

1,412,430.

Fig. 1.

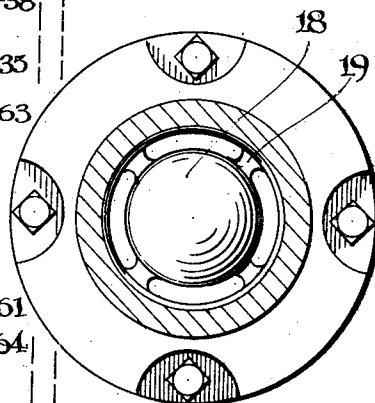
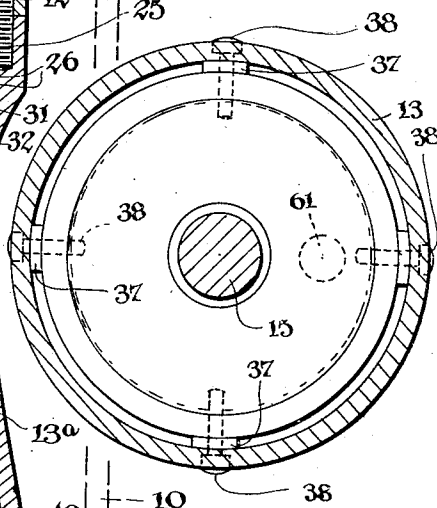
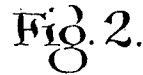


Fig. 3.

INVENTOR

BY *Munn Co.*
ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWARD B. VERNEUIL, OF MANGUM, OKLAHOMA.

WELL-DRILLING MACHINERY.

1,412,430.

Specification of Letters Patent. Patented Apr. 11, 1922.

Application filed December 14, 1920. Serial No. 430,602.

To all whom it may concern:

Be it known that I, Edward B. VERNEUIL, a citizen of the United States, and a resident of Mangum, in the county of Greer and State of Oklahoma, have invented certain new and useful Improvements in Well-Drilling Machinery, of which the following is a specification.

The present invention relates to well drilling machinery, especially adapted for deep well drilling.

Heretofore in this art, in carrying out deep well drilling operations, the drill has been suspended in the well by a drill stem or tubing which extends to above the ground and which is driven at the surface by means of a rotary or similar machine. The torque which in this arrangement is set up in the drill stem is so great as to frequently result in the breaking or twisting of the drill stems, as a consequence of which it is sometimes necessary to abandon the well. Moreover with this arrangement the power cannot be applied with a high degree of efficiency and effectiveness.

One of the principal objects of the present invention is to provide well drilling machinery of this general character which overcomes and avoids the difficulty, objections and disadvantages of the machinery now in use, which makes it unnecessary to provide or use a rotary, which relieves the drill stem or tubing of torque, which applies the power at the bottom of the well in a highly efficient and effective manner and which is of simple and durable construction, reliable in operation and easy and inexpensive to manufacture.

Other objects and advantages of the invention reside in certain novel features of construction, combination and arrangement of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming part of this specification, and in which:

Figure 1 is a transverse vertical sectional view of the invention suspended in a well casing, parts being shown in elevation for the sake of illustration;

Figure 2 is a transverse horizontal sectional view, on line 2—2 of Figure 1; and

Figure 3 is a transverse horizontal sectional view on line 3—3 of Figure 1.

Referring to the drawings wherein for the sake of illustration is shown the preferred embodiment of the invention the well casing is designated at 10. Tubing 11 extends downwardly in the well casing from above the surface of the ground and has its lower end provided with a flange 12 to which is secured the housing 13 of the invention. Stud bolts 14 effect the securing of the housing to the lower end of the tubing.

The housing adjacent the tubing is formed to constitute a turbine casing, as designated at 13^a. A turbine shaft 15 is axially arranged in the turbine casing and carries a plurality of spiral vanes 16. The upper end of the shaft is rotatably mounted in a bearing, designated generally at 17 which consists of a hub 18 arranged centrally of the tubing by means of spider arms 19 and having a bearing cavity 20 therein. A thrust bearing 21 is received in the inner end of the cavity and consists of spaced bearing plates 22 between which and in suitable races formed by recesses therein operate ball bearings 23. The end of the turbine shaft abuts against the outer bearing plate, as shown in Figure 1. A radial bearing, designated generally at 25, is arranged in the outer end of the bearing cavity and comprises radially spaced rings 26, between which and in races formed by the rings the ball bearings 27 operate. The inner ring 26 directly engages the periphery of the turbine shaft, as shown in Figure 1. Preferably the portion of the shaft engaged by the radial bearing 25 is somewhat reduced in cross section. A circular plate 30 is arranged at the lower end of the bearing 17 and closes the lower end of the bearing cavity. The plate is provided with a circumferential series of ports 31 which register with the spaces between the spider arms 19. These spaces between the spider arms 19 and the ports 31 define the water inlet to the turbine chamber. Intermediate the plate 30 and the turbine shaft a brass bushing 32 is arranged. A brass bearing plate 16^a is also provided for the lower end of the vanes of the turbine.

Below the lower end of the turbine chamber a gear casing 35 is arranged. This cas-

ing includes a hollow cylinder 36 arranged coaxially with the turbine shaft and with the portion of the housing 13 in which it is contained. Spacing elements 37 carried by stud bolts 38 which support the gear casing in the housing serve to maintain the gear casing spaced from the housing and to thereby define outlets 39 from the turbine chamber. An upper head 40 is threaded into the upper end of the cylinder and secured in position by the action of the inner ends of these stud bolts 38. The head 40 is provided with a central opening through which the turbine shaft 15 extends. The turbine shaft is journaled on the upper head by means of a brass bushing 41 directly engaging the turbine shaft and carried by the head. An annular flange 42 depends from the upper head within the gear casing and coacts with the packing gland 43 to provide a stuffing box for the turbine shaft. The stuffing box also includes a brass bushing 44 interposed between the gland 43 and the turbine shaft 15.

The lower end of the cylinder is closed by a head 45 and secured to the cylinder by means of stud bolts 46 and having a central opening 47 and a bearing cavity 48 therein.

A drill stem or shaft 50 is journaled in the lower head 45 by means of a bushing 51 arranged in the opening of the head and directly engaging the shaft. A collar 52 is integrally formed or otherwise secured to the drill stem 50. One face of the collar 52 engages a thrust bearing 53 arranged in the inner end of the bearing cavity and the other face of the collar engages a brass bearing ring 54. The lower end of the bearing cavity is closed by a stuffing box 55.

The lower end of the shaft 50 is threaded, as indicated at 56, to receive the drill bit or the like 56. A guard or deflector 57 is secured to the lower end of the housing 13 and extends down around the lower head of the cylinder to adjacent the bit and not only encloses and protects the parts but directs the outlet of water to the bit to be hereinafter more fully described.

The upper end of the drill shaft stem and the lower end of the turbine shaft are machined or otherwise formed to define a ball race to receive ball bearings 59 whereby a spindle bearing is constituted for both the turbine shaft and the drill shaft.

Means is provided for transmitting the motion from the turbine shaft to the drill shaft and comprises a drive pinion 60 fixed to the lower end of the turbine shaft. A countershaft 61 is journaled at its ends in suitable bearings 62 in the heads of the cylinder and is arranged in substantially parallel relation to the turbine shaft and the drill shaft. A driven pinion 63 is fixed to the countershaft and meshes with the

drive pinion 60 of the turbine shaft. A second pinion or driving pinion 64 is also fixed to the countershaft in spaced relation to the driven pinion 63 and this driving pinion 64 meshes with a driven pinion 65 fixed to the upper end of the drill shaft or stem. The pinions 63, 64 and 65 are preferably of skew type embodying obliquely arranged gear teeth and the ratio of the pinions is such as to increase the power applied to the drill shaft.

In practice, water or other fluid under pressure is supplied through the tubing 11 to the water inlets to the turbine chamber and from the water inlets the fluid is projected against the vanes of the turbine. This effects a high degree of rotation of the turbine shaft and this motion of the turbine shaft is transmitted through the gearing or motion transmission means described to the drill shaft or stem. After the water has expended its energy upon the vanes of the propeller it flows outwardly through the outlets 39 and is directed by the guard or deflector against the cuttings of the drill bit to entrain the cuttings and insure their easy discharge from the well. As the drilling of the well progresses the tubing is lowered to advance the drill bit but the relative relation and position of the drill bit and its power plant, to wit, the turbine and its gearing, is unchanged irrespective of the depth of the well. The turbine or power plant is always immediate to the drill shaft or bit and there is no undesirable torque set up in the tube. There is no necessity for any machinery to rotate the tubing. There is an efficient and effective application of torque to the drill bit and there is also a provision made for the proper carrying off and discharge of the cuttings of the drill.

I claim:

1. In well drilling machinery of the character described in combination with tubing extending downwardly in the well, a housing suspended upon the lower end of said tubing having a portion formed to constitute a turbine chamber, a turbine shaft in said chamber, spiral vanes upon said shaft, a bearing for the upper end of said shaft comprising a hub having a bearing cavity, spider arms supporting said hub centrally of said tubing, a thrust bearing arranged in said cavity and abutting the upper end of the turbine shaft, and a radial bearing in said cavity and engaging the periphery of the turbine shaft, a gear casing in said housing adjacent the lower end of said turbine chamber having a bearing for the lower end of said turbine shaft, means for securing said gear casing in spaced relation in and to said housing, a drill shaft journaled in said gear casing, a spindle bearing between the drill shaft and the turbine shaft, motion transmission means

between the turbine shaft and the drill shaft including a drive pinion fixed to the turbine shaft, a countershaft, a driven pinion on the countershaft meshing with the drive
 5 pinion, a driving pinion on said countershaft and a driven pinion on said drill shaft meshed with said driving pinion, and a deflector carried by the lower end of said housing and directing a discharge from said
 10 discharge chamber upon the cuttings of the drill.

2. In well drilling machinery of the character described in combination with tubing extending downwardly in the well, a housing
 15 suspended upon the lower end of said tubing having a portion formed to constitute a turbine chamber, a turbine shaft arranged in said turbine chamber, spiral vanes upon said shaft, a bearing for the upper end of said
 20 shaft comprising a hub having a bearing cavity, spider arms supporting said hub centrally of said tubing, a thrust bearing arranged in said cavity and abutting the upper end of said shaft, a radial bearing engaging
 25 the periphery of said shaft and a closure plate for said bearing cavity, a gear casing in the housing adjacent the lower end of the turbine chamber having a bearing for the lower end of the turbine shaft, means for
 30 securing said gear casing in spaced relation in and to said housing, a drill shaft rotatably journaled in said gear casing, a spindle bearing between said drill shaft and said turbine shaft, and motion transmission means
 35 between the turbine shaft and the drill shaft including a drive pinion fixed to the turbine shaft, a countershaft, a driven pinion on the countershaft meshing with said drive pinion, a driving pinion on said countershaft
 40 and a driven pinion on the drill shaft meshed with said driving pinion.

3. In well drilling machinery of the character described, in combination with tubing extending downwardly in the well and
 45 adapted to supply water under pressure, a housing suspended upon the lower end of said tube and having a portion constituting said turbine chamber, a turbine shaft arranged coaxially in said chamber, spiral
 50 vanes carried by said turbine shaft, a bearing for the upper end of said turbine shaft including a thrust bearing and a radial bearing, a gear casing arranged in said housing below said turbine chamber and coaxially
 55 therewith, means for securing said gear casing in and spaced from said housing, a drill shaft, a bearing for said drill shaft carried by said gear casing, a spindle bearing between said drill shaft and said turbine shaft,
 60 means for transmitting the motion of said turbine shaft to said drill shaft, and a guard or deflector for directing the discharge from said turbine chamber upon the cuttings of said drill.

4. In well drilling machinery of the character described, in combination with tubing
 65 extending downwardly in the well and adapted to supply water under pressure, a housing suspended upon the lower end of said tube and having a portion constituting
 70 a turbine chamber, a turbine shaft arranged coaxially in said chamber, spiral vanes carried by said turbine shaft, a bearing for the upper end of said turbine shaft including a thrust bearing and a radial bearing, a gear
 75 casing arranged in said housing below said turbine chamber and coaxially therewith, means for securing said gear casing in and spaced from said housing, a drill shaft, a bearing for said drill shaft carried by said gear
 80 casing, a spindle bearing between said drill shaft and said turbine shaft, and means for transmitting the motion of said turbine shaft to said drill shaft.

5. In well drilling machinery of the character described, tubing adapted to extend
 85 downwardly into the well and to supply water under pressure, a housing upon the lower end of said tubing including a portion adjacent said tubing and defining a turbine
 90 chamber, a turbine shaft in said chamber, vanes carried upon said shaft, a bearing for the upper end of said shaft and defining with said tubing the water inlet to said turbine chamber, a gear casing arranged in
 95 said housing below said turbine chamber and defining with said housing a water outlet from said turbine chamber, a drill shaft journaled in said gear casing, and means within said gear casing for transmitting the
 100 motion of said turbine shaft to said drill shaft, all as and for the purposes set forth.

6. In well drilling machinery of the character described, in combination with tubing
 105 extending downwardly into the well and adapted to supply water under pressure, a housing suspended upon the lower end of said tubing and having a turbine chamber therein, a turbine shaft arranged in said chamber, vanes carried by said turbine shaft,
 110 a bearing for the upper end of said turbine shaft, a gear casing arranged in said housing below said turbine chamber, means for securing said gear casing in and spaced from said housing, a drill shaft, a bearing
 115 for said drill shaft carried by said gear casing, a spindle bearing between said drill shaft and said turbine shaft and gearing in said gear casing for transmitting the motion of said turbine shaft to said drill shaft.
 120

7. In well drilling machinery of the character described, tubing adapted to extend
 125 downwardly into the well and to supply water under pressure, a housing upon the lower end of said tubing including a portion adjacent said tubing and defining a turbine chamber, a turbine shaft in said chamber, vanes carried upon said shaft, a bearing for

the upper end of said shaft and defining with said tubing the water inlet to said turbine chamber, a gear casing arranged in said housing below said turbine chamber and defining with said housing a water outlet from said turbine chamber, a drill shaft journaled in said gear casing, and means within said gear casing for transmitting the motion of said turbine shaft to said drill shaft, and a deflector carried by the lower end of the housing for directing the discharge from said turbine chamber upon the cuttings of said drill.

EDWARD B. VERNEUIL.