

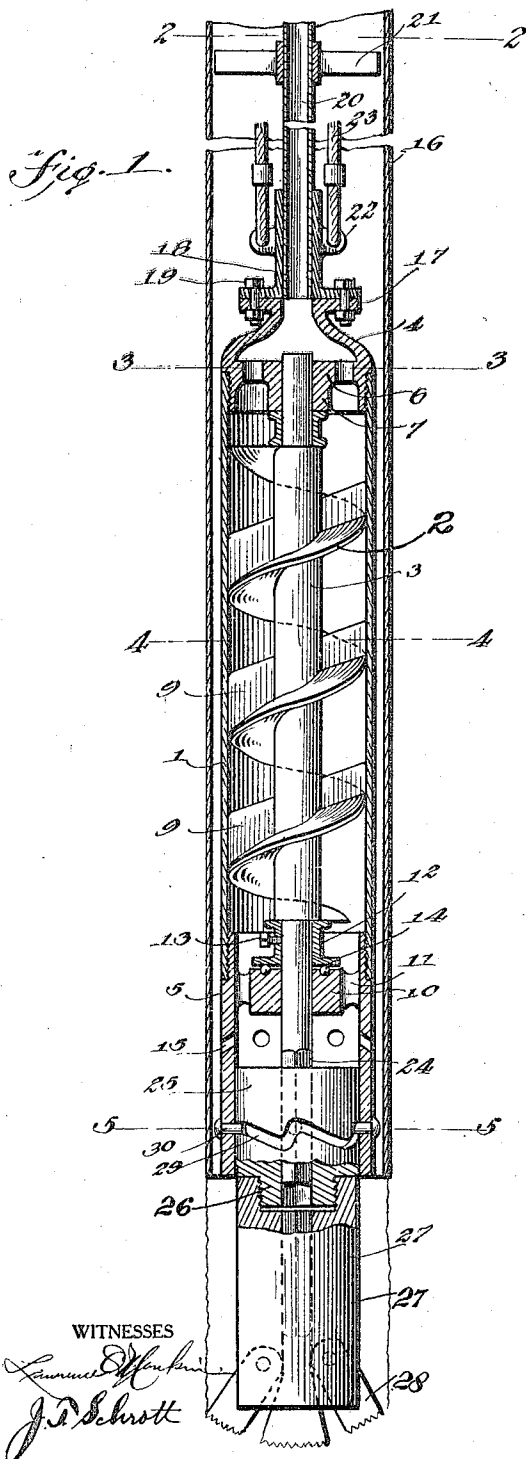
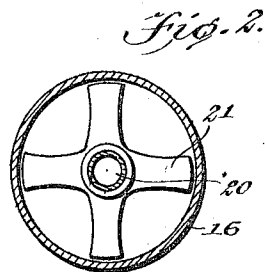
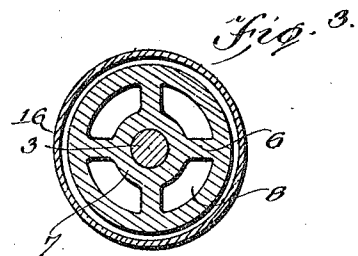
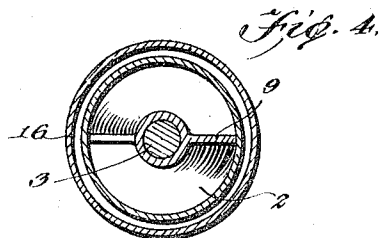
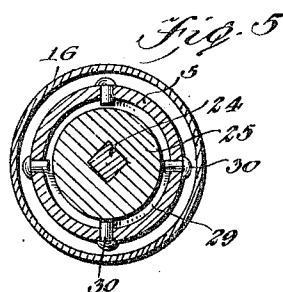
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ROTARY HYDRAULIC WELL DRILL

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WITNESSES

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ROTARY HYDRAULIC WELL DRILL.

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This invention relates to improvements in well drills, and it consists of the constructions, combinations and arrangements herein described and claimed.

5 An object of the invention is to provide a well drill which is operable by hydraulic pressure, there being a drive shaft having a spiral provided with baffles upon which both the weight and pressure of the fluid
10 has an effect in turning the shaft.

Another object of the invention is to provide a collar which is rotatable with the drive shaft and has an associated slot and pin structure of such arrangement that a
15 reciprocatory motion is imparted to the drill bit simultaneously with the rotation thereof.

Another object of the invention is to provide an independent suspension for the spiral casing to thereby relieve the drill
20 stem of that additional weight.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawing, in which

25 Figure 1 is a longitudinal section of the drilling mechanism at the lower end of a well casing and showing the improvements therein.

Figure 2 is a cross section on the line
30 2—2 of Figure 1.

Figure 3 is a cross section on the line
3—3 of Figure 1.

Figure 4 is a cross section on the line
4—4 of Figure 1.

35 Figure 5 is a cross section on the line
5—5 of Figure 1.

In carrying out the invention provision is made of a spiral casing 1, so-called because it houses the helix or spiral 2 which is
40 formed upon the drive shaft 3. The spiral casing 1 is internally threaded at the upper and lower ends; the first threads securing the water chamber 4, the latter the bearing sleeve 5. The water chamber 4 has an internal spider 6 (Fig. 3) supporting a central hub 7 in which the upper end of the
45 shaft 3 has bearing. The chamber 4 by virtue of having an internal spider also has passages 8 through which the water can
50 freely pass downward into the casing 1 to impact the spiral 2. In order that both the weight and force of the water may be fully utilized the spiral 2 is fitted with a plurality of baffles 9 against which the water

impacts and produces a vigorous driving
55 action of the shaft 3.

An arrangement somewhat similar to the water chamber 4 occurs in the bearing sleeve
5, this by virtue of the fact that there is a bearing cup 10 centrally supported in the
60 spiral casing 1 by arms 11 which also define a spider. A collar 12, clamped at 13 or otherwise affixed to the shaft 3, rides upon ball bearings 14 upon the hub 10. This immediate arrangement provides a thrust bearing,
65 and in practice the thrust bearing will be designed to prevent as much as possible the entrance of sand and other foreign matter. The illustration in Figure 1 is largely
70 conventional.

A circumferential series of openings 15 in the bearing sleeve 5 provides for the escape of water from the spiral casing 1 after the driving function of the shaft 3 has been
75 completed. These openings (which may be round, oval or otherwise) are made on a flange so that the water is directed downward into the bore in the course of construction. This sets up a washing action,
80 there being a return stream of water in the space between the spiral casing 1 and the well casing 16, and so on up to the surface. It is to be noted that the water chamber 4 is closed, that is to say it has a flange 17 to which the similar flange of a support is secured at 19. The support 18 is the element
85 into which the drill stem 20 is screwed or otherwise fitted. The drill stem is hollow and serves as a conduit for the water from a force pump (not shown) on the surface
90 to the bore of the well. In extremely deep wells it may be found necessary to employ a number of spreaders 21 to keep the drill stem 20 from chattering. These spreaders are nothing more than crosses or spiders
95 (Fig. 2) which fit tightly upon the drill stem but are loose in the casing 16.

Lugs 22 on the sides of the supporting means provide places to which the ends of
100 steel cables 23 are secured in order to support the spiral casing 1 and its carried parts, and thereby relieve the drill stem 20 of the additional weight. These cables run to the surface and over any suitable drum capable of such operation as to raise or lower
105 the mechanism as may be required.

That portion of the drive shaft below the bearing hub 10 is made non-circular as at

24. This non-circular portion 24 of the drive shaft extends into the collar 25 and terminates substantially even with the end of the threaded nipple 26. A head 27 is
 5 screwed upon this nipple. The head carries bits 28, but in practice other types of bits may be substituted for the head 27, the connecting place afforded by the nipple 26 readily permitting the exchange.

10 A slot 29 in the peripheral face of the collar 25 causes a reciprocatory or jumping motion of the bit head 27 during rotation. In order to carry this purpose into effect the slot 29 is of a zig-zag nature (Fig. 1)
 15 and the points of a number of studs 30 set in the wall of the bearing sleeve 5 enter the slot thereby providing fixtures upon which the slot can ride. It is obviously necessary that the collar 25 be loose in the sleeve 5 other-
 20 wise it could neither rotate nor reciprocate. It is the studs 30 that hold the collar in place.

The operation may be readily understood. In practice the drill stem 20 is connected
 25 with any suitable force pump at the surface, by means of which pump fluid is forced down the stem 20, into the water chamber 4, through the spiral casing 1, through the openings 15 into the well casing 16 whence
 30 it returns to the surface, however first serving to wash out the bore. The impact of the water against both the spiral 2 and the baffles 9 causes rotation of the drive shaft 3.

The drive shaft 3 by virtue of its non-circular end 24 causes rotation of the collar
 35 25 and the drill head 27. The zig-zag slot 29 rides over the studs 30 as the collar 25 rotates, and inasmuch as the head 27 is attached to the collar at the plate 26 the resulting jumping motion is imparted to the
 40 head and to the drill point carried thereby. The reciprocation of the collar 25 occurs in respect to the non-circular end 24 of the drive shaft. It has been explained before
 45 that the wire cables 23 support the spiral casing and the parts carried thereby, thereby relieving the drill stem 20 of the otherwise additional weight.

Upon analyzing the structure presented,
 50 it becomes plain that the actual driving power is applied almost directly to the drill contrary to the prevailing practice in which the driving power is applied at the surface and transmitted through a drill stem or
 55 other intermediary. This is not intended to imply that all surface machinery is eliminated. This is not so because a pump for forcing the water down must of necessity be employed. It is also necessary to employ
 60 suitable hoisting machinery for lowering and retracting the mechanism.

While the construction and arrangement of the improved well drill is that of a generally preferred form, obviously modifica-
 65 tions and changes may be made without de-

parting from the spirit of the invention or the scope of the claims.

I claim:

1. A well drill having a bit head, relatively stationary means in reference to which it
 70 is both rotatable and reciprocatable, means which under the impact of a fluid partakes of a rotary motion only, a non-circular extension forming part of said rotary means,
 75 and means carrying said bit head said means having a zig-zag slot riding upon the relatively stationary means and receiving said non-circular extension, being subject to the rotary motion of the fluid impacted means
 80 and the reciprocatory motion afforded by the eccentric slot and relatively stationary means.

2. A well drill having a rotatable and reciprocatable collar to which a drilling element is attachable, a drive shaft having a
 85 non-circular extension by which the collar is rotated and upon which the collar reciprocates, a spiral formed on the shaft and having baffles to receive the impact of fluid to
 90 thereby rotate the shaft, means constituting a casing for the spiral and collar, and means associated both with a portion of said casing means and with the collar by which
 95 the reciprocatory motion is caused during rotation, and by which the collar is supported at the same time.

3. A well drill having a collar with a zig-zag slot, a casing having a sleeve provided
 100 with means entering the slot and providing a support for the collar, a drive shaft situated in the casing having a spiral to be impacted by fluid conducted through the casing to cause rotation of the shaft, and a
 105 non-circular extension of the shaft by which said rotation is imparted to the collar and in respect to which extension the collar then reciprocates by virtue of said means engaging
 110 said slot.

4. A well drill having a collar provided
 110 with a zig-zag slot and having means to carry a drilling element, a casing, a drive shaft situated in the casing and having means which upon being impacted by fluid directed
 115 into the casing causes the rotation of the shaft, a sleeve attached to the casing having means entering the slot to support the collar and having fluid outlet openings close
 120 to the top of the collar, and a non-circular extension of the drive shaft by which the collar is rotated and upon which the collar is reciprocatable by virtue of the action of
 125 said slot upon said supporting means.

5. A well drill having a casing, a drilling element having a collar by means of which
 125 it is rotatably and reciprocatably mounted on one end of the casing, means in the casing for operating the collar, a hollow drill
 130 stem by which driving fluid is conducted to the casing, and means connecting the casing with the drill stem having passages con-

ducting the fluid from the drill stem to the casing.

6. A well drill comprising a drive shaft having a spiral provided with baffles, a casing in which said structure is housed, a hollow drill stem for conducting water to the casing, a water chamber by which the casing and drill stem are connected, said chamber having a spider supporting a hub which provides the upper bearing for the shaft, a collar having a zig-zag slot and means to which a drilling element is attachable, a

sleeve carried by the casing having a hub furnishing the lower bearing for the shaft, means carried by the sleeve projecting into the slot and thereby supporting the collar, said sleeve having openings for the escape of the water close to the top of the collar, and a non-circular extension of the drive shaft by which the collar is rotated and upon which the collar is reciprocable by virtue of the action of said slot on the means projecting into said slot.

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