May 15, 1928. 1,670,092

W. C. BAILEY

ROTARY DISK BIT

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Fig. 1.

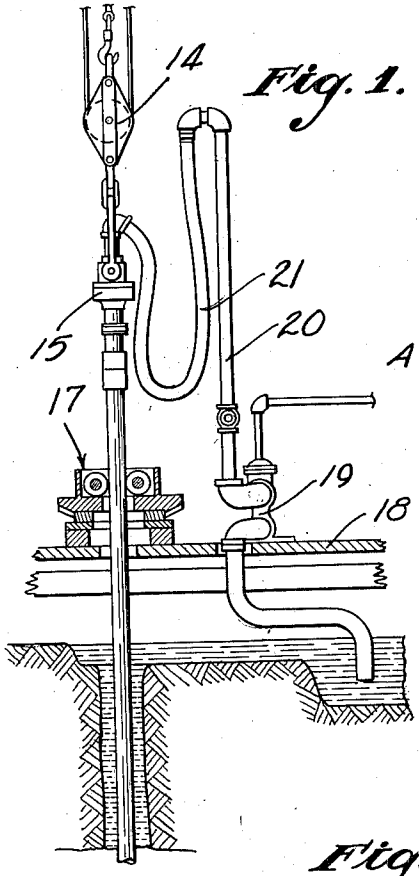


Fig. 3.

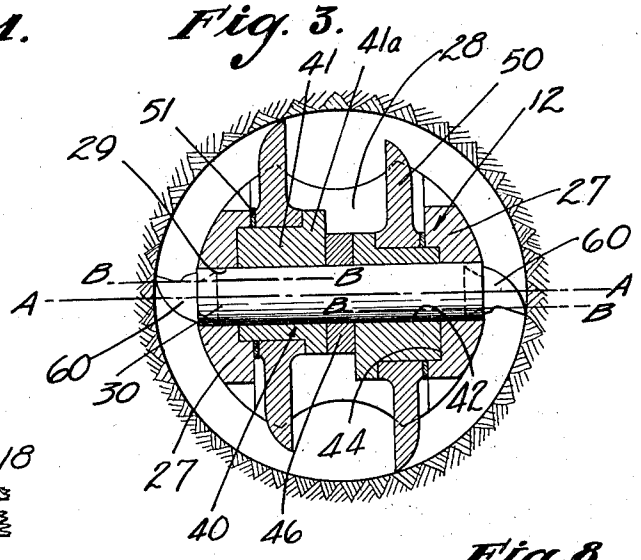


Fig. 8.

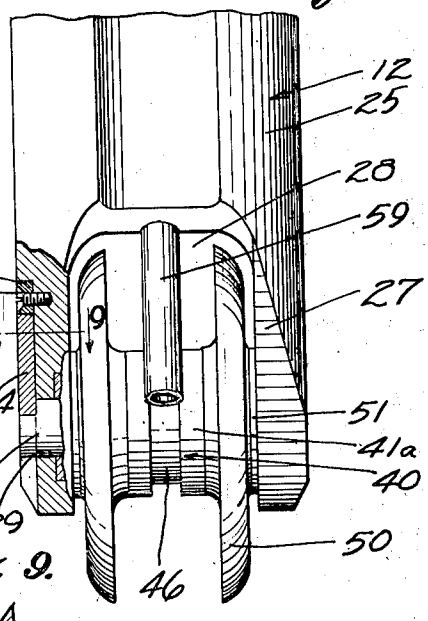


Fig. 6.

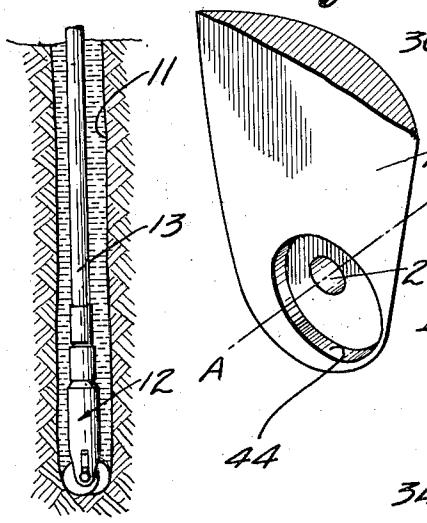
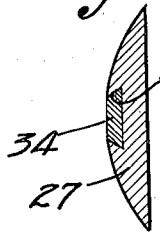


Fig. 9.



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Fig. 2.

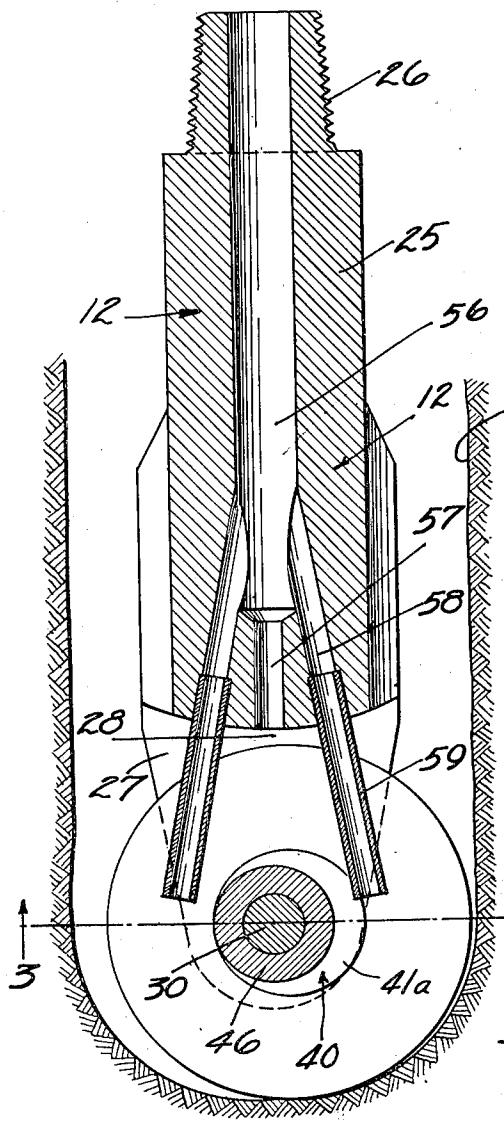


Fig. 5.

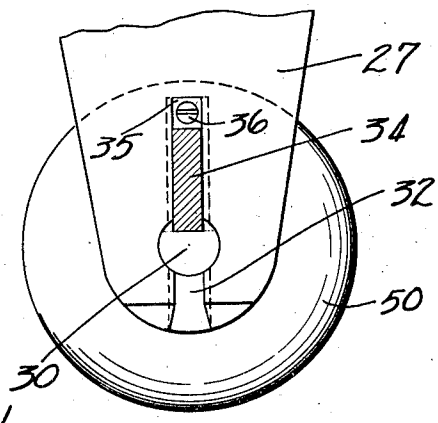


Fig. 4.

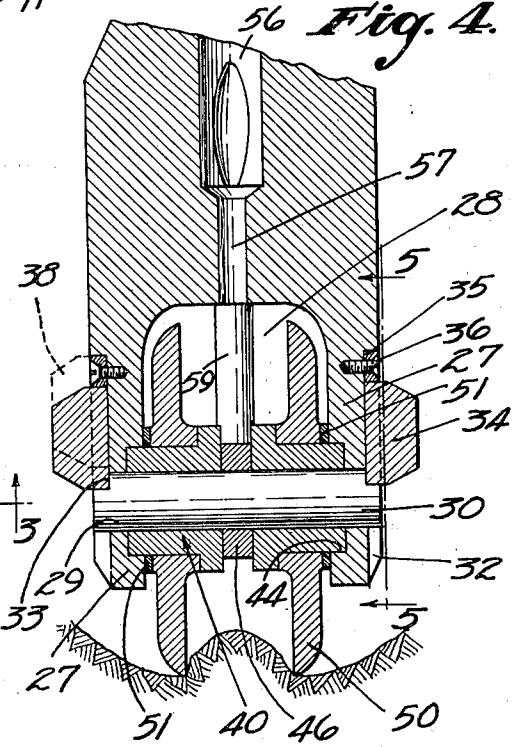
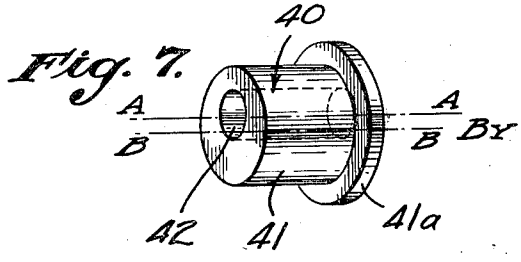


Fig. 7.



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Patented May 15, 1928. 1,670,092

UNITED STATES PATENT OFFICE.

WALTER C. BAILEY, OF NORWALK, CALIFORNIA.

ROTARY DISK BIT.

Application filed May 7, 1927. Serial No. 189,569.

My invention relates to the drilling of oil wells and particularly to rotary bits employed therein.

In the rotary system of drilling wells a bit is secured to the lower end of a drill-pipe, which drill-pipe is extended to the surface of the ground and is rotated by means of a rotary located on the floor of the derrick. The drill-pipe is supported by means of a travelling-block, this travelling-block being connected to a swivel at the upper end of the drill-pipe. Rotary mud is supplied to the drill or bit by means of a pressure-pump which is connected to the swivel by means of a stand-pipe and a flexible hose. The rotary mud passes from the bit upward through the well to the surface of the ground, carrying cuttings of the bit therewith. Disk-bits are commonly employed as the cutter and ordinarily consist of a body and a plurality of rotatable disks, these disks being off-set to each side of a horizontal axis of the bit.

It is an object of my invention to provide an improved disk-bit.

Another object of the invention is to provide a disk-bit in which the disks are retained in off-set position by a very rigid means.

A still further object of the invention is to provide a disk-bit in which the disks are off-set but are supported by a single shaft.

Another object of the invention is to provide a disk-bit having a novel means for securing the shaft to the body.

In my invention the disk-bit has a shaft which is supported on a diametral plane by a pair of legs of the body of the bit. Carried by the shaft are eccentric bushings on which the cutters are carried.

It is one of the objects of this invention to provide a disk-bit of the character specified in which the bushings are secured to the body.

Further objects and advantages of the invention will be made evident in the following description.

Referring to the accompanying drawings in which my invention is illustrated,

Fig. 1 is a diagrammatic view illustrating the utility of the invention.

Fig. 2 is a vertical section through the invention.

Fig. 3 is a cross section taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary section of the lower part of the bit, this section being taken at right angles to Fig. 2.

Fig. 5 is a fragmentary section taken on the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary perspective view of one of the legs of the invention.

Fig. 7 is a perspective view of one of the bushings of the invention.

Fig. 8 is a fragmentary view partly sectioned of an alternative form of the invention.

Fig. 9 is a section taken on the line 9—9 of Fig. 8.

Referring to Fig. 1, 11 represents a well which is being sunk by means of a disk-bit 12 embodying the device of this invention. The disk-bit 12 is secured to the lower end of a drill-pipe 13 which is extended into the well from the surface of the ground. The drill-pipe 13 is supported by means of a travelling-block 14 which is connected to a swivel 15 located at the upper end of the drill-pipe. The drill-pipe 13 and the disk-bit 12 are rotated by a rotary 17 which is supported on the floor of a derrick 18. Rotary mud is supplied through the drill-pipe 13 and the disk-bit 12 by means of a pressure-pump 19 connected to the swivel 15 by means of a stand-pipe 20 and a flexible hose 21.

The details of a preferred form of the invention are shown best in Figs. 2 to 7 inclusive. The numeral 25 represents a body having a pin 26 at the upper end, by means of which the disk-bit is attached to the lower end of the drill-pipe. The body 25 has depending legs 27 which form a central space 28 at the lower end of the body. As illustrated best in Fig. 3, the depending legs 27 are formed symmetric on a horizontal axis A—A which extends in a diametral plane. Formed in each of the legs 27 is an opening 29 which is concentric with the line A—A. Extending through these openings 29 and through the space 28 is a shaft 30, this shaft 30 being on the axis A—A.

The shaft 30 is locked to the depending legs 27 of the body 25 by means illustrated best in Figs. 3, 4 and 5. The outer faces of the legs 27 are provided with vertical dove-tailed grooves which are formed centrally on a vertical plane which intersects the line A—A. The lower ends of the dove-tailed grooves 32 are opened at the lower ends of the depending legs 27, and the upper ends thereof terminate a distance above the shaft

30. The ends of the shaft 30 are provided with dove-tailed recesses 33. Resting in the dove-tailed grooves 32 above the shaft 30 and extending into the dove-tailed recesses 33 are lock-members 34. The lock-members 34 as will be seen from Figs. 3 and 5, are dove-tailed so that they may slide along the dove-tailed grooves 32 but may not move laterally with respect thereto. The upper ends of the dove-tailed grooves 32 are filled by key-plates 35, these key-plates 35 being secured in place by flat-head machine screws 36. The lock-members 34, before the shaft 30 is installed, are moved into an extreme upper position in the dove-tailed grooves 32, as indicated by dotted lines 38 in Fig. 4, the key-plates 35 not being in place at this time. The shaft 30 is then installed in place and the lock-members are lowered into locking position as shown by full lines in the drawings. At this time the lower ends of the lock-members move into the dove-tailed recesses 33, thus securing the shaft 30 in place. The key-plates 35 are then secured in the upper ends of the dove-tailed grooves 32, thus preventing the lock-members from sliding along the dove-tailed grooves 32.

Carried by the shaft 30 in the space 28 are bushings 40. Each bushing 40 is constructed as shown in Fig. 7. The numeral 41 represents a cylindrical bearing portion of the bushing which is formed concentric on an axis B—B. At one end of the cylindrical bearing portion 41 is an annular and radial flange 41^a. Formed through the bushing 40 is an opening 42 which is parallel to the axis B—B but is eccentric to the bushing. The opening 42, when the bushing is in place, is concentric with the line A—A of the disk-bit. As illustrated in Fig. 6, each depending leg 27 is provided with a counterbore 44. The counterbores 44 are eccentric with respect to the line A—A on a horizontal plane, and one counterbore 44 is off-set on one side of the line A—A where as the other counterbore 44 is off-set on the other side of the line A—A. As shown in Figs. 3 and 4, the ends of the bushings 40 project into the eccentric counterbores 44. It will be seen that in this manner the eccentric bushings are locked in a certain position with respect to the body 25. There is a space between the inner ends of the bushings 44 and in this space is a spacer 46 adapted to hold the bushings in the positions shown. It will be seen that it is necessary to have a space between the bushings so that they can be moved upward into the space 28 and then outward so that the ends thereof rest in the counterbores 44. With reference to Fig. 3, it will be seen that the center lines B—B of the bushings 40 are off-set in a horizontal plane on opposite sides of the line A—A.

Carried by the bearing portions of the bushings 40 are cutters in the form of disks 50. The disks 50 are retained in place by the annular flanges 41^a and are separated from engagement with inner faces of the depending legs 27 by wear-plates 51. As shown in the drawings, the disks 50 are in off-set relation in planes parallel to the line A—A but are parallel in planes at right angles to the line A—A. The disks 50 rotate on center lines indicated by the lines B—B in Fig. 3. It will be seen that in this manner the disks engage the wall of the well 11 on opposite sides according to common practice.

In assembling the parts of the disk-bit, the disks 50 and the wear-plates 51 are first installed on the bushings 40 and then the bushings 40 are moved into the opening 28 and then moved outward so that the ends thereof rest in the eccentric counterbores 44. The spacer 46 is then placed between the adjacent ends of the bushings 40 and the shaft 30 is extended through the aligned openings of these parts of the bit. It should of course be understood that the lock-members 34 have first been installed as previously explained. The lock-members are then secured in locking position and the bit is ready for use.

Lubrication is supplied to the bit through a lubricating duct 56 having a central branch 57 and outer branches 58 at the lower ends thereof. The outer branches 58 have lubricating tubes 59 extending downward therefrom so that the leading edges of the disks 50 may be supplied with rotary mud.

From the foregoing description it will be seen that the assembly for supporting the disks 50 in off-set positions is quite rigid; the reason being, first, that the bushings 40 are supported by a unitary member, namely, the shaft 30, and, second, the bushings 40 are extended into the eccentric counterbores 44 so that a rigid locking between the bushings and the body is procured.

In the preferred form of my invention as illustrated in Figs. 2 to 7 inclusive, the lock-members 34 are provided with reaming elements 60 which are formed integrally therewith. These reaming elements 60 are adapted to true up any unevenness as the well is being drilled.

In Figs. 8 and 9 I show an alternative form of the invention in which the reaming elements 60 are omitted. In Figs. 8 and 9 similar parts are designated by the same numerals that these numerals designate in the other figures of the drawings.

I claim as my invention:

1. A rotary bit for drilling wells comprising: a body having a pair of depending spaced legs, there being aligned openings formed in said legs and disaligned counterbores on the inner faces of said legs; a shaft extending into said openings and through

said space; bushings carried on said shaft in said space, said bushings being oppositely eccentric to said shaft and each one extending into one of said counterbores; means for retaining said shaft in place; and cutters carried by said bushings.

2. A combination as defined in claim 1 also including a spacer adapted to be located between adjacent ends of said bushings.

3. A combination as defined in claim 1 in which said counterbores are eccentric to said aligned openings in a horizontal plane, said counterbores being off-set on opposite sides of the axis of said shaft.

4. A combination as defined in claim 1 in which said means for retaining said shaft in place comprises a receiving groove formed in one of said depending legs, a recess formed at one end of said shaft, and locking means adapted to fit in said receiving groove and said recess.

5. A combination as defined in claim 1 in which said means for retaining said shaft in place comprises a receiving groove formed in one of said depending legs, a recess formed at one end of said shaft, locking means adapted to fit in said receiving groove and said recess, and a key member positioned in said receiving groove above said lock member to prevent said lock member from moving upward out of a position in which it extends into said recess.

6. A combination as defined in claim 1 in which said means for retaining said shaft in place comprises a receiving groove formed in one of said depending legs, a recess formed at one end of said shaft, and locking means adapted to fit in said receiving groove and said recess, and in which a cutter is provided on said locking means.

7. A rotary bit for drilling wells comprising: a body having a pair of depending spaced legs, there being aligned openings formed in said legs and disaligned counterbores on the inner faces of said legs; a shaft extending into said openings and through said space; bushings carried on said shaft in said space, said bushings being oppositely eccentric to said shaft and each one extending into one of said counterbores; cutters, one of said cutters being carried by each of said bushings; a spacer carried on said shaft between said bushings, said spacer being adapted to hold said bushings in said disaligned counterbores; and lock means, said lock means being adapted to rest in a receiving groove of one of said legs and to extend into a recess formed in one end of said shaft.

8. A combination as defined in claim 7 in which said receiving groove is vertical and connects to the lower end of said depending leg in which it is formed, and in combination with a key member adapted to fit in the upper end of said receiving groove above said lock-member so as to retain said lock-member in a position to extend into said recess.

9. A combination as defined in claim 1 in which said shaft retaining means is formed to provide a reaming cutter.

10. A rotary bit for drilling wells comprising: a drill bit body adapted to support a pair of cutters, there being a pair of pockets formed in said body on opposite sides of the axis thereof, said pockets being disaligned with each other, and a hole in said body which is disaligned with each of said pockets; cutter bushings adapted to fit into said pockets, there being openings in said bushings adapted to be aligned with said hole in said body; cutters adapted to rotate upon said bushings; and a locking pin adapted to extend into said body hole and into the openings in said bushings.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 2nd day of May, 1927.

WALTER C. BAILEY.