May 16, 1933. C. S. CRICKMER 1,908,693

DISK DRILL BIT

Filed May 2, 1930 3 Sheets-Sheet 1

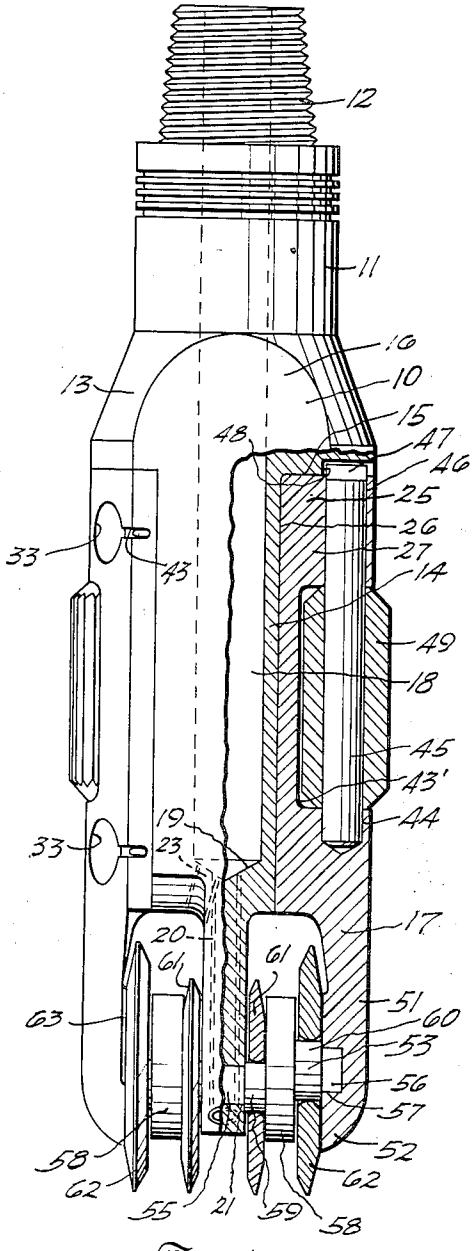

Fig. 1

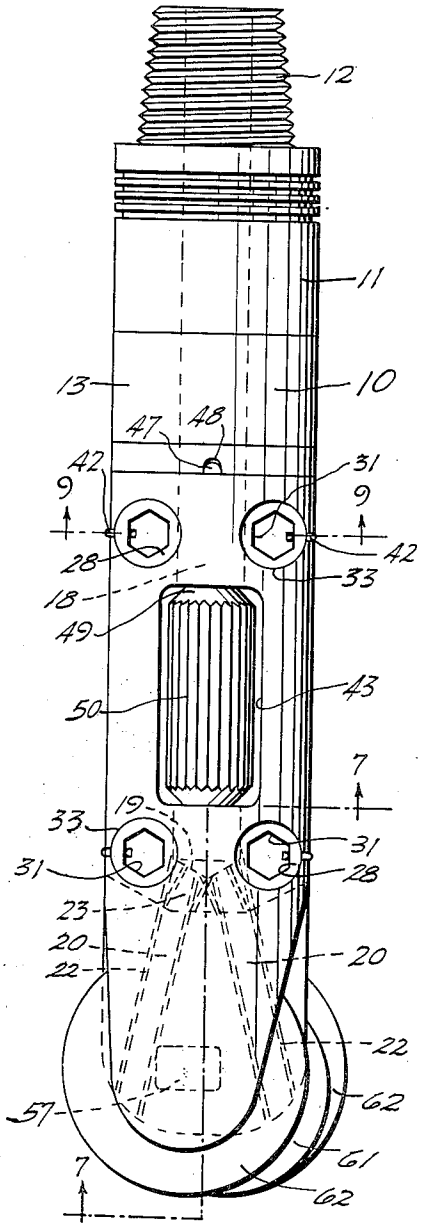

Fig. 2

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DISK DRILL BIT

Filed May 2, 1930 3 Sheets-Sheet 2

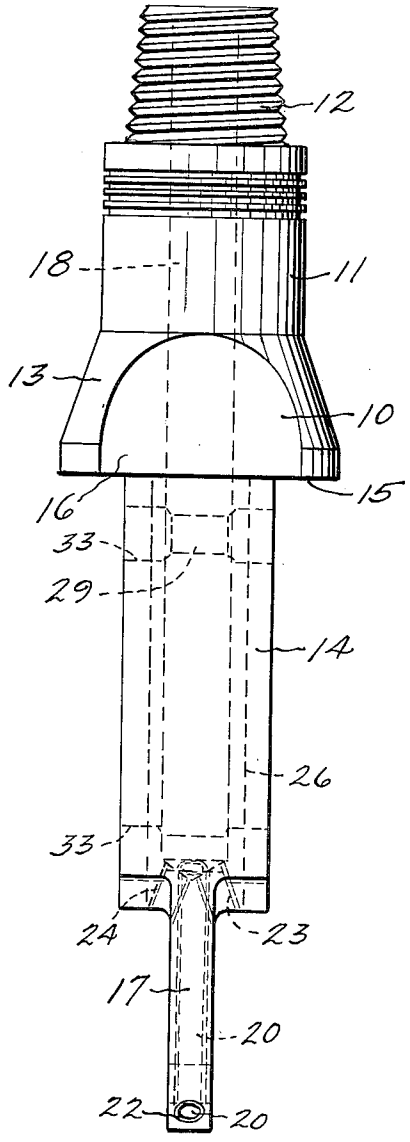

Fig. 3

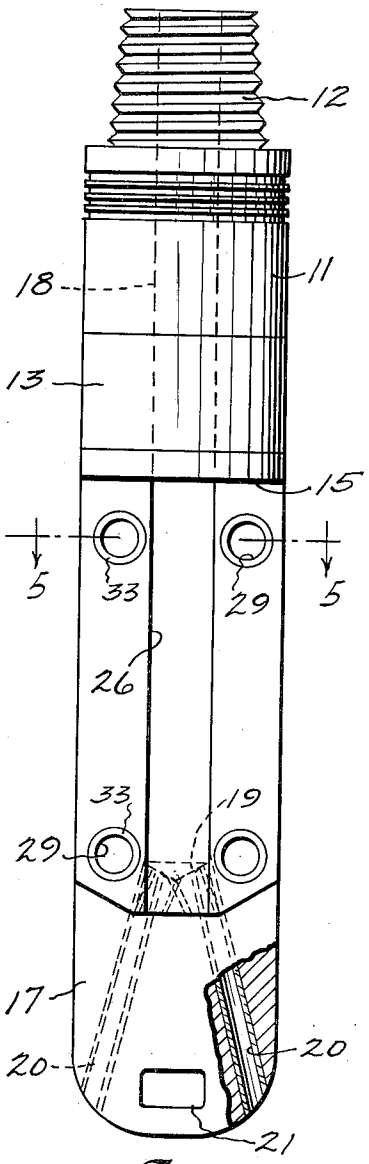

Fig. 4

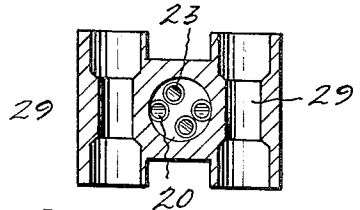

Fig. 5

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May 16, 1933. C. S. CRICKMER 1,908,693

DISK DRILL BIT

Filed May 2, 1930 3 Sheets-Sheet 3

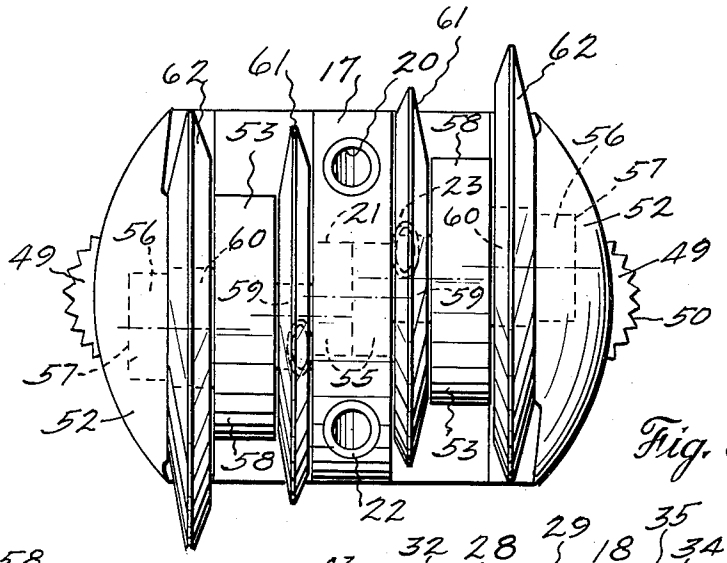

Fig. 6

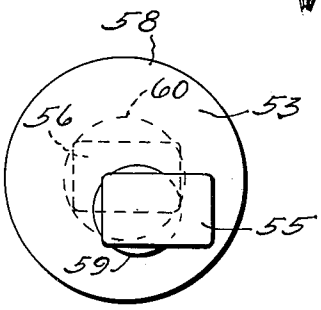

Fig. 8

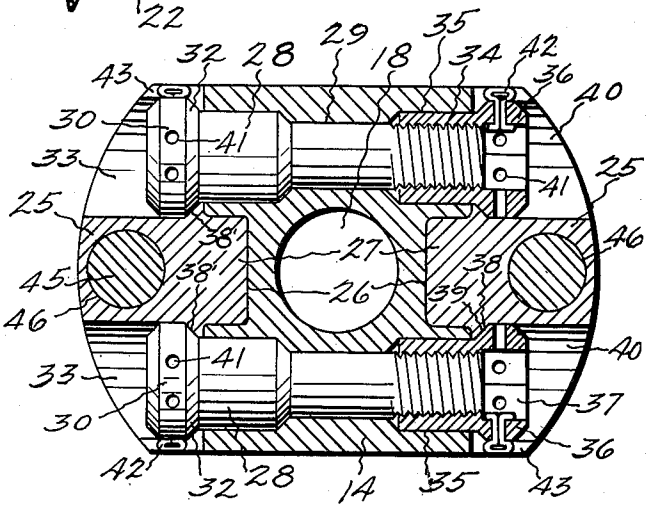

Fig. 9

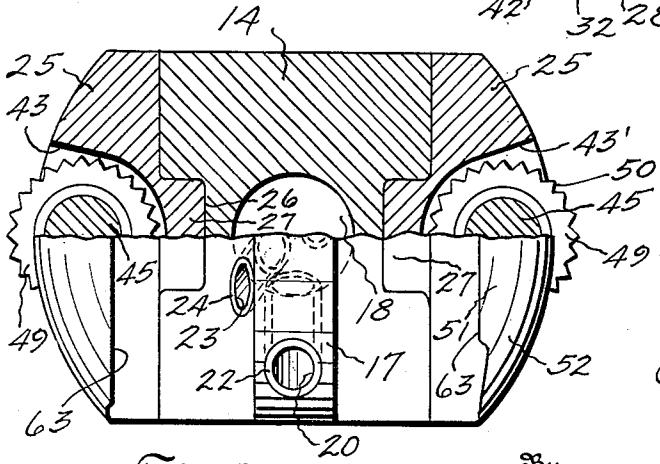

Fig. 7

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Patented May 16, 1933 1,908,693

UNITED STATES PATENT OFFICE

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DISK DRILL BIT

Application filed May 2, 1930. Serial No. 449,153.

This invention relates to new and useful improvements in disk drill bits.

One object of the invention is to improve the means for supplying drilling fluid to the cutters and this result is obtained by shortening the fluid courses or ducts. As there is considerable abrasion, due to the flow and pressure of the fluid, and it is advantageous to have the gage rollers mounted in the cheek plates, the body or stock of the bit must, therefore, be elongated. In shortening the fluid ducts the body is provided with an axial bore which may have substantially the same diameter as the drill stem. This bore is terminated just above the tongue of the bit and, therefore, it is necessary only to extend the ducts from the bottom of this bore. By securing removable liners in these ducts said liners may be removed when worn and the bit thus saved from damage by abrasion from the drilling fluid.

Another object of the invention is to provide fastening bolts for the cheek plates on each side of the central bore of the stock and to provide locking means for said bolts and the nuts therefor, whereby the same are prevented from becoming loose while drilling.

A further object of the invention is to provide improved means for mounting and securing the gage rollers, whereby the latter are adequately held in position and may be readily removed when desired.

Still another object of the invention is to improve the entire structure of the bit to make for greater sturdiness and economy in construction and operation, as well as efficiency in drilling.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings in which an example of the invention is shown, and wherein:

Figure 1 is a view of a bit constructed in accordance with the invention, partly in elevation and partly in section,

Figure 2 is a side elevation of the same,

Figure 3 is an elevation of the bit stock,

Figure 4 is a similar view at right-angles thereto,

Figure 5 is a horizontal cross-sectional view taken on the line 5—5 of Figure 4,

Figure 6 is an underside view of the bit,

Figure 7 is a sectional view taken on the line 7—7 of Figure 2, the disks and axles being omitted,

Figure 8 is a side elevation of one of the axles, and

Figure 9 is an enlarged horizontal cross-sectional view taken on the line 9—9 of Figure 2.

In the drawings the numeral 10 designates the body or stock of the bit which has a collar or neck 11 at its upper end surmounted by a screw-threaded tapered pin 12. Below the collar is a head 13 from the center of which depends a shank 14. The shank is angular in cross-section, as is best shown in Figures 5, 6 and 7, and the head has concentric curved portions which overhang the sides of the shank to form thrust shoulders 15. The other two sides of the shank are substantially flush with flattened panel 16 on opposite sides of the head and the distance between these panels is substantially the same as the diameter of the collar 11, thus making two sides of the bit body substantially flush, as is best shown in Figure 2. This makes for symmetry and prevents unnecessary obstructions which might interfere with the handling of the bit in the well.

The shank 14 is formed at its lower end with a depending tongue 17, which has its vertical ends substantially flush with the panels 16 and the coincident sides of the shank. The flat sides of the tongue are substantially parallel to the other two sides of the shank and said tongue is disposed centrally of the bit body. The body is formed

with an axial bore 18 extending downward through the pin 12, collar 11, head 13 and shank 14. This bore terminates above the upper end of the tongue and has a dished bottom 19.

From the bottom 19 divergent ducts 20 extend downwardly through the tongue on opposite sides of a socket 21. Removable liners 22 are suitably secured in the ducts and may be made of metal especially adapted to resist the abrasion resulting from the flow of the drilling fluid. These liners may be replaced when worn.

At right angles to and between the ducts 20 divergent ports 23 extend from the bottom 19 of the bore through the bottom of the shank on each side of the tongue. This bottom overhangs the flat sides of the tongue so that the fluid is discharged on each side of said tongue. Removable liners 24 constructed similar to the liners 22 are suitably secured in the ports 23 so as to be removed when worn out.

Vertical cheek plates 25 are fitted against each side of the shank 14 under the shoulders 15. These cheek plates have their outer sides curved to conform to the contour of the head 13, while their edges are flattened to conform to the panels 16 and the coincident sides of the shanks. Each shank has upright key seats or channels 26 receiving central vertical tongues 27 on the inner sides of the cheek plates. The seats and tongues are angular in cross-section and it is obvious that the cheek plates cannot undergo lateral displacement by reason of the keys and upper displacement by reason of the shoulders 15, although they may be moved downwardly and outwardly from the shank.

The entire inner or back side of each cheek plate has a positive supporting contact with the shank and this makes for sturdiness. The greatest load and strain on the cheek plates will result in an upward thrust, an outward displacement of the plates and a torsional or twisting string. There is practically very little downward load on the plates and as all other loads and strains are provided for by the shoulders 15 and keys 27, the fastenings for the cheek plates will only have to support said plates against downward displacement and outward displacement or spreading. The tendency to spread is very marked because of the cutters carried at the bottom of the bit, and, therefore, substantial fastenings must be provided.

For fastening the cheek plates I provide four transverse tie bolts 28, two upper bolts and two lower bolts passing through apertures 29 on each side of the bore 18. As each bolt is the same in construction, a description of one will explain all. The bolt has an enlarged cylindrical head 30 provided with a countersunk wrench socket 31 and joined to the bolt proper by an inclined annular shoulder 32. The cheek plate is provided with a counter bore 33 having at its inner end a seat 38′ shaped to receive the head 30 and shoulder 32. The opposite end of the bolt is screw-threaded for receiving a nut 34. The nut fits in a cylindrical socket 35 in the shank and has a head 36 provided with a countersunk wrench socket 37, as is best shown in Figure 9.

It is obvious that the bolt and nut must be securely held in place and also must draw the cheek plates against the shank when tightened. The head 36 of the nut is provided with an annular inclined shoulder 38 engaging a complementary seat 39 at the inner end of a counter bore 40 in the cheek plate. This shoulder and seat coacting with the shoulder 32 of the head and its seat will cause the bolt to tightly engage and firmly compress the cheek plates and shank. The head 30 and the head 36 must be countersunk within the face of each cheek plate so as not to catch on obstructions when the bit is rotating and it is highly important that the nuts be securely fastened on the bolts. For fastening the nuts and the bolts the head 36 and the head 30 have a plurality of radial apertures 41 for receiving cotter keys 42, the heads of which are secured in sumps 43 in the face of the cheek plates. The keys are made heavy enough to prevent shearing and by this means the nuts and bolts are adequately fastened.

Each cheek plate has an upright transversely dished recess or pocket 43′ at the center of its face and terminating short of the nut and bolt sockets. At the bottom of each recess is a step socket 44 for receiving the lower end of a pin or axle 45 which extends upwardly through a bore 46 in the upper end of the cheek plate. Each pin has a diametrical tongue or key 47 at its upper end loosely engaging in a groove 48 in the overhanging shoulder 15. By this means the pin is held against rotation and is confined in the cheek plate.

Within each recess 43′ a vertical guide roller or reamer 49 is journaled on the pin 45 so that a portion of its fluted surface 50 projects beyond the face of the cheek plate. It will be noticed that the vertical sides of the recesses 43′ are flared outwardly and this provides sufficient clearance for discharging matter which might otherwise accumulate in said recesses and interfere with the free rotation of the reamers. The upper and lower ends of the reamers are bevelled, as is customary, and the tops and bottoms of the recesses form bearings for said reamers.

The lower ends of the cheek plates are reduced on their inner sides to form hangers 51, each of which has a rounded nose 52 at its bottom which gives the bit a better working finish. These hangers are spaced from the tongue, but depend in vertical planes

substantially parallel to the flat sides of said tongue. Axles 53 each have a trunnion 55 at one end engaging in the socket 21 and a trunnion 56 at the opposite end engaging in a socket 57 in the inner face of the correlated hanger 51. The trunnions 55 are angular and when placed side by side completely fill the socket 21, thus holding said axles against rotation. These axles extend on opposite sides of the tongue and also on opposite sides of the transverse axis of the bit running substantially parallel to the longitudinal axes of the axles.

Each axle (Figures 1 and 8) includes a central circular spacing disk or member 58 having a bearing collar 59 on one side and a bearing collar 60 on the opposite side. These collars are eccentrically located with relation to the center of the disk, as well as with relation to each other, and the trunnion 55 extends from the collar 59, while the trunnion 56 extends from the collar 60. On each collar 59 is mounted an inner or central circular cutter disk 61, while on each collar 60 an outer circular cutter disk 62 is journaled. These disks preferably have curvilinear bores and sufficient side clearance to wobble on their journals as they revolve.

By observing Figure 1, it will be seen that the outer disks are larger in diameter than the inner disks and yet their lower cutting edges are all in the same horizontal plane. This is due to the eccentric relation of the collars. By observing Figure 6, it will be seen that each pair of disks, an inner disk and an outer disk being considered a pair, have their axes offset from each other and offset from the transverse axis of the bit, and that one pair of disks have their axes on one side of the transverse axis of the bit, while the other pair of disks have their axes on the opposite side of said transverse axis.

This mounting has been found advantageous in causing the disks to properly track and revolve when the bit is rotated. This mounting, together with the wobbling feature, prevents the cutting edges from wearing flat and increases the cutting efficiency of the bit. The spacer disks 58 separate the cutting edges of the cutter disks and the hangers 51 are provided with bosses 63 which take the side thrust of the outer disk 62.

The overhanging portions of the bottom of the shank 14 and the cheek plates 25 provide cavities above the disks and these cavities are given upward flares 64 at their tops so that the drilling fluid discharged through the liners 24 may freely wash out the cuttings from these cavities, as well as washing down the sides of the disks. The liners 22 discharge the drilling fluid from the bottom of the tongue, thus placing the fluid along the cutting surface at the bottom of the hole and causing it to flow outward and pass under the edge of each disk.

Various changes in the size and shape of the different parts, as well as modifications and alterations, may be made within the scope of the appended claims.

What I claim, is:

1. In a drill bit, a bit body including a head and a reduced shank extending from the head having an integral reduced tongue depending from its lower end, whereby shoulders are formed on the bottom of the head overhanging two opposite sides of the shank, the body having an axial bore extending downward to the bottom of the shank and also provided with inclined fluid ducts extending from the bore to the bottom of the tongue, as well as fluid ports extending from the bottom of the bore to the bottom of the shank on each side of the tongue, cheek plates mounted on each side of the shank and engaging under the shoulders of the head of the body, hangers extending from the lower ends of the plates and in spaced relation with each side of the tongue, axles having their ends supported in the tongue and hangers, cutter disks journaled on the axles, and means on the axles for spacing the disks thereof apart.

2. A drill bit as set forth in claim 1, with two of the faces of the shank and two of the faces of the head and two vertical edges of the tongue all being substantially flush on each side of the bit body.

3. In a drill bit, a bit body having a reduced shank and overhanging shoulders, horizontal grooves provided in said shoulders and extending to the outer edges thereof, cheek plates secured to the body under said shoulders, reamer pins mounted in the cheek plates and each having a tongue at its upper end engaging in one of the grooves of the body shoulders, whereby the reamer pins may be slid outwardly with the cheek plates from the shank and reamers mounted on said pins.

4. In a drill bit, a bit body having overhanging shoulders and provided with a depending shank having vertical seats therein, the shank having bolt holes on each side of the seats extending therethrough at its upper and lower ends, cheek plates fitting against the shank and having tongues engaging in the seats thereof, the cheek plates having larger openings registering with the bolt holes of the shank, bolts extending through the bolt holes of the shanks and having enlarged heads countersunk in one cheek plate, and nuts engaging the bolts and countersunk in the holes of the other cheek plate, an axle carried by the cheek plates and the shank, and disk cutters journaled on said axle.

5. In a drill bit, a body having a tongue at its lower end provided with an elongated angular socket, hangers at the lower end of the body on opposite sides of the tongue and spaced therefrom, the inner faces of the

hangers having elongated angular sockets, axles each including a central spacing member having journals on opposite sides thereof offset from each other transversely of the spacing member and also offset from the center of the spacing member, each axle having an angular trunnion at each end, the outer trunnions of the axles engaging in the sockets of the hangers and the inner trunnions of the axles engaging in the socket of the tongue, whereby the axles are each held at each end against rotation, and cutter disks mounted on said axles.

In testimony whereof I affix my signature.

CHARLES S. CRICKMER.