

July 28, 1936.

D. T. BROWNLEE

2,049,047

DRILL HEAD

Filed April 4, 1935

2 Sheets-Sheet 1

Fig. 1.

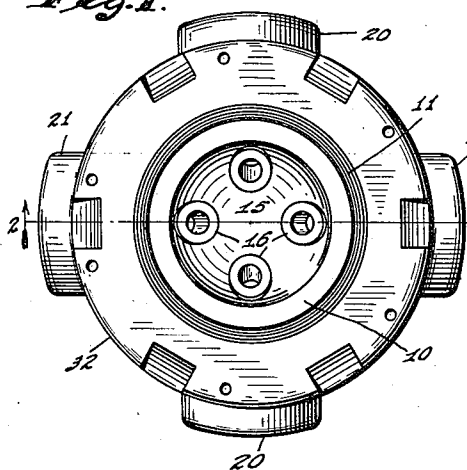


Fig. 3.

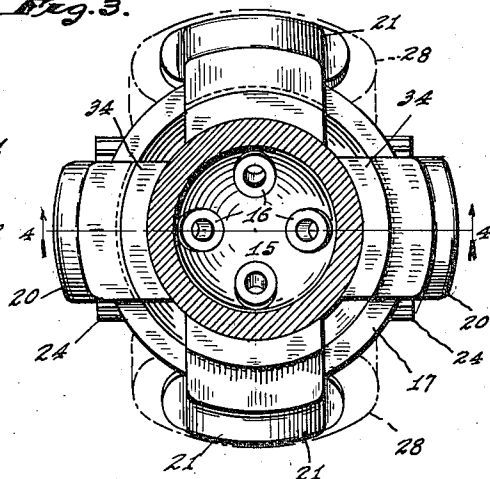


Fig. 2.

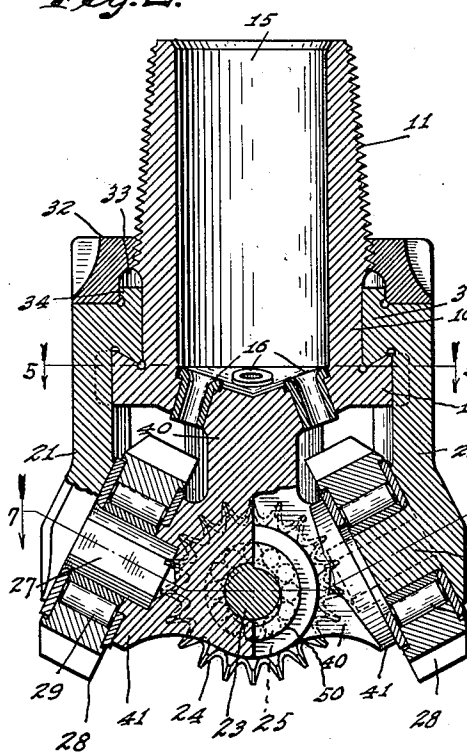
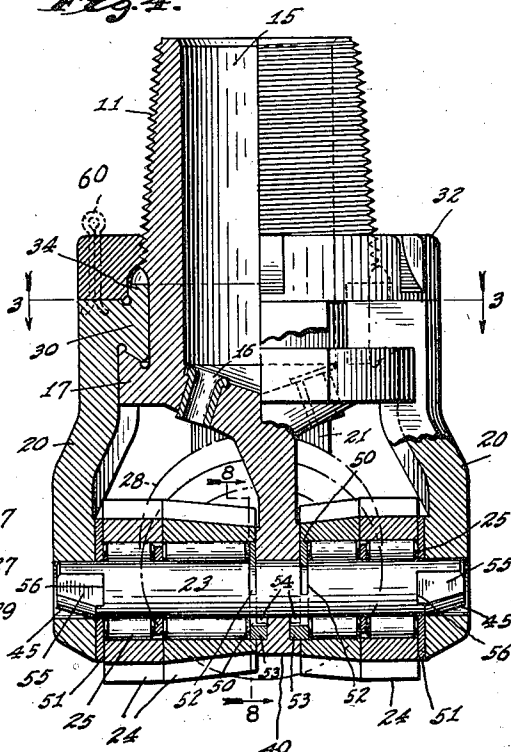


Fig. 4.



Inventor

DALMAR T. BROWNLEE,

By

Attorneys

Attorneys

July 28, 1936.

D. T. BROWNLEE

2,049,047

DRILL HEAD

Filed April 4, 1935

2 Sheets-Sheet 2

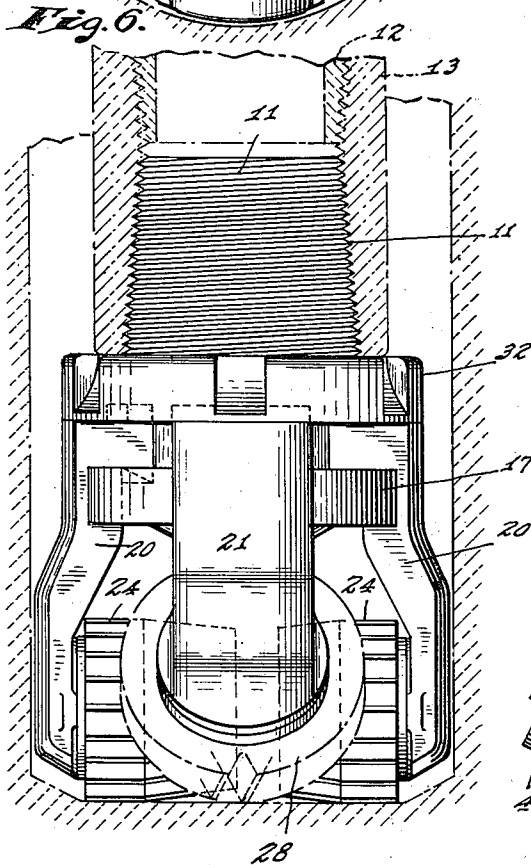
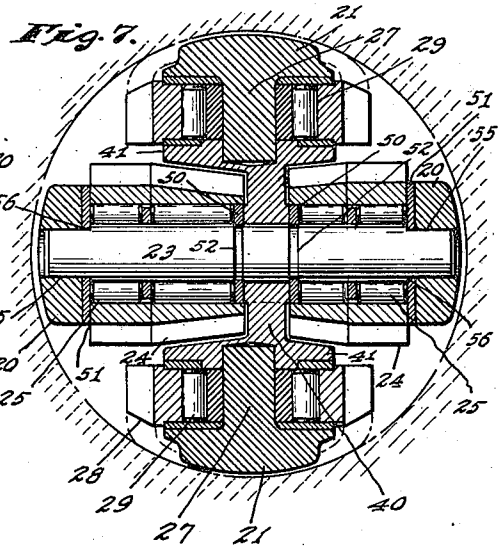
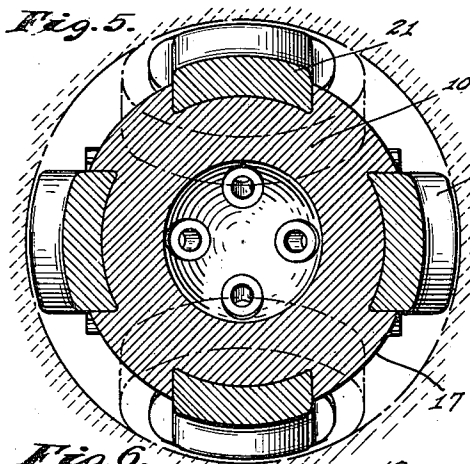
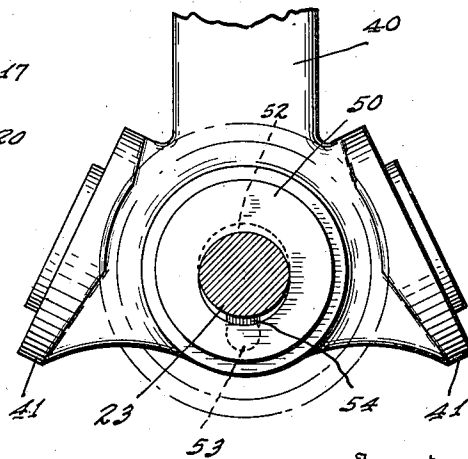


Fig. 8.



Inventor
DALMART T. BROWNLEE,

By

Atty. Frank

Attorneys

UNITED STATES PATENT OFFICE

2,049,047

DRILL HEAD

Dalmar T. Brownlee, Indianapolis, Ind., assignor
to L. G. S. Devices Corporation, Indianapolis,
Ind., a corporation of Indiana

Application April 4, 1935, Serial No. 14,583

15 Claims. (Cl. 255—71)

My invention relates to well-drilling heads of the roller-cutter type and it is my object to produce a head which, while possessing great strength and rigidity, can be readily disassembled when it is desired to replace the cutters.

In carrying out my invention I form the head of a generally cylindrical body threaded at its upper end for attachment to the drill pipe and having near its lower end an outwardly projecting annular flange. The cutters are carried by means of removable arms which project downwardly from the head and which are provided near their upper ends with inwardly extending bosses adapted to be clamped against the aforesaid flange by means of a nut which co-operates with the threads on the upper end of the body. One diametrically opposite pair of these arms supports the outer ends of a transverse shaft carrying the cross roller cutters, while each of the other pair of arms has an inwardly and downwardly inclined integral spindle carrying a side cutter. The head is provided with a downwardly extending web which serves as an intermediate support for the cross-cutter shaft and also as a support for the inner ends of the side-cutter spindles.

The accompanying drawings illustrate my invention: Fig. 1 is a plan view of the head; Fig. 2 is an axial section on the line 2—2 of Fig. 1 in the plane of the axes of the side cutters; Fig. 3 is a transverse section on the line 3—3 of Fig. 4; Fig. 4 is a section on the line 4—4 of Fig. 3 and in the plane of the axis of the cross-cutters; Fig. 5 is a transverse section on the line 5—5 of Fig. 2; Fig. 6 is a side elevation of the head; Fig. 7 is a transverse section on the line 7—7 of Fig. 2; and Fig. 8 is a fragmental section on the line 8—8 of Fig. 4.

The head comprises a generally cylindrical body portion 10 provided at its upper end with external screw-threads 11 adapting it for attachment to the drill pipe 12 through the medium of a coupling 13. (See Fig. 6). As is customary, the body 10 is provided with an upwardly opening axial recess 15 through the bottom of which extend bushings 16 positioned to direct water upon the cutters.

Below the threads 11, the body 10 is provided with an outwardly projecting annular flange 17 the upper surface of which is preferably frusto-conical sloping inwardly and downwardly. The flange 17 is notched (see Fig. 5) for the reception of two pairs of equally spaced downwardly projecting arms 20 and 21.

The two arms 20, which are located diametrical-

ly opposite each other, are provided at their lower ends with aligned holes for the reception of the ends of a transverse shaft 23 carrying a series of cross-roller cutters 24. These cross-roller cutters may be of any desired number and form, and are preferably supported from the shaft 23 through anti-friction bearings 25.

The two arms 21, which also are located diametrically opposite each other, are respectively provided near their lower ends with spindles 27 which are preferably integral with the arms and which are disposed with an inward and downward inclination. The spindles 27 support side cutters 28, conveniently through the medium of anti-friction bearings 29 of any desired type.

Each arm of the two pairs of arms 20 and 21 is provided near its upper end with an inwardly extending flange 30 the lower surface of which is in the form of a segment of a frusto-conical surface complementary to the frusto-conical upper surface of the flange 17 on the head-body 10. The inner surface of the flange 30 is machined to conform to the curvature of the head-body 10, while the inner surface of the arm below the flange is machined to conform to the bottom of the arm-receiving notch in the flange 17.

The two pairs of arms 20 and 21 are held in position on the head by means of a nut 32 which co-operates with the threads 11 to force the arms downwardly and to seat the arm-flanges 30 in firm engagement with the body-flange 17. Preferably, the nut 32 is provided with a counterbore extending upwardly from its lower surface and each of the arm flanges 30 is provided with an upward projection 34 adapted to enter this counterbore and machined exteriorly to fit the wall thereof.

The head-body 10 is shown as having a downwardly extending web 40 provided with an opening for the reception of the shaft 23, the web thus serving as an intermediate support for such shaft. Preferably, the web 40 is not disposed centrally of the head in the plane of the shaft 23, but is offset somewhat from the center in order to permit one of the cutters 24 to extend inwardly close to the axis of the hole being drilled.

The web 40 extends transversely of the shaft 23 beyond the inner cross-roller cutters 24 and is provided at each end with a generally circular flange 41 the outer surface of which is disposed in a plane perpendicular to the axis of the adjacent spindle 27. On the axis of each of the spindles 27, the web 40 is provided with a cylindrical recess or pocket which receives the

inner end of such spindle and provides a support therefor.

In the longitudinal plane containing the axis of the head and the axes of the two spindles 27 (the plane in which the sectional view shown in Fig. 2 is taken), the axes of the side-cutter spindles 27 are parallel to the frusto-conical upper surface of the flange 17,—or, at least, the angle between the head axis and an element of such frusto-conical surface is no smaller than the angle between the axis of the head and either of the spindles 27—so that each arm 21 is brought into and out of association with the head-body 10 by movement parallel to the axis of the spindle 27. To permit corresponding movement of the other two arms 21, the ends of the cross-roller shaft 23 are relieved as indicated at 45.

The lower ends of the arms 20 are preferably supported against inward movement, and for this purpose I may mount in fixed positions on the cross-roller shaft 23 an inner pair of washers 50, which bear against opposite faces of the web 40, and an outer pair of washers 51, which bear against the inner surfaces of the arms 20. (See Figs. 4 and 7.) Each of the inner washers 50 is seated in a groove 52 cut in the upper surface of the shaft 23. Preferably, the bottom of the groove 52 has a radius of curvature corresponding to the radius of the shaft 23, with the center of curvature displaced downwardly from the axis of the shaft 23, as is clear from Fig. 8. Each of the washers 50 has an eccentric hole for the reception of the shaft 23, the eccentricity of the hole being such that when the washer 50 is seated in the associated groove 52 its outer surface will be concentric with the shaft 23 so as to be received within the central bore of the adjacent cross-roller cutter 24.

To prevent rotation of each washer 50 upon the shaft 23, it is provided with an inwardly extending projection 53 (Figs. 4 and 8) receivable in a recess 54 cut in the adjacent face of the web 40. When the inner cross-rollers 24 are in place the washers 50, which have a relatively close fit within them, are thereby held seated in the grooves 52, thus definitely locating the shaft 23 in fixed position axially of itself relative to the web 40.

Each extreme outer end of the shaft 23 is provided with diametrically opposite parallel flattened portions 55 creating shoulders 56 against which the outer washer 51 bears. As a result, any inward pressure on the lower end of either of the arms 20 is transmitted through the adjacent washers 51, the shaft 23, and the washer 50 to the central web 40; and the lower end of the arm 20 is thereby prevented from being deflected inwardly to bind the cross-roller cutters 24.

In assembling the head, the shaft 23 and inner thrust-washers 50 are first put in place. The cross-roller cutters 24 are then mounted on the shaft, with the inner ends of the inner pair of cutters overlapping the washers 50 to hold them seated in their associated grooves 52. The outer thrust-washers 51 are then mounted on the shaft 23; and the two pairs of arms 20 and 21, are put in position. Before the arms 21 are assembled, however, side cutters 28 are placed upon the spindles 27. The inner ends of the spindles 27 seat against the bottoms of the pockets in the web 40 which receive them in order to transmit directly to the web any inward pressure against the lower ends of the arms 21.

With the two pairs of arms 20 and 21 in po-

sition, the nut 32 is rotated to engage the upper ends of the arms and to force the projections 30 into firm engagement with the flange 17. With the nut 32 tightened, the head is then attached to the coupling 13 on the lower end of the drill-pipe 12, such coupling bearing against and backing up the collar 32 to aid it in clamping the arms 20 and 21 in place. The resistance to rotation which the cutters encounter tends to rotate the head relatively to the coupling 13 in a direction such as to increase the clamping action which it and the collar 32 exert on the arms 20 and 21.

To prevent loosening of the collar 32 as the result of friction between the coupling 13 and 15 collar 32 when the head is removed from association with the drill pipe, I may provide the collar 32 with a cotter key 60 co-operating with one of the arms 20 and 21. Preferably, the cotter key is so disposed as to limit unscrewing movement only of the collar 32 and not to interfere with any tightening of the collar 32 which may occur as the result of the tendency of the head to rotate when in operation.

It will be noted that all parts of the head are held in their respective positions in the assembled structure by the clamping action of the nut or collar 32 and that upon loosening of such nut the entire head can be dismantled, thus facilitating inspection and repair. Further, since the nut 32 is the sole means holding the parts of the head together and since it tends to be tightened when the head is in use, there is little if any chance of the head becoming accidentally disassembled when in operation.

I claim as my invention:

1. In a drill head, a body with means thereon for attachment to a drill pipe, an external annular flange on said body, angularly spaced cutter-supporting arms extending downwardly below said flange and having inwardly directed flanges adapted to engage the upper surface of said body-flange, and means for clamping said arm flanges against the upper surface of said body flange.

2. The invention set forth in claim 1, with the addition that said body flange has notches in its periphery for the reception of the respective arms.

3. In a drill head, a body threaded at its upper end for attachment to a drill pipe, an external annular flange on said body, angularly spaced cutter-supporting arms extending downwardly below said flange and having inwardly directed flanges adapted to engage the upper surface of said body-flange, and a nut mounted upon the threaded upper end of said body for clamping said arm flanges against the upper surface of said body flange.

4. The invention set forth in claim 1, with the addition that the upper face of said body flange slopes downwardly and inwardly, the co-operating face of each arm flange being complementarily formed.

5. The invention set forth in claim 1, with the addition that the upper face of said body flange is frusto-conical sloping downwardly and inwardly, the co-operating face of each arm flange being complementarily formed.

6. The invention set forth in claim 3 with the addition that the lower surface of said nut is counterbored, each of said arms having an upward projection engaging the wall of said counterbore when the nut is tightened.

7. In a drill head, a body having means there-

on for attachment to a drill pipe, axially extending cutter-supporting arms associated with said body, each of said arms having an inwardly extending transverse flange near its upper end,

5 a pair of relatively movable abutments carried by said body and relatively axially movable to clamp an arm-flange between them, the lower surface of each arm flange being undercut and the co-operating abutment-face being complementarily formed to prevent removal of the arm flange from between said abutments when they are tightened, and cutters supported from said arms.

8. In a drill head, a body having means there-
15 on for attachment to a drill pipe, axially extending cutter-supporting arms associated with said body, each of said arms having an inwardly extending transverse flange near its upper end, a pair of relatively movable abutments carried by
20 said body and relatively axially movable to clamp an arm-flange between them, one of the top and bottom faces of each arm flange being undercut and the co-operating abutment-face being complementarily formed to prevent removal of the
25 arm flange from between said abutments when they are tightened, and cutters supported from said arms.

9. In a drill head, a body, axially extending cutter-supporting arms associated with said
30 body, each of said arms having an inwardly extending transverse flange near its upper end, a pair of relatively movable abutments carried by said body and relatively axially movable to clamp an arm-flange between them, at least one of said
35 arms having near its lower end an inwardly and downwardly inclined spindle, and a cutter rotatable on said spindle, said head being provided with a downwardly extending web having a laterally opening recess for the reception of the
40 inner end of said spindle.

10. In a drill head, a body provided with a downwardly extending web, a pair of arms extending downwardly on opposite sides of said web, a shaft extending transversely through said
45 arms and web, thrust washers mounted on said shaft and engaging the opposite faces of said web and the inner faces of said arms, said shaft having provisions engaging all said washers to

resist inward pressure on the lower ends of said arms and to prevent movement of said shaft longitudinally of itself in said web, and one or more cutters mounted on said shaft.

11. In a drill head, a body provided with a
5 downwardly extending web, an arm extending downwardly in spaced relation to said web, a shaft extending through said arm and into said web, said shaft having a transverse groove in its outer surface adjacent the outer face of said
10 web, a thrust washer receivable in said groove, and a cutter mounted on said shaft and embracing said washer to hold it seated in said groove.

12. The invention set forth in claim 11 with the addition of means for preventing rotation
15 of said washer on said shaft.

13. In a drill head, a body provided at its upper end with screw threads for attachment to a rotatable head-driving member, one or more demountable cutter-supports associated with said
20 head, and means for clamping said cutter-supports in place on said head, said means including a clamping collar mounted on said screw-threads and positioned to be engaged by a driving member screwed on said screw-threads.
25

14. In combination, a drill head having a body provided at its upper end with screw-threads, a rotatable head driving member mounted on said screw-threads, one or more demountable cutter-supports, and means for clamping said sup-
30 ports in place on said body, said means including a member engaged by said head-driving member, whereby any tendency of said head-driving member to rotate in the driving direction relative to said body will increase the clamping ac-
35 tion extended on said supports.

15. In combination, a drill head having a body provided at its upper end with screw-threads, a rotatable head driving member mounted on said screw-threads, and a demountable cutter-sup-
40 port, said body being provided with a laterally extending abutment and said cutter-support having a portion engaging the upper surface of said abutment to be forced thereagainst by rotation of said head-driving member in the
45 driving direction relative to said body.

DALMAR T. BROWNLEE.