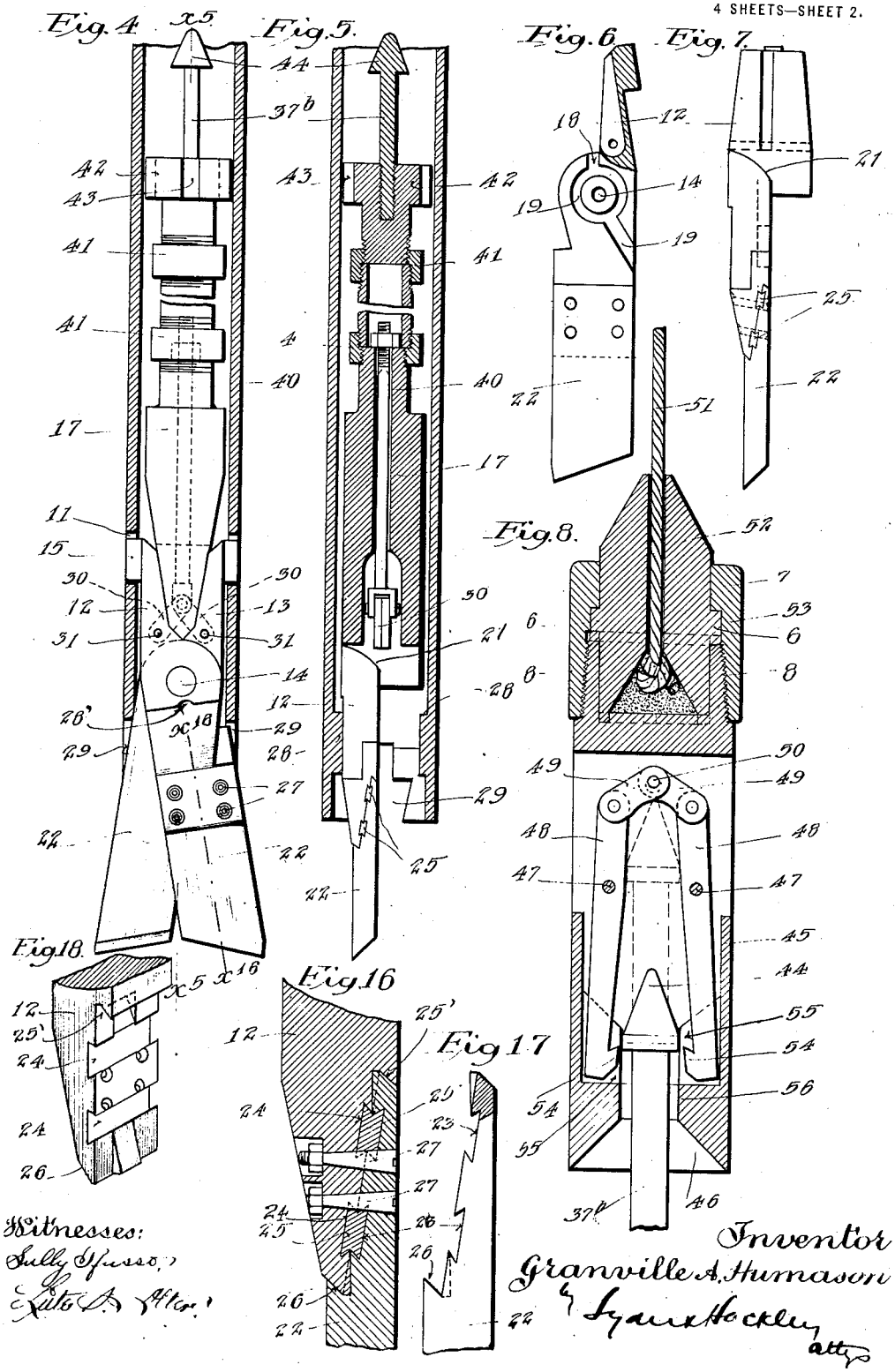
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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

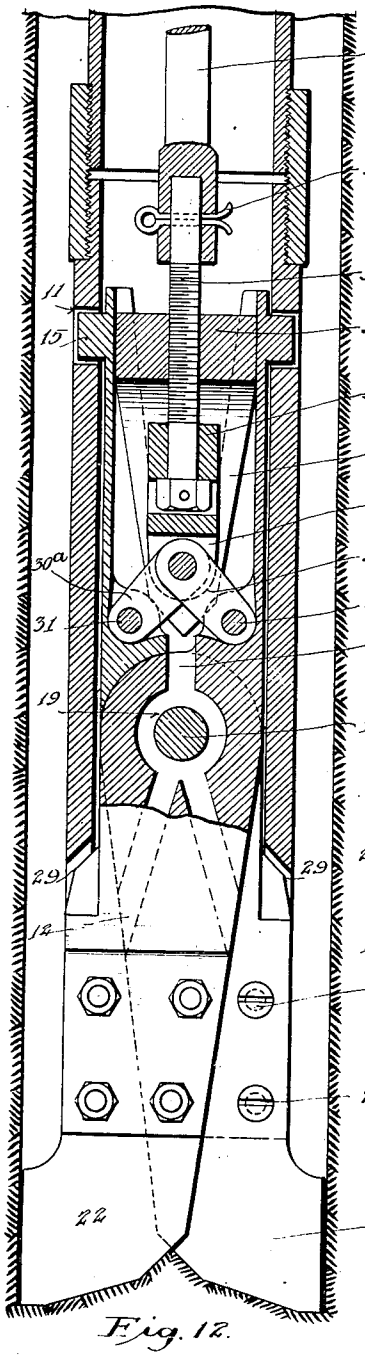


Fig. 12.

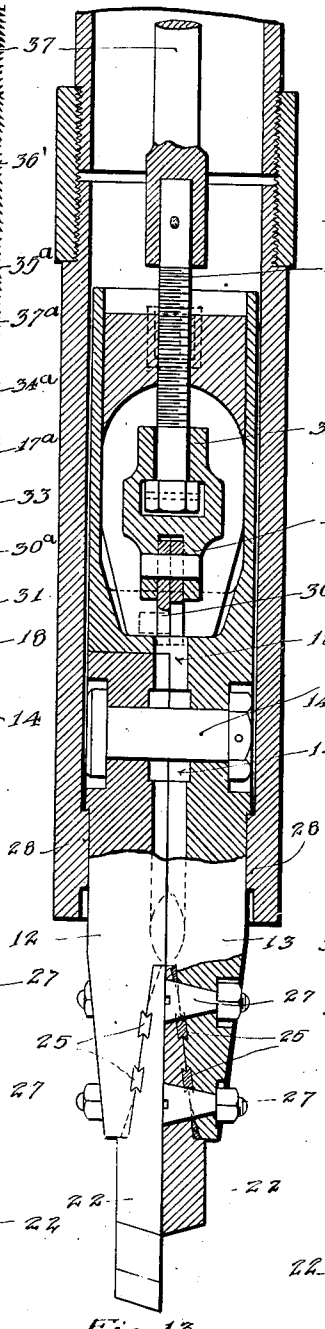


Fig. 13.

Fig. 15

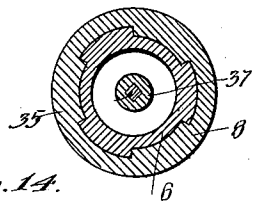
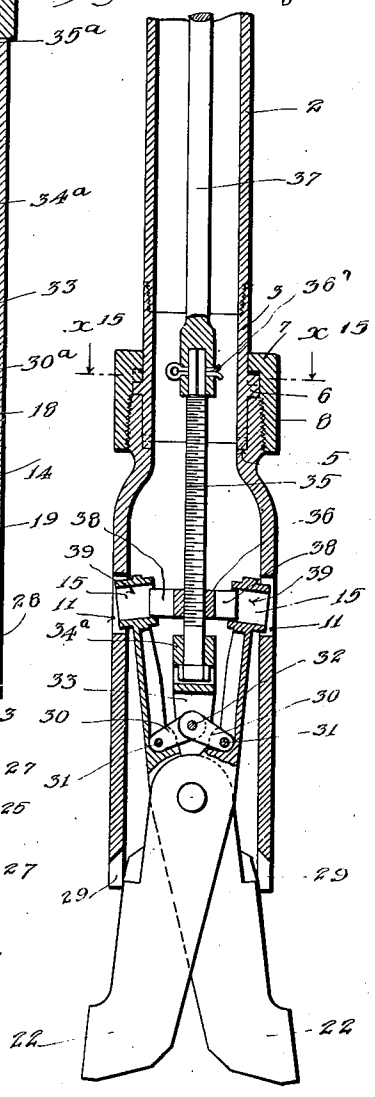


Fig. 14.



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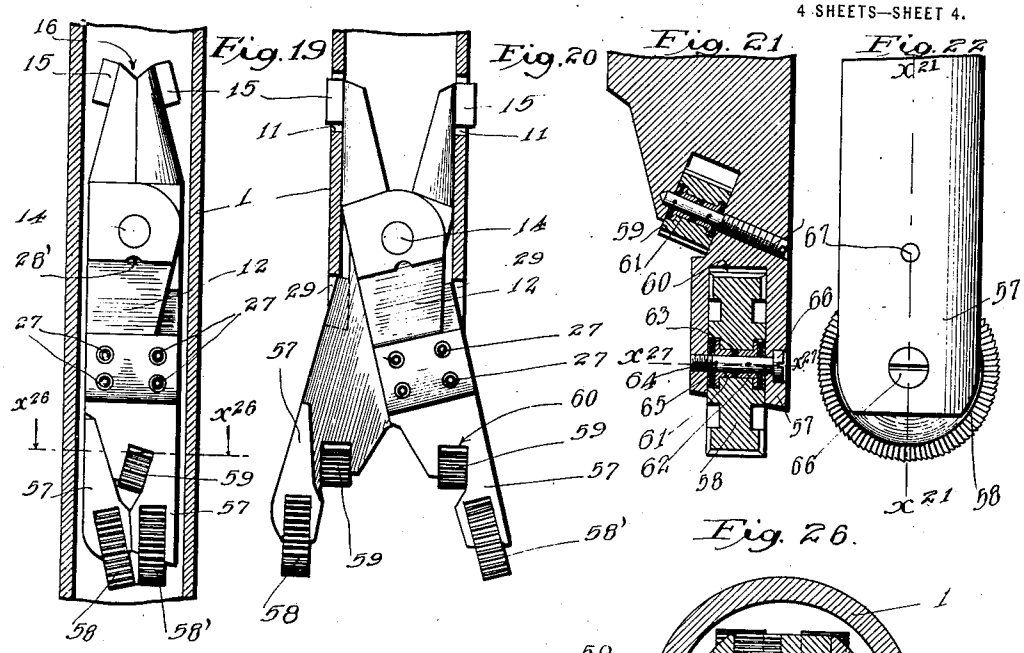
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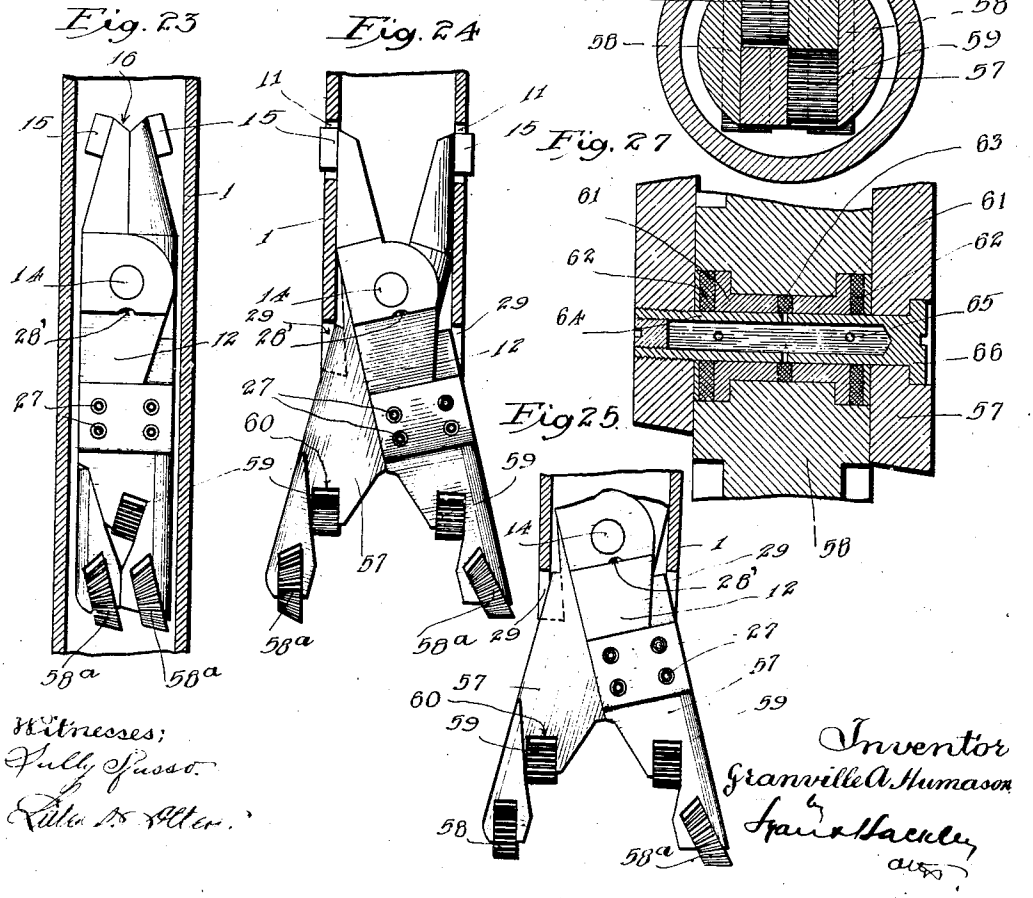
APPLICATION FILED JUNE 6, 1914.

1,171,790.

Patented Feb. 15, 1916.

4 SHEETS—SHEET 4.





Witnesses;
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Atty's.

UNITED STATES PATENT OFFICE.

GRANVILLE A. HUMASON, OF SHREVEPORT, LOUISIANA, ASSIGNOR TO ROTARY EXPANSION BIT COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

COMBINED UNDERREAMER AND BIT.

1,171,790. Specification of Letters Patent. **Patented Feb. 15, 1916.**

Application filed June 6, 1914. Serial No. 843,451.

To all whom it may concern:

Be it known that I, GRANVILLE A. HUMASON, a citizen of the United States, residing at Shreveport, in the parish of Caddo and State of Louisiana, have invented a new and useful Combined Underreamer and Bit, of which the following is a specification.

This invention relates to a combined underreamer and bit adapted for rotary drilling and underreaming, and one of the objects of the invention is to provide a novel form of expansible rotary bit which may be inserted through the tubing and then expanded to cutting size.

Another object is to provide means for regulating the cutters and adjusting the cutting size of the bit for drilling or underreaming.

Another object is to provide novel means for securing the cutting blades.

Another object is to provide novel means for inserting and removing the tool.

Another object is to avoid the use of springs.

Referring to the drawings: Figure 1 is a vertical section partly in elevation through the lower part of the drill pipe. Fig. 2 is a vertical section through the lower part of the drill pipe, showing the tool in elevation, and partly withdrawn. Fig. 3 is a view similar to Fig. 2 at right angles to the section in Fig. 2. Fig. 4 is a vertical section through the lower part of the drill pipe showing the tool in elevation with the cutting blades expanded. Fig. 5 is a section on line x^5—x^5, Fig. 4. Fig. 6 is a front elevation in detail partly in section of a cutter. Fig. 7 is a side elevation of the cutter. Fig. 8 is a vertical section through the controlling device. Fig. 9 is a cross section on line x^9—x^9, Fig. 10. Fig. 10 is a view similar to Fig. 8, showing hooks engaging the stem. Fig. 11 is a section on line x^{11}—x^{11}, Fig. 10. Fig. 12 is an enlarged view of a vertical section through a modified form of the tool, showing the tool expanded. Fig. 13 is a view similar to Fig. 12. Fig. 14 is a longitudinal section through another form of the tool, showing it expanded. Fig. 15 is a section on line x^{15}—x^{15}, Fig. 14. Fig. 16 is a section on line x^{16}—x^{16}, Fig. 4. Fig. 17 is a side elevation in detail of the upper part of one of the blade members. Fig. 18 is a perspective of one of the blade supporting members. Fig. 19 is a longitudinal section through the lower part of the pipe, showing another form. Fig. 20 is a view similar to Fig. 19, showing the cutters expanded. Fig. 21 is a section on line x^{21}—x^{21}, Fig. 22. Fig. 22 is a side elevation of what is shown in Fig. 21. Fig. 23 is a view similar to Fig. 19, showing a slightly modified form of cutter. Fig. 24 is a view similar to Fig. 20, showing a slightly modified form of cutter. Fig. 25 is a view similar to Fig. 24, showing a slightly modified form of cutter. Fig. 26 is an enlarged section on line x^{26}—x^{26}, Fig. 19. Fig. 27 is an enlarged sectional view of some of the parts in Fig. 21.

Referring to Fig. 1, 1 designates a barrel which is screwed to the lower end of the drill pipe 2 by any suitable coupling, the one shown comprising an inner sleeve 3, the upper end of which is internally threaded and screwed to the threaded end of the drill pipe and secured against accidental unscrewing by screws 4. The lower end of the inner sleeve 3 telescopes within the upper end of the barrel 1, the latter being formed with a shoulder 5 forming a seat for the sleeve 3, and the sleeve 3 having a flange 6 which seats against the upper end of the barrel and forms a shoulder to receive an inner flange 7 of an outer sleeve 8, the lower portion of which is internally threaded and screwed externally on the threaded upper end of the barrel 1. A key 9 between the inner sleeve and barrel 1 prevents revoluble movement between the two and bolts 10 prevent longitudinal separation.

The barrel 1 has two oppositely arranged slots 11. Within the barrel are two cutter levers 12 and 13, which are pivoted together at 14 like a pair of scissors, and projecting from the upper end of each lever is a lug 15. The upper ends of the levers are inwardly beveled at 16 to permit the easy entrance of the lower end of the wedge 17. As shown in Fig. 6, each lever has a water course 18 joining with an annular course 19 around the pivoted center 14 to conduct water to the cutters. The lever 13 has a concave shoulder 20, which receives the corresponding curved edge 21 of the lever 12, so that strain is taken off from the pivot 14. Carried by each lever is a cutting blade 22,

which is provided with dovetail slots 23, as shown in Figs. 16 and 17, and the lever is also provided with similar dovetail slots 24, and a key 25 formed in cross section of a double dovetail is inserted to lock the blade to the lever. The lever also has an undercut shoulder 25′, which receives the beveled upper end of the blade, while the blade has an undercut shoulder 26, which receives beveled lower end of the lever. Tapered bolts 27 pass through the lever and blade and partially through the keys 25 and serve to further lock the members together and also prevent lateral shifting of the blade, and prevent the keys from sliding out of position.

The lower end of the barrel 1 contains two wedge shaped lugs 28, and the barrel also has two slots 29, the slots 29 being shaped to receive the blades when they are expanded as indicated in Fig. 1. The lugs 28 act as stops to receive notched portions 28′ formed in the levers, see Fig. 4, and wedges 28 act as fulcrums during the pivoting action of the levers. The wedges also act to prevent the head of the bit falling through if the cutters break off.

In the form shown in Fig. 14, links 30 are pivoted at 31 to the respective levers and at 32 are pivoted to each other and to a block 33, which is formed with a swivel 34^a, which receives the lower end of the screw stem 35. A nut 36 engages the screw 35 and has lugs 38 which extend loosely into slots 39 formed in the lugs 15. The screw 35 is connected by pin 36′ with a rod 37 which extends up through the drill pipe 2 to the upper end thereof, and by turning the rod 37 the screw 35 may be revolved to move the nut 36 up or down, and thereby expand or contract the cutters. Thus, assuming the parts to be in the position shown in Fig. 14, if it be desired to collapse the cutters, the screw 35 will be revolved in a direction to cause it to rise in the nut 36, as the nut 36 is prevented from rising by its engagement with slots 39 in lugs 15, and lugs 15 are engaged in slots 11. In this form the lugs 15 are hollow to permit the outward passage of any cuttings which might accumulate and fill the slots 39 and prevent the lugs entering. The upward movement of screw 35 draws up on the block 33, and on the pivot 32, thereby causing links 30 to draw inward on their pivots 31 and move the upper ends of the levers toward each other, thereby moving the lower ends of the cutters likewise inwardly until the members stand substantially parallel, by which time the lugs 15 will have been moved inward sufficient to clear the slots 11, and the collapsed bit may be drawn up into the barrel. By enlarging the size of the barrel as in Fig. 14, the cutter may be expanded to drill a larger size hole and this barrel may be placed on the same drill pipe thus not necessitating a larger drill pipe.

In the form shown in Figs. 12 and 13, the wedge 17^a is constructed as a bifurcated downward extension from the nut 37^a, and as the screw 35^a is revolved in a direction to lower the nut 37^a, the wedge is gradually forced between the levers to assist the links 30^a in spreading the levers apart.

In the form shown in Figs. 1 to 11, instead of operating the parts by revolving the threaded stem, as in the other forms, the stem is reciprocated by a special device. The wedge 17 has a threaded tubular extension 40 with screw collars 41, and is adapted to carry the required weights for operating the wedge. The upper end of the extension 40 has a cap 42 with water courses 43. The stem 37^b is screwed into the cap 42, as shown in Figs. 4 and 5, and has a conical head 44. Figs. 8 and 10 show the device employed for operating the stem of forms 1 to 11, which consists of a barrel 45 with a hollow conical lower end 46. Pivoted at 47 within the barrel are levers 48, the upper ends of which are connected by toggle links 49, the links 49 being pivoted together at 50. A rope 51 is secured to the barrel 45 by a rope socket 52, which is screwed to the barrel 45 by a sleeve 53. The levers 48 are provided on the lower ends with hooks 54, which extend into slots 55 formed in an inner flange 56, and the bore within the flange 56 permits sliding engagement of the head 44 of the stem 37^b. To insert the tool into the casing, the levers 48 are arranged in the position shown in full lines in Fig. 10 with the hooks 54 engaging the head 44, the toggle links 49 being straight across, and there being no pin in hole *a*. The rope 51 is then lowered, and when the tool arrives at the bottom and is arrested, the rope is lowered still farther, which brings the toggle links 49 against the top of the head 44, which swings the center pivotal connection of the toggle links upward, as shown in full lines in Fig. 8, the views of the head 44 being shown in dotted lines, which swings the hooks 54 laterally out into the slots 55, and by then pulling up on the rope 51 the device is removed, leaving the tool in position at the bottom of the drill pipe.

When it is desired to remove the tool, a pin is inserted into the hole *a*, and the levers 48 are adjusted with the toggle links 49 bent downwardly as indicated in dotted lines in Fig. 9, this being done at the top of the well before the device is lowered. The device is then lowered and passed freely down over the head 44, because the hooks 54 are retracted in line entirely within the recesses 55. Continued downward movement brings the depressed central pivot of

the toggle links against the top of the head 44 and swings this pivot upward until the toggle links strike the pin inserted in the hole *a*, which prevents further upward movement and holds the toggle links in line with each other, and with the hooks 54 engaged underneath the head 44, as shown in full lines in Fig. 10, and by then pulling up on the rope the device will lift the tool.

Figs. 19 to 22 inclusive show a modified form of cutter, in which instead of the plain cutting blades 22 shown in the previous forms, I provide cutter holders 57, which are secured by bolts 27 in lieu of the blades 22, the holders 57 being provided with rotary cutting disks 58, 59. The cutters 58, 58′ are arranged in the lower ends of the holders 57, while the cutters 59 are of smaller size and arranged in slots 60 above the cutters 58, 58′. The cutter 58′ is arranged in line with its holding member 57, while the cutter 58 is arranged at an angle to its holding member. As shown in Figs. 21 and 27, the cutters 58 are provided with bushings 61 with packing 62 at each end and packing 63 between the bushings 61, and a hollow pin 64 forms a bearing for the bushings 61 and is provided with lubricant holes 65. The lower pin is provided with an ordinary flanged head 66 slotted for a screw driver, while the upper pin is provided with an elongated screw threaded head 67, as shown in Fig. 21.

In the form shown in Fig. 23, the cutters 58^a are beveled and but a single cutter 59 is employed as in Fig. 19, while in Fig. 24 two cutters 59 are employed, also two cutters 58^a.

In the form shown in Fig. 25, two cutters 59 are employed, and a single beveled cutter 58^a and a single cutter 58. As before stated, the cutter holders 57 may be detached and the plain blades 22 substituted if desired.

What I claim is:—

1. A combined underreamer and bit comprising a barrel, a pair of levers pivoted together and provided with cutters and slidable within said barrel, and means for sliding said levers in said barrel to expand or contract the levers, said levers being provided with an annular water course around their pivot and with water courses leading from the annular water course.

2. In a combined underreamer and bit, a pair of levers having lugs and pivoted together and provided with cutters, a wedge movable between said levers to expand their cutters, a barrel provided with slots to engage the lugs and a screw connected to the wedge to move said wedge.

3. In a combined underreamer and bit, a pair of levers pivoted together, a barrel in which said levers are slidable, means for locking said levers against longitudinal or rotative movement in said barrel when expanded, toggle links connected to said levers above their pivot, and means for actuating said toggle links to expand or contract said levers.

4. In a combined underreamer and bit, a pair of levers pivoted together, a barrel in which said levers are slidable, means for locking said levers against longitudinal or rotative movement in said barrel when expanded, toggle links connected to said levers above their pivot, a wedge movable between said levers above their pivot to expand them, and means for operating said toggle links and wedge.

5. In a combined underreamer and bit, a barrel, a pair of levers pivoted together and slidable within said barrel and provided with cutters, toggle links connected to said levers above their pivot, a screw, and means operated by said screw and connected with said toggle links for adjusting said levers.

6. A combined underreamer and bit comprising a barrel, a pair of levers pivoted together and slidable in said barrel, toggle links connected with said levers above their pivot, a block connected to said toggle links, a screw swiveled in said block, and means engaging the thread of the screw to cause the toggle links to be actuated when the screw is turned to adjust the levers.

7. A combined underreamer and bit comprising a barrel, a pair of levers pivoted together and slidable in said barrel, toggle links connected with said levers above their pivot, a block connected to said toggle link, a screw swiveled in said block, a wedge with a nut engaging the screw and movable between the levers to coöperate with the toggle links to adjust the levers when the screw is rotated.

8. In a combined underreamer and bit, a pair of levers pivoted together, a barrel in which said levers are slidable, means for adjusting the relative angular position of said levers, each of said levers having a dovetailed slot, a cutter provided with a dovetailed slot, and a key provided with a double dovetail engaging the adjacent lever and cutter, and bolts passing through the cutter and lever.

9. In a combined underreamer and bit, a pair of levers pivoted together, each of said levers having a concave shoulder and a convex shoulder, the convex shoulder of each lever fitting the concave shoulder of the other, a barrel in which said levers are slidable, cutters on the levers, and means for adjusting the cutters.

10. In a combined underreamer and bit, a barrel, a pair of levers having notches and pivoted together and slidable in said barrel, the barrel having notches in its lower end adapted to receive the levers when they are extended, lugs at the lower end of the barrel to engage said notches, and means for extending or contracting the levers.

11. In a combined underreamer and bit, a barrel, a pair of levers pivoted together and slidable in said barrel, said barrel being provided with a pair of lugs near its lower end adapted to strike said levers at a point below their pivot to act as a fulcrum for the levers, and means for moving said levers.

12. In a combined underreamer and bit, a barrel provided with slots, a pair of levers pivoted together and slidable in said barrel, said levers being provided with lugs adapted to engage in said slots, cutters on the levers, and means for adjusting the cutters.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 29 day of May, 1914.

GRANVILLE A. HUMASON.

In presence of—
G. T. HACKLEY,
LORRAINE E. DURROW.