

May 9, 1933.

R. D. DODDS

1,908,227

METHOD AND APPARATUS FOR DRILLING WELLS

Filed Jan. 17, 1930

2 Sheets-Sheet 1

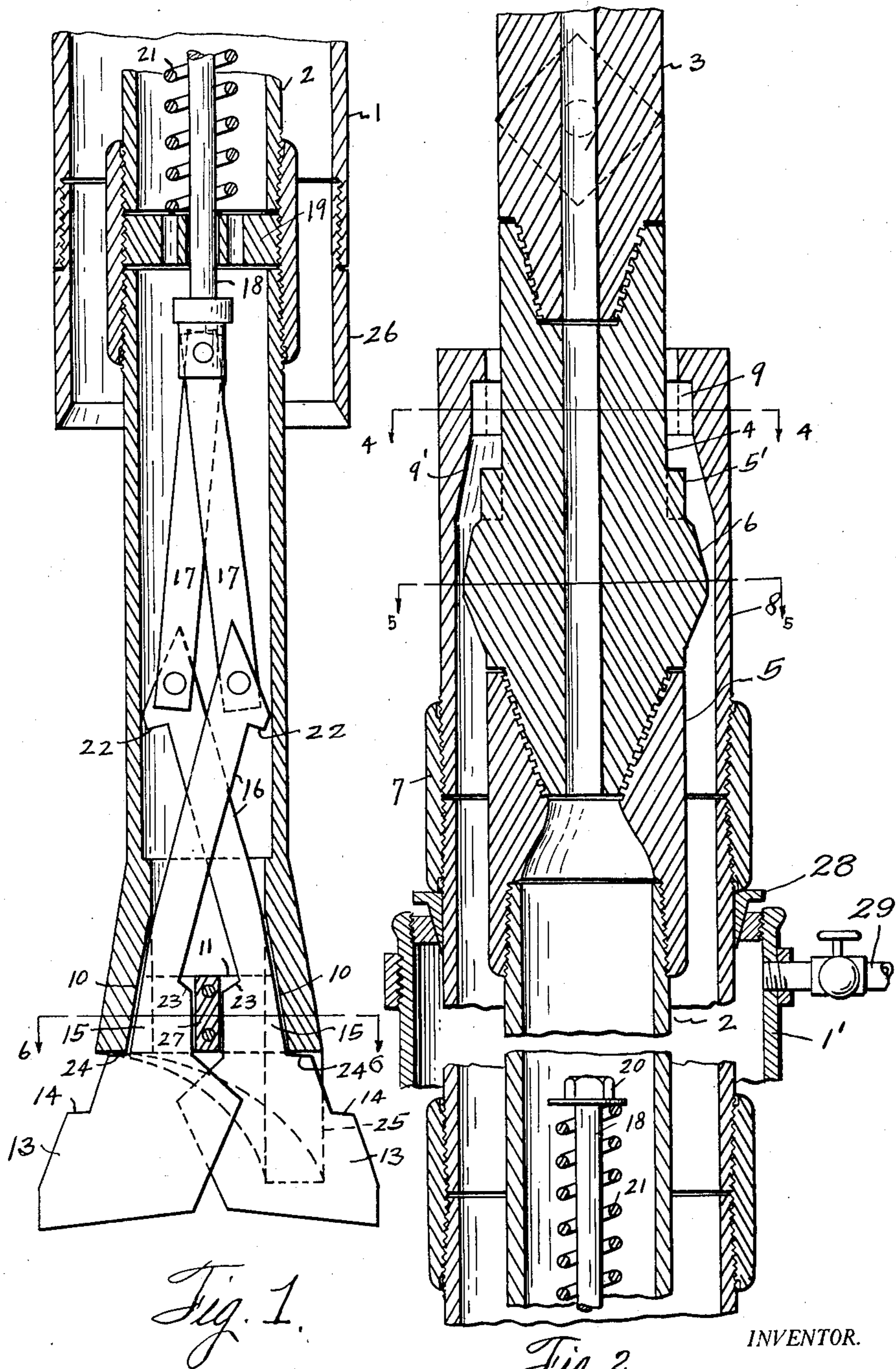


Fig. 1.

Fig. 2.
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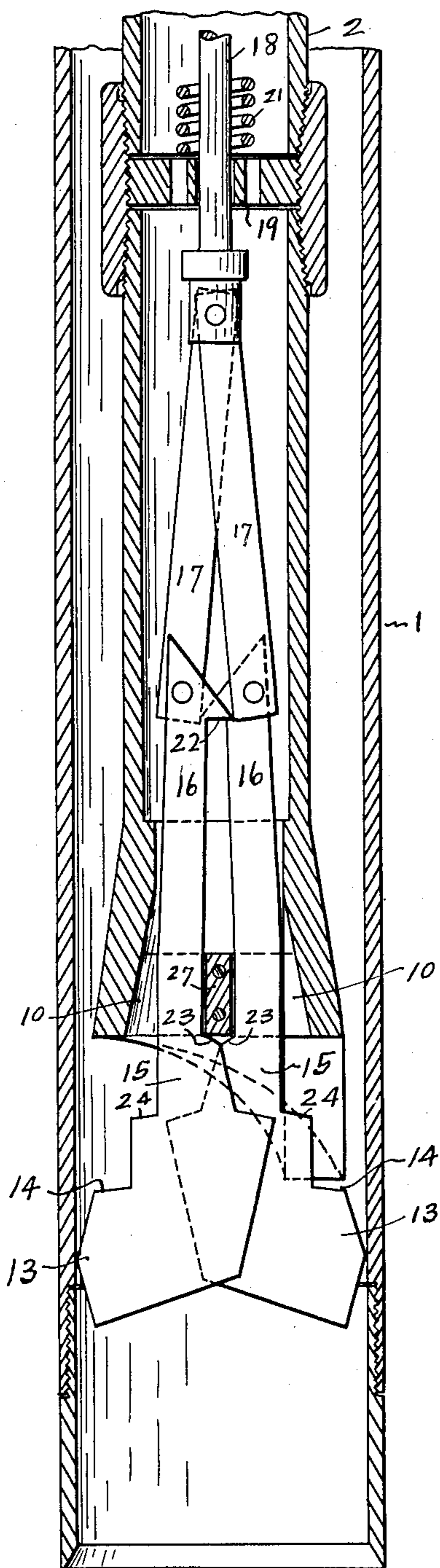


Fig. 3.

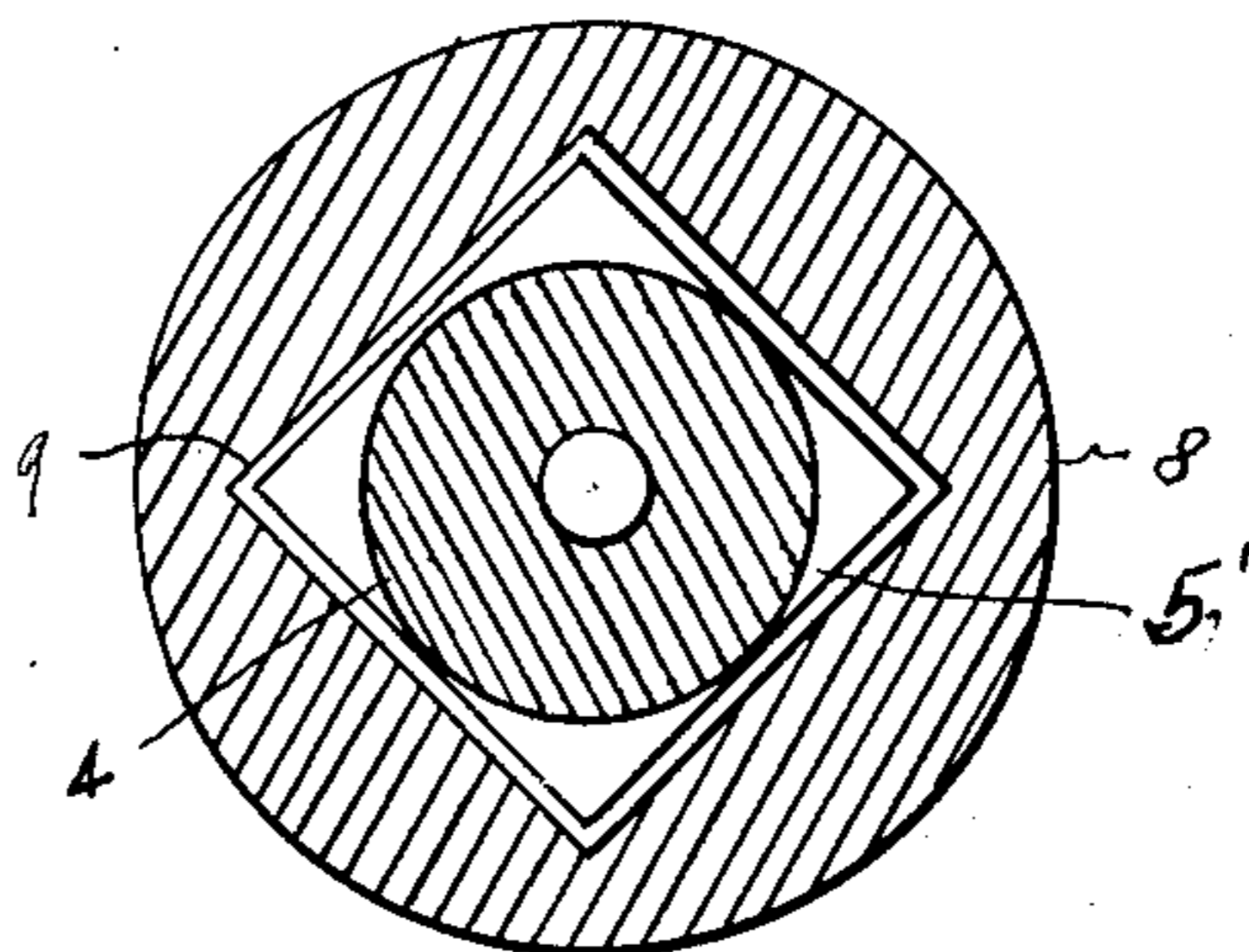


Fig. 4.

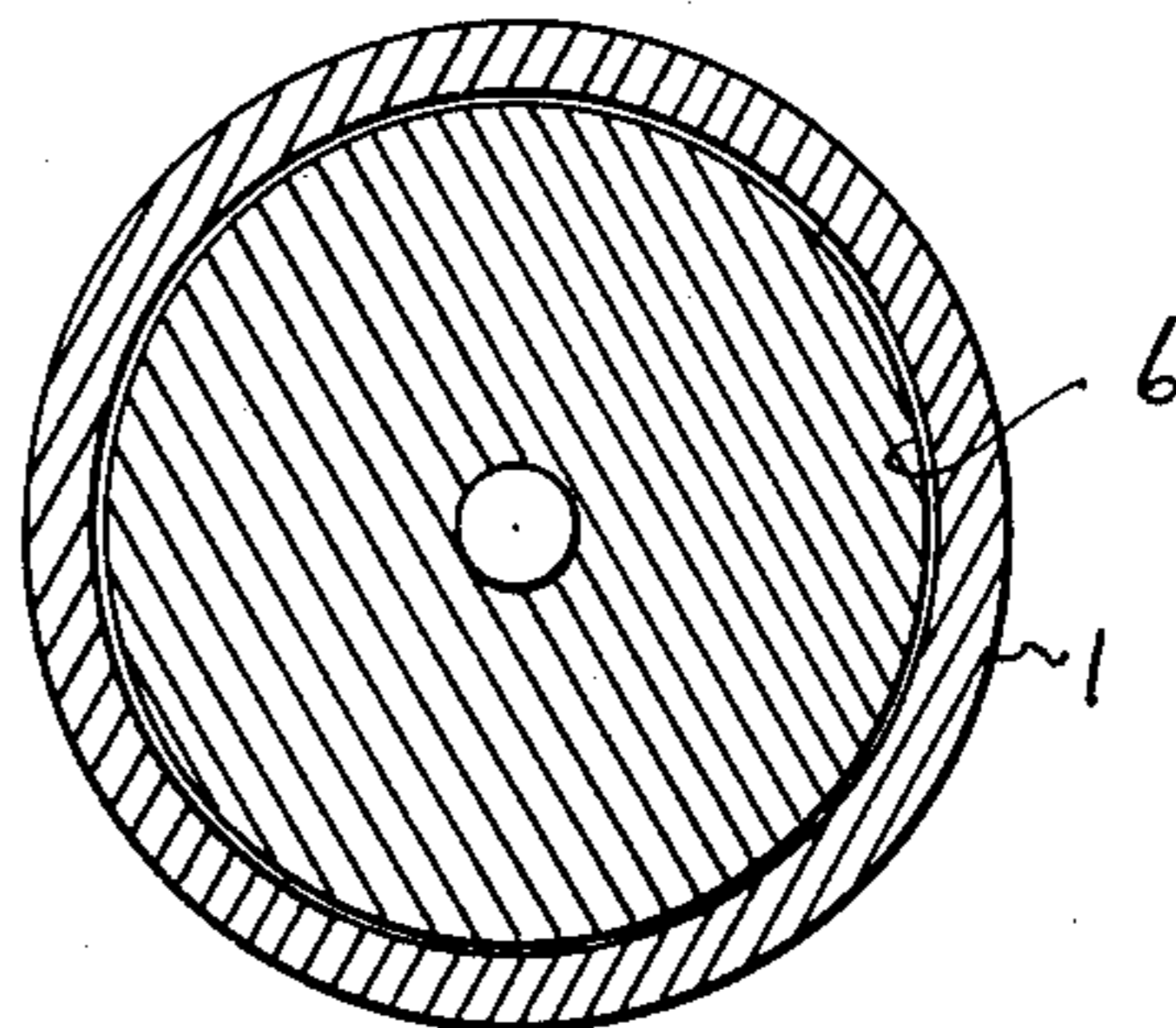


Fig. 5.

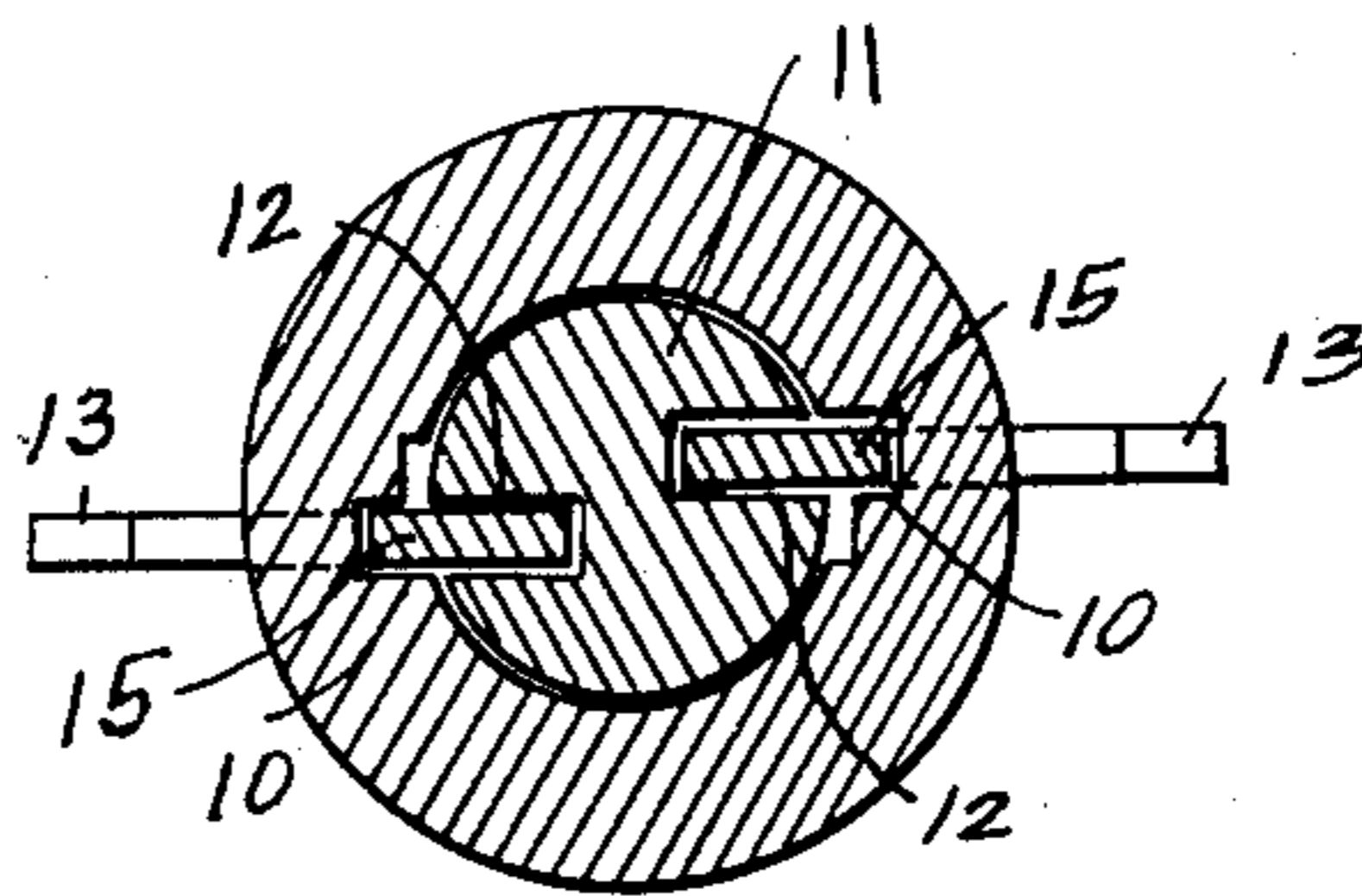


Fig. 6.

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METHOD AND APPARATUS FOR DRILLING WELLS

Application filed January 17, 1930. Serial No. 421,566.

This invention relates to new and useful improvements in a method and apparatus for drilling wells.

One object of the invention is to provide apparatus of the character described specially designed for use in drilling wells where formation is encountered which has a tendency to cave in and embodies an outer casing adapted to maintain the walls against caving and an inner string, or stem, through which the drilling tool is driven, with interlocking means between said stem and casing whereby the latter may be moved, and rotated, from the former to prevent the casing from becoming stuck in the bore during drilling operations.

Another object of the invention is to provide a novel type of collapsible drilling tool mounted in the stem and provided to work beneath the casing and which will be automatically collapsed, by the casing, upon withdrawal of the stem up through the casing, and which will automatically expand into drilling position, when the tool is lowered into position beneath said casing.

A further feature of the invention is to provide a drilling apparatus of the character described of such construction that the drilling fluid may be circulated down through the drill stem and back up through the casing about the stem, or back up through the bore around the casing as desired.

With the above and other objects in view this invention has particular relation to certain novel features of construction, operation and arrangement of parts an example of which is given in this specification and illustrated in the accompanying drawings, wherein:—

Figure 1 shows a vertical sectional view of the lower end of the apparatus in position for drilling.

Figure 2 shows a vertical sectional view of the upper end thereof.

Figure 3 shows a vertical sectional view of the lower end of the apparatus showing the drilling tool collapsed therein.

Figure 4 shows a cross sectional view taken on the line 4—4 of Figure 2.

Figure 5 shows a cross sectional view taken on the line 5—5 of Figure 2, and

Figure 6 shows a cross sectional view taken on the line 6—6 of Figure 1.

Referring now more particularly to the drawings, wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates the well casing and the numeral 2 designates the drill stem therein to the lower end of which the drilling tool is attached. A preferred form of such tool will be hereinafter described. A grief stem 3, preferably square in cross section, is attached, by the coupling 4, to the upper end of the drill stem. The lower end of the coupling 4 is screwed into the connecting collar 5 of the drill stem and its upper end is reduced as at 5', and polygonal in form and beneath said reduced portion said coupling has an enlarged annular face 6. Attached to the upper end of the casing 1, by the collar 7, there is a coupling 8. The upper end of the coupling 8 is thickened inwardly and is formed with the bearing 9, polygonal in cross sectional contour and shaped to snugly receive the upper end 5' of the coupling 4 thus forming, in effect, a clutch between the drill stem and casing when said upper end of said coupling 4 is seated in said bearing 9. Beneath said bearing 9 the coupling 8 has an internal annular seat 9' confronting the face 6.

It is to be understood that while drilling the casing 1 will be supported at the ground surface by any suitable appliance provided for the purpose, usually by means of an elevator, or slips 28, around the outer casing beneath the collar 7, which in turn are supported by the convention surface casing 1' set in the upper end of the well bore and through which the casing 1 extends said slips closing the space between the casing 1, 1'. It is to be further understood that the drill stem will be driven from the conventional rotary drilling machine and may be elevated and lowered through the conventional draw work, all located at the surface of the ground.

In drilling the drilling fluid may be forced down through the drill stem and returned back up through the casing 1 to the ground

surface. If it be desired to return said drilling fluid up around the casing 1 the drill stem 2 may be elevated to seat the upper end 5' of the coupling 4 in the bearing 9 with the
 5 face 6 seated against the seat 9' and this will block the upper end of the casing 1 and force returns up around the casing and out through the valve controlled line 29.

In order to prevent the casing 1 from becoming stuck in the bore, it may be rotated from the stem when the upper end 5' of the coupling 4 is in the bearing 9; or said casing may be moved up and down through the instrumentality of said stem.

15 While drilling the drilling tool will be located a considerable distance beneath the lower end of the casing and the walls of the bore beneath the casing may be maintained against caving in by the pressure of the fluid
 20 in the bore.

As drilling proceeds and the bore is deepened it will become necessary, from time to time, to add other sections to the upper end of the casing as well as to the upper end of the
 25 stem. When this becomes necessary the drill stem is elevated and the coupling 4 will engage the coupling 8 and the casing 1 will be elevated with the stem until the upper end of the casing is above the rotary drilling machine and elevators may then be latched
 30 around the casing beneath the collar 7 and supported on the drilling machine to hold the casing elevated. The coupling 8 may then be unscrewed and picked up and held
 35 suspended by a block and tackle or other available means. The drill stem may be then further elevated and elevators latched therearound beneath the collar 5 and such elevators supported on the upper end of the casing
 40 1 to support the drill stem. The grief joint 3 may then be broken out by unscrewing the coupling 4 from the collar 5 and said grief joint swung to one side and inserted through the joint, or section, to be added to the string
 45 of casing and the upper end of said casing joint connected to the coupling 8 and another joint or section, of the drill stem then attached to the coupling 4 and this assembly then swung back over the bore and the added
 50 joint of drill stem screwed into the coupling 5 and the elevators supporting the drill stem removed. The drill stem will be then supported from the derrick by the usual cable and tackle block operated from the draw
 55 works. The added joint of casing may then be screwed into the collar 7 and the elevators supporting the casing 1 removed and drilling proceeded with as before.

In the form shown there is a novel type of
 60 drilling tool shown. The lower end of the drill stem is shown flared and provided with the oppositely disposed downwardly flared inside seats 10, 10 and in said lower end of the stem there is fixed the bearing member 11 having the vertical laterally offset

slots 12, 12 therethrough, which align with the respective seats 10, 10, thus forming shank bearings for the cutter shanks. There are the blades or cutters 13, 13, having the
 70 external upwardly facing shoulders 14, 14 thereon and whose upper ends have the upwardly tapering shanks 15, 15 which wedge in the shank bearings when the drilling tool is in operative position. The shanks 15 are
 75 extended upwardly forming the arms 16, 16 whose upper ends are pivotally connected to the lower ends of the links 17, 17. The upper ends of these links are connected to the lower end of the rod 18 which works through
 80 a central bearing in the spider 19 and whose upper end has the head 20. There is a coil spring 21 seated on said spider and surrounding said rod on which said head rests. The upper ends of the arms 16 have the shoulders 22, 22 thereon, provided to engage the
 85 bearing member 11, in case said arms should become detached so as to prevent the cutters from dropping into the bore.

The arms 16 are offset outwardly with relation to the upper end of the shanks 15
 90 forming the inside shoulders 23, 23 which converge downwardly as shown more clearly in Figure 3 and which are provided for a purpose to be hereinafter stated.

While drilling the wedge shaped shanks 15 are held by the spring 21 wedged in position in the lower end of the drill stem as above explained with the outside shoulders 24 of the blades 13 seated against the lower
 100 end of the drill stem. When the cutters are in this operative position, they are reinforced by the downwardly extending braces 25, 25 formed integrally with the lower end of the drill stem and which abut the rear sides of said cutters. When it is desired to move the
 105 drill stem upwardly through the casing or to entirely withdraw the drill stem and drilling tool upon such upward movement the outside shoulders 14 of the blades will contact against the casing shoe 26 at the lower
 110 end of the casing and upward movement of said blades will be temporarily stopped and as the drill stem moves on upwardly the spring 21 will be placed under compression. When the bearing member 11 passes up beyond the shoulders 23 the blades 13 will be
 115 collapsed or forced inwardly in the position shown in Figure 3 by the casing shoe 26 and the shoulders 23 will engage underneath the web 27 of the bearing member 11 and said shoulders 23 will be held interlocked under-
 120 neath said web by reason of the fact that the blades 13 are held in collapsed position by their contact against the sides of the casing and the drill stem the drilling tool may be
 125 withdrawn from the casing or moved up and down at will in it.

As the drill stem and drilling tool are lowered into operative position the blades will be forced downwardly by the web 27 and
 130

when the blades pass beneath the lower end of the drill stem the compression of the spring 21 will operate to cause the sloping shoulders 23 to disengage the web 27 and the said spring will then operate to pull the shanks 15 back up into their seats with the blades 13 in position for drilling and drilling may then be proceeded with.

It may be here noted that the lower section or sections of the casing may be perforated forming a screen so that when an oil producing stratum is reached the casing may be set with the screening sections thereof opposite the oil bearing stratum and the drilling stem, and drilling tool, withdrawn.

The invention comprehends not only the apparatus, but its method of use as hereinabove illustrated.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. Drilling apparatus including an outer casing to be set in a well bore, a tubular drill stem therein, bore forming means on the stem underneath the casing, means through which the stem may be interlocked with the casing to impart rotation to the casing, from the stem, when the stem is elevated relative to the casing, said means being released when the stem is lowered relative to the casing.

2. Drilling apparatus including an outer casing adapted to be set in a well bore, a tubular drill stem therein and spaced therefrom, bore forming means on the stem, said stem being movable through the casing, and rotatable independently thereof, means through which the stem may be interlocked with the casing to impart rotation thereto, when the stem is moved into one position, and released from said casing when the stem is moved into another position.

3. Drilling apparatus including an outer casing, a tubular drill stem therein and spaced therefrom and rotatable independent of the casing, drilling means on the stem, opposing seats one on the stem and the other in the casing, said stem being movable into one position to seat one of said seats against the other to close said space and into another position to carry the seats apart to open said space.

4. Drilling apparatus including an outer casing adapted to be set in a well bore, a drill stem therein and spaced therefrom and rotatable independent of the casing, said drill stem having a fluid passageway therethrough, through which fluid may be forced down through the well bore and returned up through the casing around the stem, coacting means carried by the stem and casing, respectively, effective to close said space, upon a selected movement of the stem, to cause said fluid to return up through the bore on the out-

side of the casing and a drill at the lower end of the stem.

5. Drilling apparatus including a casing adapted to be set in a well bore, a drill stem therein and spaced therefrom, bore forming means on the stem, interlocking means carried by the stem and casing, respectively, whereby the casing may be elevated upon upward movement of the stem.

6. Apparatus of the character described including a casing adapted to be set in a well bore, a drill stem therein and spaced therefrom and rotatable independently of the casing, drilling means on the stem, means carried by the casing and stem, respectively, adapted to be engaged, upon movement of the stem into one position, to establish a driving relation between the stem and casing whereby the casing may be rotated from the stem.

7. Apparatus of the character described including a casing adapted to be set in a well bore, a drill stem therein and spaced therefrom and rotatable independently of the casing, a drill on the stem, means carried by the casing and stem, respectively, adapted to be engaged, upon movement of the stem into one position, to establish a driving relation between the stem and casing whereby the casing may be rotated from the stem, and means carried by the stem and casing, respectively, whereby the space between the casing and stem may be closed when the stem is moved to said position.

8. Apparatus of the character described including a casing adapted to be set in a well bore, a drill stem therein and spaced therefrom and rotatable independently of the casing, means on the stem for under reaming the casing, means carried by the casing and stem, respectively, adapted to be engaged, upon movement of the stem into one position, to establish a driving relation between the stem and casing whereby the casing may be rotated from the stem, said means being arranged to disengage when said stem is moved to another position.

9. Apparatus of the character described including outer pipe in a well bore, a drill stem within said outer pipe, a collapsible drilling tool at the lower end of said stem shaped to underream said outer pipe, as drilling progresses, to permit said outer pipe to descend, said drill stem and drilling tool being withdrawable through said outer pipe, interconnecting means carried by said outer pipe and drill stem, respectively, through which said pipe and stem may be interconnected to rotate simultaneously, and disconnected to permit their independent rotation.

10. Apparatus of the character described including an outer pipe in a well bore, a drill stem within said outer pipe, a drilling tool at the lower end of said stem shaped to underream said outer pipe, as drilling progresses, to permit said outer pipe to descend,

said drilling tool being withdrawable, by said stem, through the outer pipe, means at the upper ends of said pipe and stem through which the stem may be connected to the outer
5 pipe to manipulate the same, and disconnected therefrom to rotate independently thereof.

11. In drilling a well, the method of operations which consists in maintaining a casing
10 and a tubular drill stem in the well being drilled and forcing drilling fluid down through said stem and returning the fluid alternately up through the casing and up around the outside of the casing.

12. In drilling a well the method which consists in operating a drilling tool through the casing in the well by rotation and alternatively operatively connecting said tool
15 with the casing and rotating the latter and releasing said tool from the casing and rotating the tool independently of the casing.
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In testimony whereof I have signed my name to this specification.

REDUS D. DODDS.

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