Oct. 29, 1929. F. W. HILD 1,733,372

SPACED LEG REAMING DISK BIT

Filed Nov. 8, 1924

Fig. 1.

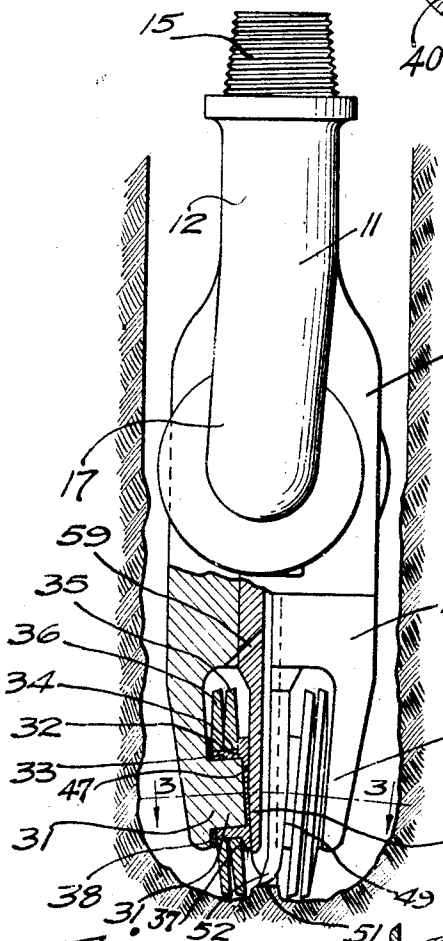


Fig. 3.

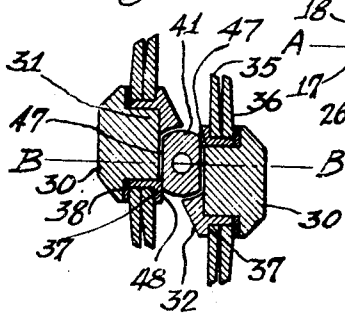


Fig. 5.

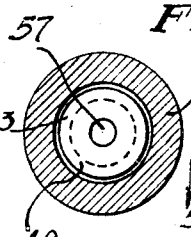


Fig. 2.

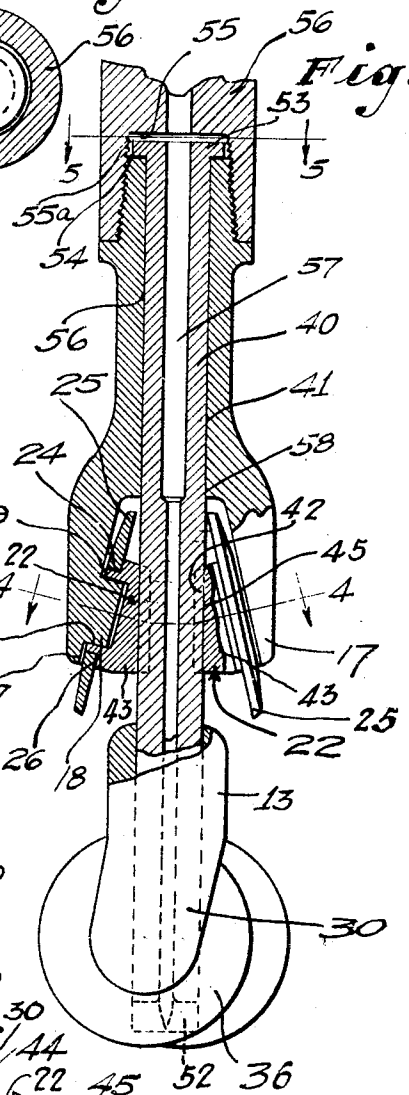
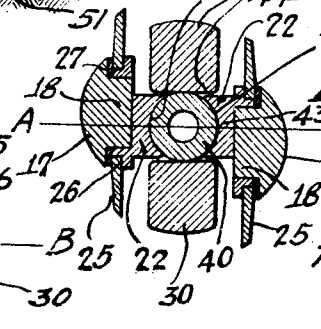


Fig. 4.



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SPACED-LEG REAMING DISK BIT

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This invention relates to drill bits used in the rotary system of drilling oil wells, and relates particularly to rotary disk bits.

In the drilling of oil wells, the hole is generally sunk by means of a bit which is rotated by a rotary table situated at the surface of the well, through a string of drill pipe. Disk bits are used very extensively for this purpose because of the fact that their life is comparatively long. The reason for this is that the cutting disks thereof are rotatably mounted. These disks, as the cutting proceeds, rotate and therefore present a cutting surface which is much greater than that of the fishtail types of bit.

Disk bits, however, have their disadvantages. One great fault found therewith is that flat spots will wear upon the disks. The cause of this is largely due to the failure of the disk to rotate, this resulting from an excessive friction on the disks which resist the inherent rotative tendency thereof. The disks also fail to rotate when the bit is rotated while they are not in contact with the bottom of the hole as when circulating through the well. In this case the disks contact only at the sides of the hole and there is no rotative tendency then present. This flattening of disks results in greatly shortening the life of the disks; it reduces the efficiency of the bit and also causes the bit to bore a hole which may be considerably under size.

Another condition of defective operation of the disk bit is coring. Since the disks are spaced apart from each other a relatively substantial distance, it is obvious that the material between the disks is not subjected to the cutting action thereof. A center core, therefore, forms as the bit moves downwardly. If the disks are carried exteriorly to a central supporting body, the core soon encounters the latter and any hard formation may prevent further progress of the bit. If the disks are carried between spaced legs, the core may rise much higher with better chances of its breaking off before encountering the supporting body. A rising core oftentimes deflects the bit and causes a crooked hole.

Another common deficiency in the present type of rotary disk bit is that there is a tendency of "corkscrewing" or the forming of crooked holes. This is primarily due to the fact that there is no means for centralizing the bit as it advances downwardly.

It is an object of this invention to provide a desk bit in which the flattening of the disks is reduced to a minimum. This is accomplished by mounting the disks in a novel manner which greatly accentuates the tendency of the disks to rotate. In this way I am able to provide a disk bit in which the life thereof is considerably longer than the present type of bit, which is more efficient and which will cut the proper size hole for a greater period of time than does the present type of disk bit.

It is also an object of the invention to provide a means for cutting away the core formations. This I accomplish by providing a central cutting member. By this provision I do away with any interference to the progress of the bit, which, as explained above, conduces to the cutting of crooked holes and other obvious disadvantages.

It is a still further object of the invention to provide a disk bit in which the formation of corkscrew holes will be entirely obviated. This is accomplished by the provision of an additional set of disks which serve as reaming cutters and which prevent the wobbling of the drill.

It is also an object of this invention to provide a simple and rugged means for retaining the cutter supporting members and the cutter disks in place.

By incorporating the above and other objects which will appear hereinafter, in a disk bit, I am able to provide a bit which is superior to other bits in a number of ways. In the first place, because of the simple and effective design, I am able to provide a bit which is exceedingly rugged. By the novel arrangement of the disk retaining means and securing pins, I am able to provide a bit which is extremely simple in construction relative to other bits. A bit including the features of my invention will be very reliable because it will not corkscrew, it will cut to proper size, the disks will not flatten, and the core will be cut away as it forms.

Further objects of the invention and the

additional advantages thereof will be made evident hereinafter.

Referring to the drawings which are for illustrative purposes only,

Fig. 1 is an elevational view of a drill bit embodying the features of my invention, a portion of the lower end thereof being sectioned to clearly show the boring cutter arrangement and the manner for securing same in place.

Fig. 2 is an elevational view of a bit embodying the features of my invention, this view being taken at right angles to Fig. 1 and being sectioned at the upper end thereof to clearly show the means for retaining the reaming cutters in place.

Fig. 3 is a section taken as indicated on the line 3—3 of Fig. 1.

Fig. 4 is a section taken as indicated by the line 4—4 of Fig. 2.

Fig. 5 is a section taken as indicated by the line 5—5 of Fig. 2.

As shown in the drawings, my invention may be provided in the form of a disk bit having a body 11 which provides an upper portion 12, and a lower portion 13, said upper and lower portions being joined together by means of a flat web 14. At the upper end of the upper portion 12 there is provided a threaded pin 15 arranged for securing the bit 11 to a string of drill pipe. Downwardly extending arms 17 are provided on the upper portion 12 of the body 11, these arms 17 being on opposite sides of the body 11 and being slightly offset relative to a central line A—A of Fig. 4. Formed on the inner sides of the arms 17 are stub pins 18 which provide circular outer faces 19; these pins being situated on axes which slope downwardly toward the rotating axis of the bit. Bushings 22 are situated so that the pin formations 18 extend into central openings 23 thereof. Rotatably disposed on the bearing faces 24 of the bushings 22 are upper reaming members 25, these reaming members 25 being situated between shoulders 26 of the bushings 22 and wear plates 27. As will be seen from Fig. 2, the reaming members 25 are disposed so that the upper portions thereof are converged; or, in other words, the disks 25 are arranged in planes nonparallel with the rotating axis of the drill bit.

Extending downwardly from the lower portion 13 of the body 11 are legs 30, these legs being offset relative to a central line B—B, as shown in Fig. 3, and having upwardly and inwardly sloping pins 31 formed on the inner faces thereof, as shown in Figs. 1 and 3. On the pins 31 are placed bushings 32 which have openings 33, into which the pins 31 project. Rotatably mounted on the bearing faces 34 of the bushings 33 are a pair of boring members in the form of disks 35 and 36, these disks 35 and 36 being situated between shoulders 37 of the bushings 32 and wear plates 38. These disks 35 and 36, as clearly shown in Fig. 1, are disposed in planes at angles to the axis of rotation of the bit, both sets of disks slanting inwardly at the lower end thereof.

A means for holding the bushings 22 and 32 in place is provided in the form of a central securing pin 40, which rests in a central opening 41 in the body 11 of the bit. The upper bushings 22 are provided with arcuated faces 42, which are formed on the inner faces of the lug portions 43 of the bushings 22, these lug portions, when the bushings 22 are in place, extending into a central opening 44 in the web portion 14 of the body 11. After the bushings 22 are inserted in place, the securing pin is then positioned in its proper place, the engagement between the outer face 45 of the pin 40 and the arcuated face 42 of the bushings 22 serving to retain the bushings 22 securely in place.

The lower end of the securing pin 40 is, as shown in Figs. 1 and 2, flattened on opposite sides as indicated at 47, these flattened portions 47 being arranged to engage with inner flattened portions 48 of the lower bushings 32. The extreme lower ends of the flattened faces 47 are converged, as shown at 49 in Fig. 1, and the lower portions of the faces 48 of the bushings 42 are also converged to accommodate the faces 49, as indicated at 50 in Fig. 1.

As previously mentioned, there is a tendency for the formation of cores between the cutter disks of the bit. My invention provides means for cutting away a core formation, indicated at 51 in Fig. 1. This means I provide in the form of cutter blades 52 which may be formed on the lower end of the securing pin 40, these blades 52 serving to expediently remove any core formation.

In order to resist axial movement in the securing pin 40, I provide a cap or enlargement 53 at the upper end thereof, resting between the upper end 54 of the pin 15 and a face 55 of the box 55ª provided by a drill collar 56 which supports the bit. Resistance to rotational movement of the pin 40 relative to the bit is offered by engagement of the flattened faces 47 and 48.

Lubricating mud for the cutters may be supplied thereto through a central mud passage 57, provided in the securing pin 40, there being branches 59 for supplying the boring members 35 and 36 with lubricating fluid. From the drawings, it will be noticed that the securing pin extends entirely through the body of the bit and that the lubricating-fluid passage 57 is wholely in the securing pin. This is a prominent advantage from the following standpoint: The lubricating fluid is generally in the form of a thin mud and contains abrasive particles. These particles soon wear the passage in a bit to a larger diameter and the flow of mud is less restricted.

When the passage enlarges so that too large a flow passes therethrough, the body of the old type of bit must be replaced. In my bit it is only necessary to replace the securing pin 40.

The manners in which a bit incorporating the features of my invention overcome the beforementioned disadvantages are substantially as follows:

The formation of flat spots on the disks is greatly minimized by providing disks in which the tendency for them to rotate is accentuated. This accentuation is accomplished by mounting the disks at angles relative to the axis of each other and to rotation of the bit. This angular disposing of the disks also assures the rotating of the disks when the bit is rotated and the disks are engaging only with the side of the hole.

Corkscrewing is prevented by the provision of the reaming members 25 which serve to ream the hole to proper size and to prevent any wobbling in the bit, this wobbling being the chief cause of corkscrewing. By providing rigid cutter blades 52, all of the interferences present in the old types of disk bit are obviated.

The wearing plates, the bushings and the disk cutters which constitute the wearing parts of the bit are replaceable and, therefore, the life of the body 11 is quite long. It will be seen that in a disk bit of this design the parts thereof are all substantially enclosed and are protected from damage by any external source.

I claim as my invention:

1. A disk bit comprising: a body; legs extending from said body; a pin formed on the adjacent side of each of said legs; a bushing supported on each of said pins; means extended into said body longitudinally thereof for retaining said bushings in place; and cutters rotatably disposed on said bushings and adapted to be removed therefrom without altering the disposition of said pins relative to each other.

2. A disk bit comprising: a body; legs extending from said body; a pin formed on the adjacent side of each of said legs; a bushing supported on each of said pins, said bushings being placed on said pins from the inner ends of said pins without altering the disposition of said pins relative to each other; means extending into said body longitudinally thereof for retaining said bushings in place; and cutters rotatably disposed on said bushings.

3. A disk bit comprising: a body; legs extending from said body; a pin formed on the adjacent side of each of said legs; a cup-shaped bushing supported on each of said pins; means extended into said body longitudinally thereof for retaining said bushings in place, said means being centrally disposed between said bushings; and cutters rotatably disposed on said bushings.

4. A disk bit comprising: a body; legs extending from said body; a pin formed on the adjacent side of each of said legs; a cup-shaped bushing supported on each of said pins, said bushings being placed on said pins from the inner ends of said pins without altering the disposition of said pins relative to each other; means extended into said body longitudinally thereof for retaining said bushings in place, said means being centrally disposed between said bushings; and cutters rotatably disposed on said bushings.

5. A disk bit comprising: a body consisting of a single unitary member; disk cutters rotatably supported by said body for boring a hole; and means arranged between said disks and terminating above the lower parts thereof for disintegrating a core which forms between said disks, said means being removable as a unit from the upper end of said body.

6. A disk bit comprising: a body consisting of a single unitary member; legs extending from said body; a pin formed on the adjacent side of each of said legs; a bushing supported on each of said pins; means extending entirely through said body longitudinally thereof for retaining said bushings in place; cutters rotatably disposed on said bushings; and unitary core disintegrating means formed on the lower end of said retaining means.

7. A disk bit comprising: a body consisting of a single unitary member; legs extending from said body; a pin formed on the adjacent side of each of said legs; a cup-shaped bushing supported on each of said pins, said bushing being placed on said pins from the inner ends of said pins; means for retaining said bushings in place, said means being centrally disposed between said bushings; cutters rotatably disposed on said bushings; and core disintegrating means formed on the lower end of said retaining means.

8. A disk bit comprising: a pair of relatively spaced depending offset legs extending from said body; boring disks rotatably supported on the inner side of each of said legs and disposed in planes at angles to the axis of rotation of the bit; relatively spaced depending offset arms extending from said body above said legs; and guiding disks rotatably supported on the inner side of each of said arms, said guiding disks being disposed at opposite angles to that of the boring disks and the axis of rotation of said bit.

9. A disk bit comprising: a body having legs and arms extending therefrom; pins formed on said legs and said arms; bushings supported by said pins; cutter disks rotatably supported by said bushings; and a unitary means for securing all of said bushings in place.

10. A disk bit comprising: a body having legs and arms extending therefrom; pins formed on said legs and said arms; bushings

supported by said pins; cutter disks rotatably supported by said bushings; and unitary means for securing said bushings in place, said securing means being extended centrally entirely through said body and between said bushings.

11. A disk bit comprising: a body having legs and arms extending therefrom; pins formed on said legs and said arms; bushings supported by said pins; cutter disks rotatably supported by said bushings; and a cylindrical securing pin extending through a central opening in said body and engaging between said bushings to hold them in place.

12. A disk bit comprising: a body having legs and arms extending therefrom; pins formed on said legs and said arms; bushings supported by said pins; cutter disks rotatably supported by said bushings; and a cylindrical securing pin extending through a central opening in said body and engaging between said bushings to hold them in place, said pin being flattened at the lower end thereof and engaging flat faces of the lowermost of said bushings in a manner to prevent the rotation of said securing pin.

13. A disk bit as defined in claim 12 in which the lower flatened end of said securing pin and the flat faces of said lowermost bushing are tapered so as to prevent said securing pin from dropping below a certain position.

14. A disk bit comprising: a body having legs and arms extending therefrom; pins formed on said legs and said arms; bushings supported by said pins; cutter disks rotatably supported by said bushings; a cylindrical securing pin extending through a central opening in said body and engaging between said bushings to hold them in place, said pin being flattened at the lower end thereof and engaging flat faces of the lowermost of said bushings in a manner to prevent the rotation of said securing pin; and core removing cutters formed on the lower end of said securing pin.

15. A disk bit comprising: a body having legs and arms extending therefrom; pins formed on said legs and said arms; bushings supported by said pins; cutter disks rotatably supported by said bushings; a cylindrical securing pin extending through a central opening in said body and engaging between said bushings to hold them in place, said pin being flattened at the lower end thereof and engaging flat faces of the lowermost of said bushings in a manner to prevent the rotation of said securing pin; core removing cutters formed on the lower end of said securing pins; and means for holding said securing pin in place.

16. The combination of: means to which a bit may be secured; a bit comprising a body secured to said means and adapted to carry rotatable disk cutters; and a central rigid cutter member extending longitudinally through and extending beyond opposite ends of said body, said member having a head at its upper end so disposed between the upper end of said body and said means as to prevent longitudinal movement of said rigid cutter member.

17. A disk bit comprising: a body; a bearing member having an axis of rotation at an angle to the longitudinal axis of said body; a disk supported by said bearing member; and means adapted to be installed from the upper end of said body and into the path of withdrawal of the bearing member for retaining said bearing member in place.

18. A disk bit comprising: a body; a bearing member supported by said body; and a securing pin adapted to be inserted from the upper end of said body and into the path of withdrawal of the bearing member for retaining said bearing member in place.

19. A disk bit comprising: a body having a longitudinal central opening; a bearing member supported by said body; and a securing pin adapted to be extended into said longitudinal opening from the upper end of said body and into the path of withdrawal of the bearing member for retaining said bearing member in place.

20. A disk bit comprising: a body; upper bearing members supported by said body; lower bearing members supported by said body; and a securing pin adapted to be placed from the upper end of said body for retaining said upper and lower bearing members in place.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 1st day of November, 1924.

FREDERIC W. HILD.