

[54] **DRILL BIT**

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[58] Field of Search **175/350, 353, 360-364, 175/371, 372**

[56]

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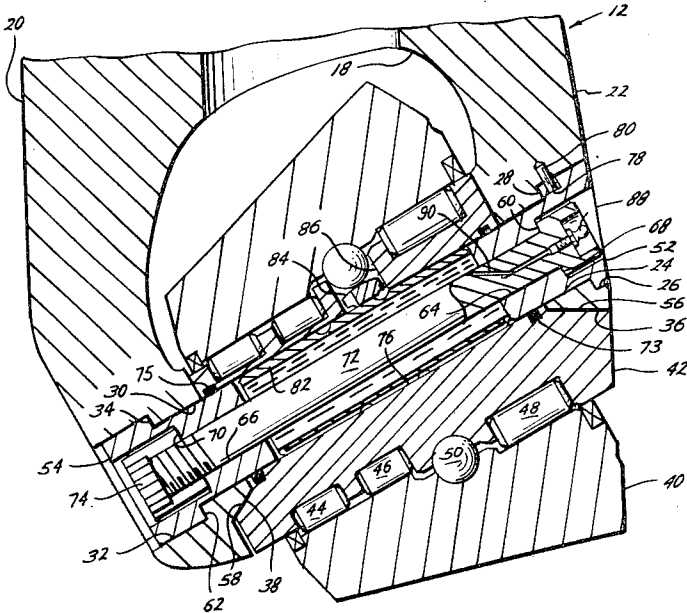
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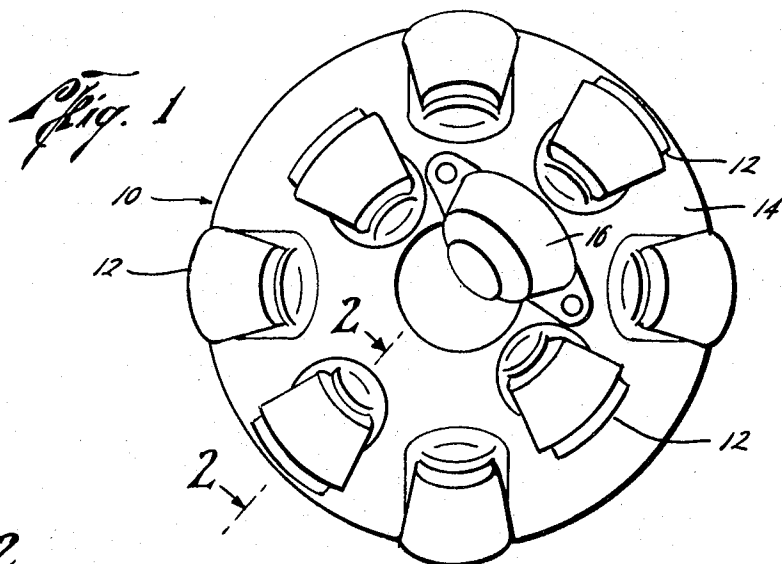
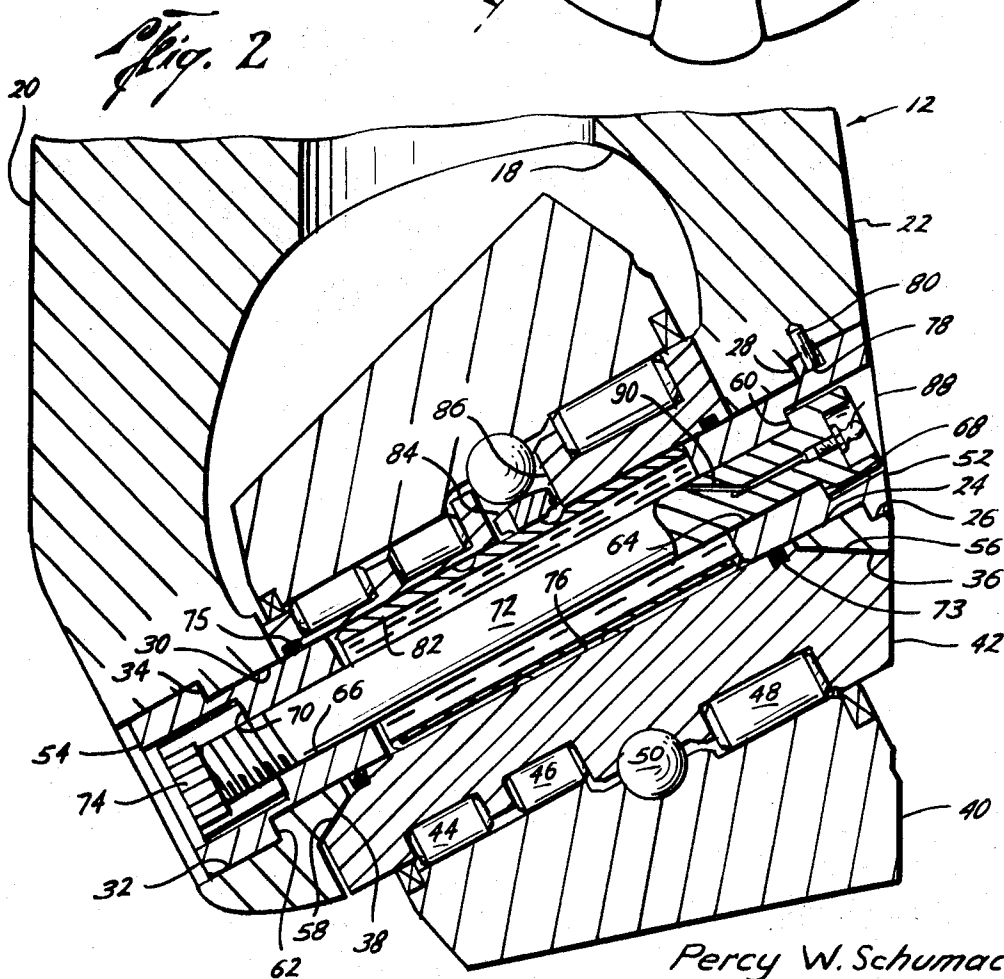
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ABSTRACT

A drill bit including at least one roller cutter rotatively mounted on a journal which is supported by bushings between two legs of a saddle support to retain the journal in its position between the legs during drilling.

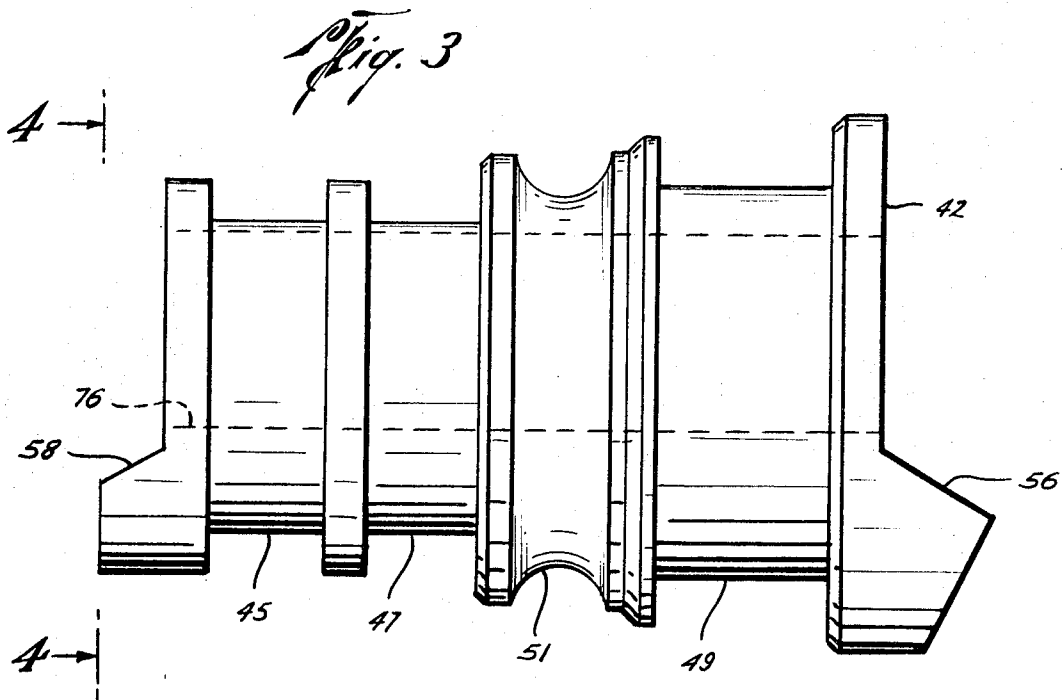
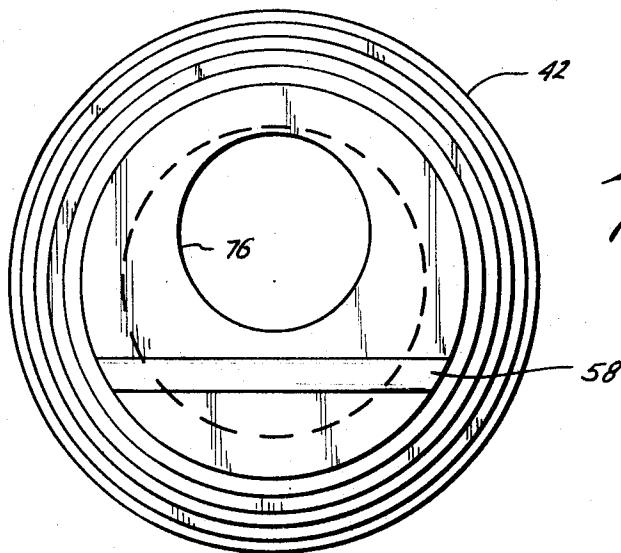
14 Claims, 4 Drawing Figures





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DRILL BIT

This application is a continuation of application Ser. No. 811,341, filed Mar. 28, 1969, and now abandoned.

SUMMARY

The present invention relates to drill bits and to the mounting of a roller cutter on a journal. It is an improvement on the structure disclosed in my prior U.S. Pat. No. 3,332,505, issued July 25, 1967.

An object of the present invention is to provide an improved drill bit with roller cutters, reduced wear and a minimum of breakage.

Another object is to provide an improved saddle mounting for a roller cutter in which the roller cutter is tightly retained and the roller cutter and its journal support may be easily and quickly removed and replaced.

Still another object is to provide an improved support mounting of a roller cutter in a saddle to support a large roller cutter.

A further object is to provide an improved journal support for saddle mounting a roller cutter wherein the journal support has improved strength.

A further object is to provide an improved drill bit having at least one saddle mounted roller cutter so constructed that the removal of a single bolt allows the cutter and its journal to be removed from their mounting.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention are hereinafter explained with reference to the structure of the present invention shown in the drawings wherein:

FIG. 1 is a bottom plan view of the drill bit of the invention.

FIG. 2 is a sectional view taken along line 2—2 in FIG. 1 to illustrate the improved saddle mounting for the roller cutter.

FIG. 3 is an elevation view of the improved journal of the present invention.

FIG. 4 is an end view of the journal shown in FIG. 3 taken along lines 4—4 in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drill bit 10 as shown in FIG. 1 includes a plurality of cutter assemblies 12 mounted on the bottom of a head 14. At least one of these cutter assemblies 12 is mounted as shown in FIG. 2 and preferably all of the cutter assemblies 12 except the cantilever mounted control cutter 16.

The cutter assembly 12 shown in FIG. 2 is supported as shown on the saddle support 18 which is suitably secured, as by welding, to the bottom of head 14. The saddle 18 has the inner leg 20 and the outer leg 22 spaced from said inner leg 20. Outer leg 22 has the bore 24 and counterbore 26 with outward facing shoulder 28 therebetween. Inner leg 20 has the bore 30 and counterbore 32 aligned with the bore 24 and counterbore 26. Bore 30 and counterbore 32 define the outwardly facing shoulder 34. Outer leg 22 terminates in the shoulder 36 which is tapered with respect to the axis of bore 24 as shown. The outer end of inner leg 20 has a shoulder 38 which is tapered but in the opposite direction with respect to the taper of shoulder 36.

The roller cutter 40 is rotatively mounted on journal 42 by bearing means such as, roller bearing 44, 46 and 48 in the roller races 45, 47 and 49 and ball bearings 50, in ball races 51. The journal 42 is mounted between legs 20 and 22 by bushings 52 and 54. Journal 42 also has tapered shoulders 56 and 58 which are adapted to engage with shoulders 36 and 38 when journal 42 is mounted by bushings 52 and 54 between legs 20 and 22. The bushing 52 has the external shoulder 60 which when bushing 52 is installed in bore 24 and counterbore 26 engages shoulder 28. The bushing 54 has the external shoulder 62 which engages shoulder 34 when bushing 54 is installed in bore 30 and counterbore 32. Both bushings 52 and 54 have central bores 64, 66 and outwardly facing shoulders 68 and 70.

The assembly is held together between legs 20 and 22 by the single fastening means which is the bolt 72 and nut 74. The head of bolt 72 engages shoulder 68 and nut 74 engages shoulder 70 so that as the fastening means is tightened, bushings 52 and 54 are seated tightly on shoulders 28 and 34. A portion of each of bushings 52 and 54 extends into the space between the legs and the journal 42. Suitable seals 73 and 75 are provided on the interior of journal 42 to seat against the exterior of bushings 52 and 54. Further, the tightening of the fastening means assures that the tapered shoulders 36 and 38 on the legs engage the tapered surfaces 56 and 58 on journal 42. This provides a wedging of the journal 42 to assure that it does not move during drilling.

The bore 76 through journal 42 is offset or eccentric with respect to the bearing means as best seen in FIG. 4 so that substantially more material of the journal 42 is on the side facing the surface which will be drilled than on the opposite side. With the added strength of material so positioned, the journal 42 is sufficiently strong to avoid any distortion of the bearing surfaces even when exposed to substantial wedging forces.

Bushing 52 has the slot 78 on its outer surface to receive the lock pin 80 which functions to prevent bushing 52 from rotating in counterbore 26 and bore 24.

A lubrication system is shown included in the structure illustrated. This lubrication system includes the sleeve 82, the plug 84 in the ball loading hole 86 and the fitting 88 in the head of bolt 72 communicating with the passage 90 through bolt 72. The sleeve 82 has two grooves around its exterior and a longitudinal slot providing communication from the interior of the sleeve 82 to the grooves. One of the grooves is in communication with the ball loading hole 86. The plug 84 is formed to close the ball loading hole 86 with respect to the ball bearings but is open to the flow of lubricant from the groove on the exterior of sleeve 82.

Thus, lubricant injected through the fitting 88 flows through the passage 90 and is discharged into the interior of sleeve 82. The lubricant flows through the slot and groove in sleeve 82 and through the ball loading hole 86 into the ball bearing 50. If sufficient pressure is applied, the lubricant will lubricate all of the bearing means. In addition to the initial charge of lubricant provided for each cutter assembly 12, lubricant may be supplied at any time the drill bit is removed from the bore it is drilling.

As can best be seen from FIGS. 3 and 4, the bore 76 through journal 42 is eccentric or offset to the unloaded side with respect to the bearing races 45, 47, 49 and 51. With this structure, all of the major thickness of journal is on the side which is loaded when the drill bit 10 is drilling. Thus, by forming the bore 76 to be eccentric in journal 42, the inner portions of the bearing races are spaced farther from the base of the saddle support 18 than the races on a concentric bore journal, to allow a larger roller cutter 40 to be mounted thereon. Also, this structure minimizes the strength of the journal 42 on its inner or unloaded portion and provides the maximum material and strength on its outer or maximum load portion. This offset bore structure is particularly advantageous in the structure shown in that the load from the bearings is transmitted through the journal to the shoulders 36 and 38 on the saddle support 18. As can be seen from FIG. 3, this load is transmitted substantially solely by the strong portion of journal 42.

Also, as previously mentioned, the cutter assembly may be disassembled by removing the bolt 72 and nut 74 whenever it is desired to replace the roller cutters. With bolt 72 removed, the bushings 52 and 53 can be removed easily, allowing journal 42 and cutter 40 to be removed. A new journal 42 and cutter 40 can then be installed on the same saddle support. With bushings 52 and 54 in place, bolt 72 and nut 74 are tightened so that journal 42 is held against movement relative to the saddle legs.

Thus, the improved drill bit of the present invention has a greater useful drilling life because the journals about which the roller cutters rotate during drilling are held securely in their saddle supports. The mounting of the journals coacts

with the eccentricity of the mounting bore through the journal to assure that the load forces are transmitted as directly as possible to the saddle support. Further, the cutter assemblies are easily disassembled by removal of a single fastening means to allow quick and easy replacement of roller cutters and their journals. 5

What is claimed is:

1. A drill bit comprising,
 - a head,
 - a plurality of cutter assemblies supported on said head, a 10
 - plurality of said assemblies including,
 - a saddle having spaced apart legs,
 - a journal having a central bore and a shoulder at each end,
 - each of said saddle legs having an outer shoulder adapted to receive the journal shoulders, 15
 - a roller cutter,
 - bearing means rotatively supporting said roller cutter on said journal between said legs,
 - said legs having aligned bores,
 - a bushing mounted in each of said bores and adapted to en- 20
 - gage within the central bore of said journal to retain said journal shoulders against said saddle leg shoulders, and
 - means for releasably securing said bushings in their mounted position whereby the journal is held against 25
 - movement relative to said saddle, by engagement of said journal shoulders on said saddle leg shoulders.
2. A drill bit according to claim 1, wherein said journal are tapered in an inward direction toward the base of said saddle legs so that tightening of said securing means tends to draw said saddle legs together and to wedge said journal in a 30
- direction away from said saddle base.
3. A drill bit according to claim 1, including lubrication means communicating from the exterior of said assembly through said bore to said bearing means. 35
4. A cutter assembly, comprising
 - a saddle having spaced apart legs,
 - a journal having a central bore therethrough,
 - a roller cutter,
 - bearing means for supporting said roller cutter for rotation 40
 - on said journal,
 - means for mounting said journal with said roller cutter thereon between said saddle legs, and
 - means for preventing rotation of said journal with respect to said saddle legs, 45
 - said bore through said journal being eccentric with respect to said bearing means with the smallest thickness of said journal being the unloaded side of said journal.
5. A cutter assembly according to claim 4, including, lubrication means communicating from the exterior of said 50
- assembly through said bore to said bearing means.
6. A cutter assembly according to claim 4, wherein said mounting means includes
 - said saddle legs having aligned bores,
 - an annular bushing mounted in each of said leg bores, 55
 - each of said bushings being adapted to engage within said central bore of said journal, and
 - a bolt extending through said journal bore and said bushings to retain said journal between said saddle legs.
7. A cutter assembly according to claim 4, wherein said 60
- rotating prevention means includes
 - a shoulder on the outer end of each of said saddle legs, and
 - a shoulder at each end of said journal and adapted to engage said leg shoulders to prevent said journal from rotating with respect to said saddle. 65
8. A cutter assembly according to claim 7, wherein said shoulders are tapered in an inward direction toward the base of said saddle legs whereby tightening said mounting means wedges said journal in its position between said 70
- saddle legs.
9. A cutter assembly according to claim 5, including a ball loading hole communicating from said central bore to

- said bearing means, and
- a plug positioned in said ball loading hole to retain ball bearings in said bearing means,
- said plug having a passage therethrough to provide communication for lubricant from said central bore to said bearing means.
10. A cutter assembly according to claim 6, including a lubrication fitting installed in said bolt accessible from the exterior of said saddle,
 - a passage through said bolt to communicate from said fitting to the interior of said central bore, and
 - a passage through said journal to communicate from said central bore to said bearing means whereby said bearing means may be lubricated from the exterior of said saddle.
 11. A drill bit comprising,
 - a head,
 - a plurality of cutter assemblies supported on said head, a plurality of said assemblies including,
 - a saddle having spaced apart legs and a base,
 - a journal having a bore and a shoulder on at least one end, at least one of said saddle legs having an outer shoulder adapted to receive said journal shoulder, 15
 - a roller cutter,
 - bearing means rotatively supporting said roller cutter on said journal between said legs,
 - said legs having aligned bores, and
 - means coacting with said aligned bores for retaining said journal shoulder in engagement with said saddle leg shoulder, 20
 - at least one of the engaging shoulders of said saddle legs and said journal being tapered in an inward direction toward the base of said saddle so that tightening of said retaining means tends to draw said saddle legs together and to wedge said journal in a direction away from said saddle base.
 12. A drill bit according to claim 11 wherein said securing means includes,
 - a bushing mounted in each of said bores in said saddle legs to engage within the bore of said journal to retain said journal shoulders in engagement with said saddle shoulders, and 25
 - means for releasably securing said bushings in their mounted position whereby the journal is held against movement relative to said saddle.
 13. A cutter assembly comprising,
 - a saddle having spaced apart legs and a base,
 - a journal having a bore and a shoulder on at least one end, at least one of said saddle legs having an outer shoulder adapted to receive said journal shoulder, 30
 - a roller cutter,
 - bearing means rotatively supporting said roller cutter on said journal between said legs,
 - said legs having aligned bores, and
 - means coacting with said aligned bores for retaining said journal shoulder in engagement with said saddle leg shoulder, 35
 - at least one of the engaging shoulders of said saddle legs and said journal being tapered in an inward direction toward the base of said saddle so that tightening of said retaining means tends to draw said saddle legs together and to wedge said journal in a direction away from said saddle base.
 14. A cutter assembly according to claim 13 wherein said securing means includes,
 - a bushing mounted in each of said bores in said saddle legs to engage within the bore of said journal to retain said journal shoulders in engagement with said saddle shoulders, and 40
 - means for releasably securing said bushings in their mounted position whereby the journal is held against movement relative to said saddle.

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