

April 30, 1929.

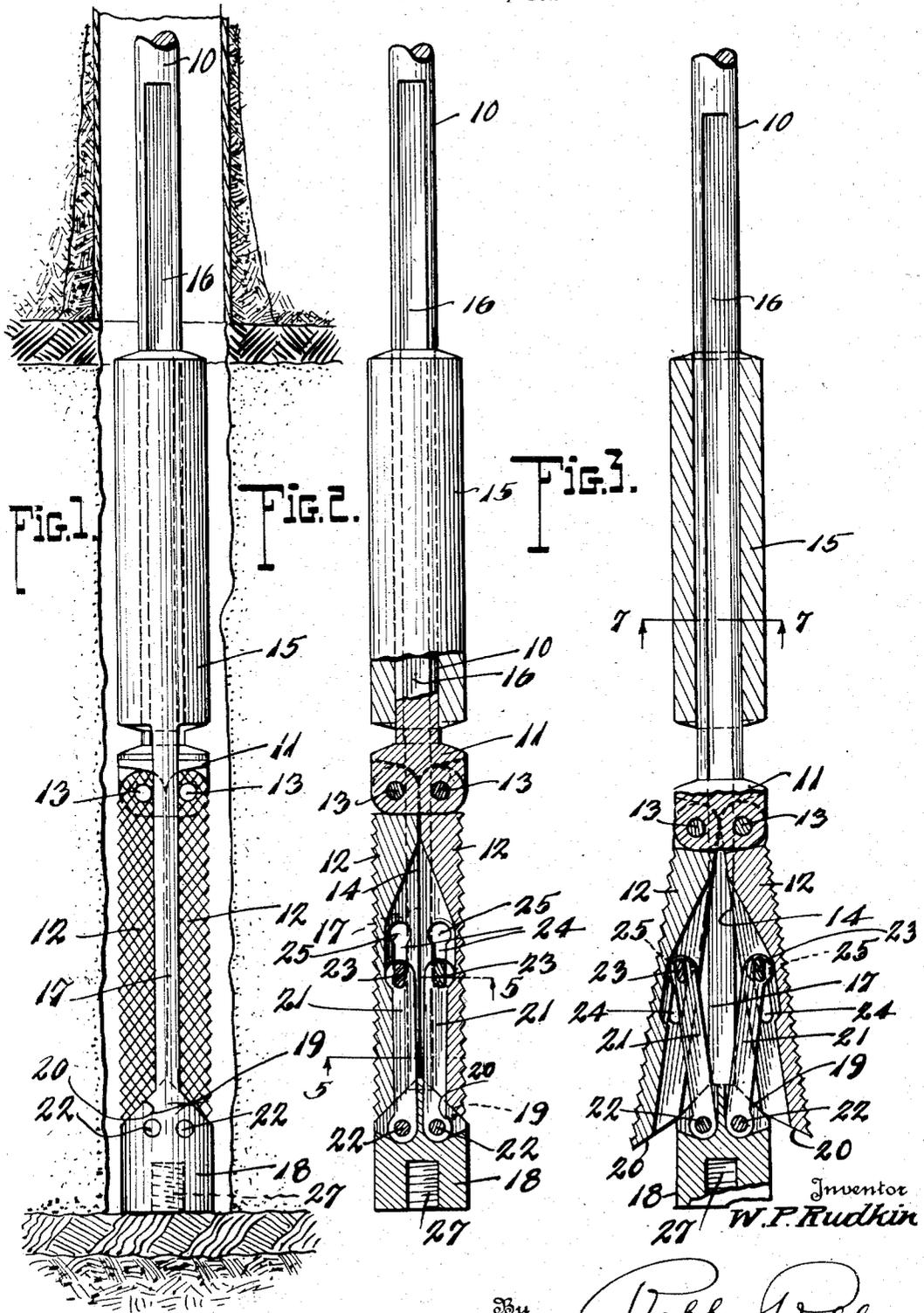
W. P. RUDKIN

1,710,998

UNDER REAMER FOR WELLS

Filed June 4, 1927

2 Sheets-Sheet 1



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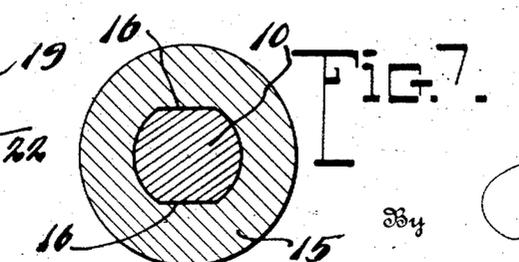
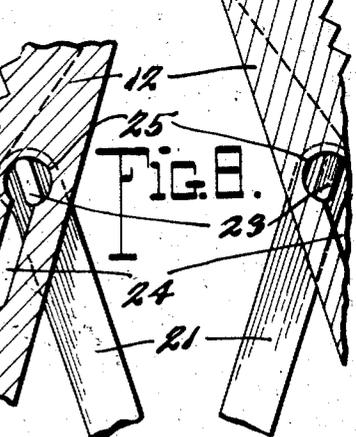
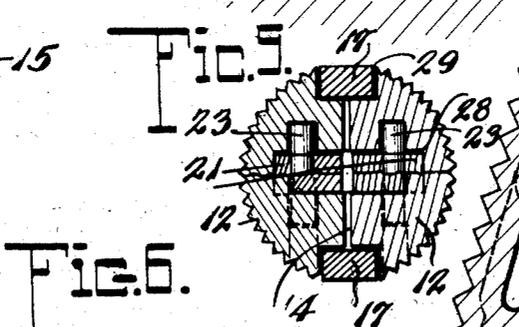
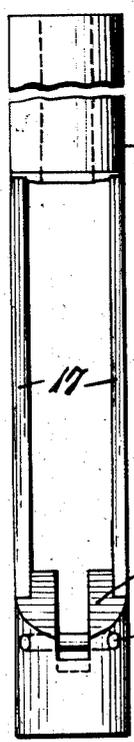
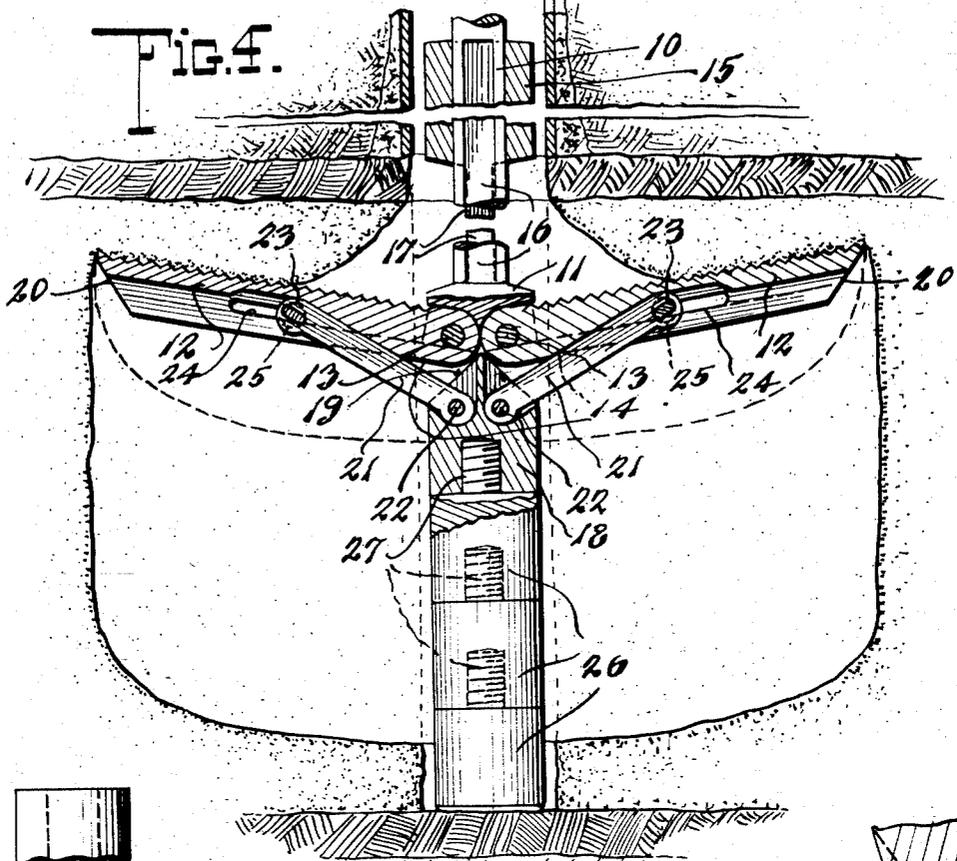
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2 Sheets—Sheet 2



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UNITED STATES PATENT OFFICE.

WILLIAM P. RUDKIN, OF OKLAHOMA CITY, OKLAHOMA.

UNDERREAMER FOR WELLS.

Application filed June 4, 1927. Serial No. 196,559.

This invention relates to an under-reamer for wells, and particularly to a construction embodying expansible cutters disposed to enlarge the well diameter at its lower portion.

5 In the drilling of oil wells it frequently occurs that a proper flow is not secured owing to the lack of gas pressure or the flow of oil from the strata into which the well extends so that it is necessary to excavate a chamber within the oil bearing strata in order to insure a proper flow of the oil. By this method a well which is not commercially productive may be brought to a proper flow and rendered valuable without the necessity of the use of explosives which often so rupture the surrounding rock and strata as to cause a flow of water into the well and the most desirable results are secured by the formation of a chamber at the base of the well.

20 The formation of such a chamber involves the projection of the cutters or reamers into a position approximately transverse to the axis of the well or the body of the tool, and this is most efficiently accomplished by a link connection between the cutters and a part engaging the base of the well. In the use of such a connection, when the links are in a folded or closed position they are practically upon a dead center and it is very difficult to initiate the outward swing of the cutters so that their movement may be continued by the link members. To overcome these objections I have provided a wedge-like member disposed to engage the free ends of the pivoted cutters which initiates their outward movement, and such movement is continued by the links.

35 In order that these links may expand the cutters into a substantially horizontal position and thus retain them for the reaming action, they are provided with a novel pivotal connection permitting sliding movement upon the cutters during the initial opening and subsequently supporting of the cutters by links from the head carried at the lower end of a sliding sleeve upon the drill rod.

40 The mere use of a wedge member alone will not expand the cutters sufficiently to effect the desired under-reaming for the formation of a chamber of material area at the bottom of the well, and my invention supplements this preliminary movement by means to shift the cutters into a substantially horizontal position.

55 The invention has for an object to provide an under-reamer in which the stem is pro-

vided with expansible cutters and carries a movable sleeve having means to initiate the movement of the cutters and a connection from said sleeve to continue said movement for the full extent of the under-reaming action of the cutters.

60 A further object of the invention is to provide a construction in which the drill stem carries pivoted cutters and also a slidable sleeve having a head at its lower end with a wedge device cooperating with the free ends of said cutters and links connecting said head and cutters by which the preliminary movement by the wedge is continued until the cutters assume a position at an angle to the drill stem.

70 A further object of the invention is to provide a particular construction of link connection with the cutters by which the links have a sliding movement upon the cutters in the initial wedging action thereon to throw the links from a dead center and these remain in relatively fixed contact at one end of an elongated way to support the cutters in horizontal position. Such a construction permits the cutters to be closely nested when introduced into the well and to have the greatest area of expansion possible by the relative movement of the parts.

75 Other objects and advantages of the invention will be hereinafter set forth and the novel features thereof defined by the appended claims.

In the accompanying drawing:

80 Figure 1 is an elevation showing the cutters in closed position;

Figure 2 is a section with the parts in similar position;

85 Figure 3 is a section showing the cutters partially open;

Figure 4 is a similar view with the cutters fully open and in position to excavate a chamber at the base of the well;

90 Figure 5 is a section on line 5—5 of Figure 2;

Figure 6 is a detail elevation of the sleeve member;

95 Figure 7 is a section on the line 7—7 of Figure 3; and

100 Figure 8 is a detail elevation showing the link connection with the cutters.

105 Like reference numerals designate corresponding parts throughout the several figures of the drawing.

110 The invention is adapted for various applications, and in the form herein shown the

drill stem 10 may be of any desired size or material and is formed at its lower end with a pivoting block 11 upon which the opposite cutters 12 are mounted by means of pivots 13 at each side of the axial center of the stem. These cutters or reamers may be of any desired type or configuration and are herein shown in Figure 5 as segmental in character so as to provide the greatest possible area and the adjacent faces 14 of such cutters are adapted to be closely aligned when the cutters are folded as shown in Figure 2 so as to cause them to be closely nested within the diameter of the remaining parts of the reamer.

For the purpose of cooperating with the free ends of the cutters and initiating their expansive movement, the stem is provided with a sleeve 15 slidingly mounted thereon and held against rotative movement by a flat contact face 16 on the stem 10 cooperating with a similar face of the sleeve as shown in Figure 7. The sleeve 15 is formed with opposite depending braces 17 carrying at their lower ends a head 18 formed upon its upper surface with a wedge device, such as the V-shaped walls 19, which cooperate with an inclined face 20 at the lower ends of the cutters.

As shown in Figure 3, when the head 18 engages the base of the well the continued movement of the reamer causes the wedge face 19 to effect an initial outward movement of the cutters 12 which is continued by the links 21 connecting the head 18 and the cutters. By reference to Figure 2 it will be seen that when the cutters are in closed position these links are substantially parallel and this initial wedging movement is necessary to throw the links off a dead center in order that the continued downward movement of the reamer will produce an upward movement of the cutters through the link action.

The links may be connected with the cutters and head in various manners, and a desirable form is shown in which the links are pivoted at 22 to opposite sides of the center of the head and provided at their upper ends with an elongated pin 23 which traverses the ways 24 formed in the cutters. This pin is of sufficiently less diameter than the ways to permit a slight rotative movement in the wedging action and in the downward travel of the drill the pin 23 is moved into the enlarged portion 25 of the way at its end next the pivot of the cutter. When within said portion the pin is capable of a rotary movement necessary in the upward swing of the cutters and also is positioned at an angle to the length of the ways so as to retain it in the pivotal enlargements 25 when the cutters are approaching a horizontal position as shown in Figures 4 and 8. This arrangement prevents any movement of the link longitudinally of the elongated way after the preliminary wedging action has thrown the links into position for action.

If it be desired to extend the operative field of the cutters when in expanded position to excavate the upper wall of a chamber, the head 18 may be provided with one or more steps 26 removably threaded into an aperture 27 of the head.

A convenient means for assembling the cutters is to provide them with an inner recess 28 adapted to receive the opposite links before described, and with an outer recess 29 within which the braces 17 are disposed, as this arrangement protects the links and permits a close assemblage of the several parts when in closed position.

The operation of the invention will be apparent from the foregoing description and it will be seen that with the cutters in the position shown in Figure 2, the downward movement of the reamers upon the wedge head of the sleeve which rests upon the base of the well causes an initial opening as shown in Figure 3 which also separates the ends of the links connected to the cutters and positions them so that the continued downward movement causes the links to seat in the enlargement of the ways and force the cutters upward into a substantially horizontal position as shown in Figure 4 which also illustrates the type of chamber formed at the base of the well.

The invention therefore presents a construction by which a full expansive movement may be secured by the use of a link connection between the head and cutters while these links may be closely folded in order to bring the cutters within the general diameter of the tool permitting its convenient introduction into the well before the reaming action is begun. By such an arrangement the links being on a dead center practically lock the cutters against accidental displacement or engagement with the walls of the well or its casing and are thrown out of such locking position by the wedging action after the tool reaches the base of the well.

While the details of construction have been shown and described, the invention is not confined thereto as changes and alterations may be made without departing from the spirit thereof as defined by the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In an under-reamer, a stem provided with expansible cutters, a movable sleeve upon said stem provided with a wedge face to engage and initiate the opening movement of the cutters, and a pivoted link between said cutters and sleeve to continue such movement.

2. In an under-reamer, a stem provided with expansible cutters, a movable sleeve upon said stem provided with a wedge face to engage and initiate the opening movement of the cutters, and a pivoted link between

said cutters and sleeve to continue such movement, said link having a sliding connection with said cutters during the initial opening movement.

5 3. In an under-reamer, a stem provided with expansible cutters, a movable sleeve upon said stem provided with a wedge face to engage and initiate the opening movement of the cutters, and a pivoted link between
10 said cutters and sleeve to continue such movement, said link having a sliding connection with said cutters during the initial opening movement and a pivotal connection therewith
15 ment.

4. In an under-reamer, a drill stem, pivoted cutters carried thereby, a sleeve slidable upon the stem, a head carried by the sleeve and having an opening device actuating the free ends of the cutters, and links
20 connecting said head and cutters intermediate their ends.

5. In an under-reamer, a drill stem, pivoted cutters carried thereby, a sleeve slidable upon the stem, a head carried by the sleeve and having an opening device disposed at the free ends of the cutters, and links pivoted upon the head and having a sliding connection with the cutters.

6. In an under-reamer, a drill stem, pivoted cutters carried thereby, a sleeve slidable upon the stem, a head carried by the sleeve and having an opening device disposed at the free ends of the cutters, and links pivoted upon the head and having a sliding connection with elongated ways upon the cutters provided with enlarged head portions to permit pivotal movement of the link connection in the continued expansion of the cutters.

7. In an under-reamer, a drill body, opposite cutters pivoted thereon, a sleeve mounted upon the drill body against rotation and formed with opposite depending braces, a head supported by said braces beneath the free ends of the cutters, a wedge device carried by said head to engage such ends of the cutters, and opposite links pivoted upon said head and formed with elongated pins adapted to traverse longitudinal ways in said cutters and to rotate within an enlargement at the inner end of said ways.

8. In a reamer, a drill stem having a flat-

tened face, a pivoting block at the lower end of said stem, opposite cutters mounted upon said block, a sleeve slidably mounted upon the stem and provided with a flat face to engage that of the stem, a head supported from said sleeve beneath the free ends of the cutters, an oppositely inclined wedge face upon said head adapted to engage the ends of the cutters, said cutters being provided with longitudinal ways having enlarged pivoting chambers at their inner ends, and links pivoted upon the head and provided with pins elongated to prevent rotary movement in the ways but adapted to rotate within the pivoting chamber into position to prevent withdrawal therefrom when the cutters are in substantially horizontal position

9. In an under-reamer, a drill stem, opposite segmental cutters pivoted thereon and provided with an interior recess and also with a recess at the end of each segmental face, a sleeve mounted upon the drill stem and provided with braces disposed within the outer recesses of the cutters, a head carried by said braces, and links extending from said head and connected to the cutters and disposed within the inner recess of the cutters.

10. In an under-reamer, a support provided with expansible cutters, a movable member upon said support formed with means engaging the lower ends of the cutters to initiate an opening movement of the cutters, and a separate connection extending intermediate the ends of the cutters to said movable member to continue the movement of the cutters out of contact with said means.

11. In an under-reamer, a support provided with expansible cutters, a movable member upon said support formed with means engaging the lower ends of the cutters to initiate an opening movement of the cutters, and a separate connection extending intermediate the ends of the cutters to said movable member to continue the movement of the cutters out of contact with said means, such connection being adapted to lock the ends of the cutters in closed position upon said means until released by the initial opening movement.

In testimony whereof I affix my signature.

WILLIAM P. RUDKIN.