

[54] SEAL MEANS FOR DRILL BIT BEARINGS
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[58] Field of Search 308/8.2, 187.1; 175/371, 372; 277/92, 96

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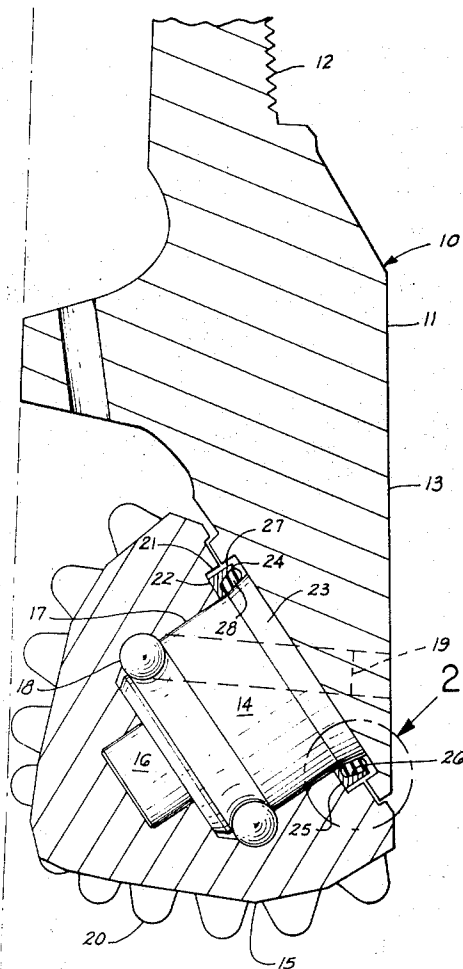
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[57] ABSTRACT

A drill bit including a roller cutter mounted on a greased bearing journal having a grease seal ring there-around and resilient means mounted between the seal ring and bearing journal to urge the seal ring against a sealing surface on the cutter in such a manner that the seal ring may be forced away from the cutter surface by some predetermined pressure from within the cutter but wherein the seal ring arrangement provides a substantially positive seal from pressures externally of the cutter to prevent detritus or other foreign material from entering into the bearing area interiorly of the drill bit cutter. Elastomeric material may be provided between the seal ring and the cutter sealing surface. The abstract is neither intended to define the invention of the application which, of course, is measured by the claims, nor is it intended to be limiting as to the scope of the invention in any way.

7 Claims, 3 Drawing Figures



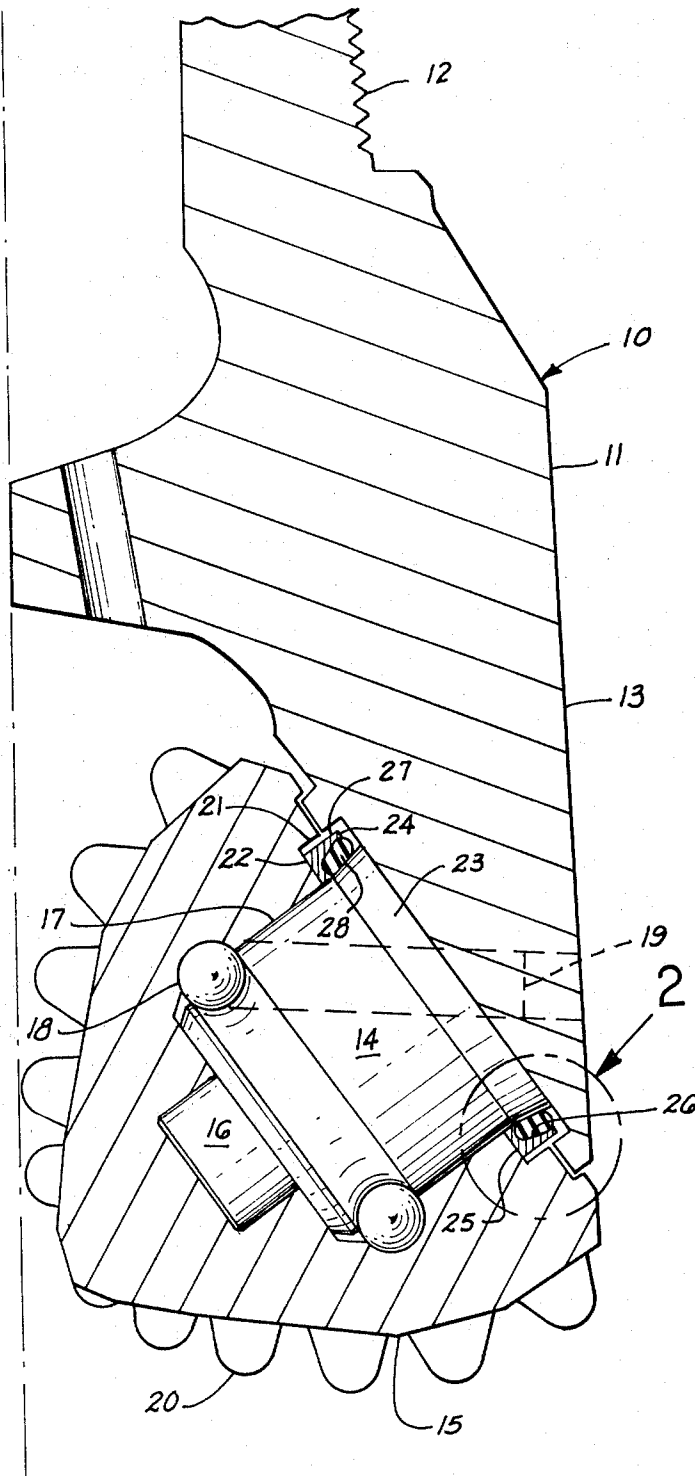
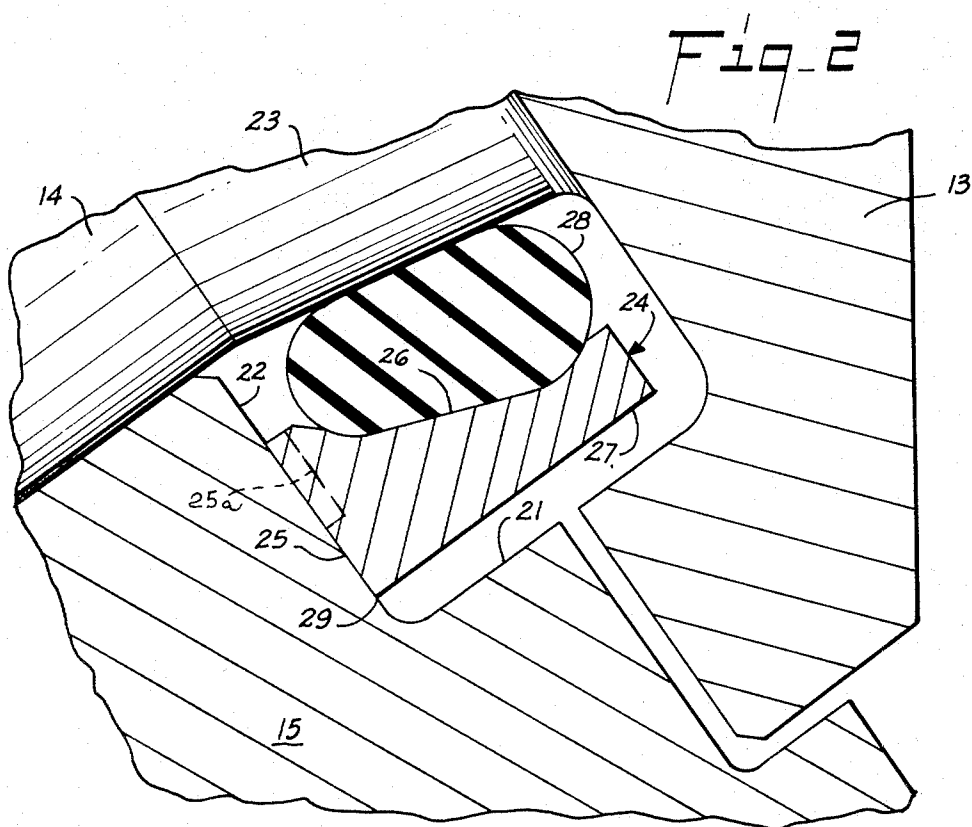
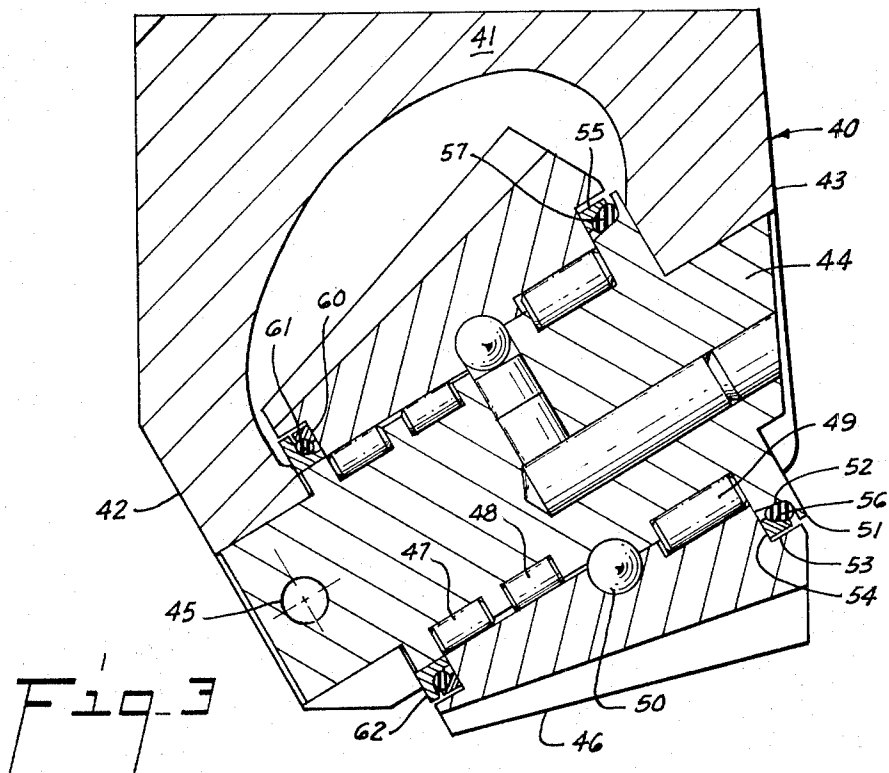


Fig. 1



SEAL MEANS FOR DRILL BIT BEARINGS

SUMMARY

This invention relates to a seal arrangement between a roller cutter and the bearing journal on which it is mounted, to confine a lubricant in the bearing area interiorly of the cutter and to keep formation cuttings and other detritus out of such bearing area.

It is an object of this invention to provide a new and improved seal arrangement for drill bit cutter bearings.

Another object is to provide a drill bit cutter seal arrangement which requires small axial space so that more bearing capacity can be utilized for the cutter.

Another object is to provide a drill bit cutter seal arrangement which may function somewhat as a check valve in that the seal may be forced open by a predetermined grease pressure from within the cutter but which cannot readily be forced open by external pressure or from detritus being wedged or lodged around the seal externally of the cutter.

Another object is to provide a drill bit cutter seal means which does not rotate with respect to the shaft so that external abrasive wear thereof is alleviated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view through a drill bit cutter together with its associated bearing journal and support illustrating a seal arrangement constructed in accordance with this invention.

FIG. 2 is a fragmentary enlarged view of that portion of FIG. 1 appearing within the broken circle 2.

FIG. 3 is a longitudinal sectional view through another type of drill bit cutter together with its associated bearing journal and support illustrating the seals of the invention employed in opposite ends of such cutter.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, there is shown at 10 a cone type of well drill of generally conventional construction comprising a bit head 11 and a threaded shank 12 for connection to a drill stem (not shown). A cutter support 13 extends downwardly from the bit head and a bearing journal 14 extends downwardly and inwardly from the support 13.

A roller cutter 15 is rotatably mounted on the bearing journal 14 on friction bearing 16 and 17 and ball bearings 18. After the ball bearings have been inserted into place, a retaining pin 19 serves to keep them in place. The roller cutter 15 may be made of alloy steel and may have cutting inserts 30 thereon, or other suitable cutting elements.

The cutter 15 is counterbored as at 21 to provide a radially extending sealing surface 22. The bearing journal 14 may have a tapered or conical surface 23. A seal ring 24 is disposed within the counterbore 21 and has a substantially radially extending seal face 25. The seal ring 24 may have its inner surface contoured as at 26 to form a conical surface or the like with the result that the seal ring portion 27 opposite the seal face 25 is attenuated.

A resilient ring 28 which may be an O-ring or the like is provided between the bearing journal 14 and the seal ring 24. The resilient ring 28 may have a round cross section in its relaxed condition and may be made of Buna-N having a 70 durometer hardness or any other suitable elastomer.

When the cutter 15 is installed in position on the journal 14, the resilient ring 28 is distorted and coacts with conical surfaces 23 and 26, as is clearly shown in FIGS. 1 and 2, to bias the seal ring 24 against the cutter sealing surface 22 with a force of from 50 to 500 pounds. I have found from actual field experience that a force of approximately 100 to 150 pounds is satisfactory for bits in the range of 7 to 10 inches in diameter.

In addition to the axial load applied by the resilient ring 28 to the seal ring 24 against the sealing surface 22, the resilient ring when so distorted exerts a radial stress on the seal ring 24. Since the ring 24 is attenuated at 27 opposite the ring seal face 25, the ring 24 which may be made from a stiff but flexible material such as plastic or metal, will be expanded radially more at the portion 27 than at the seal face 25 with the result that the ring 24 tends to pivot about point 29 so that there is greater contact pressure between the outer margin of the seal ring face 25 and the cutter sealing surface 22 than there is between the inner margin of the seal ring face 25 and the cutter sealing surface 22. This is to insure that there is no initial gap between the seal ring face 25 and the cutter sealing surface 22 at point 29 because if a gap exists at this point, abrasive particles of formation may work their way between the seal ring face and cutter surface 22 and gradually abrade away these surfaces destroying the seal and contaminating the cutter grease resulting in bearing failure.

If desired, an elastomeric material may be disposed on surface 22, on seal ring face 25 or between the surface and ring face to insure better sealing effectiveness under certain conditions.

The resilient ring 28 is in frictional contact with the conical surface 23 of the journal 14 and the conical surface 26 of the seal ring 24 thereby insuring that the resilient ring 28 and seal ring 24 will not rotate with respect to the journal 14, to alleviate external abrasive wear of the seal means.

In most instances the seal ring face 25 is stepped or otherwise cut away as at 25a to insure that the seal ring 24 may be more readily forced open by a predetermined grease pressure from within the cutter.

It will also be appreciated that in some instances, the journal area confronting the inner surface 26 of the seal ring 24 need not be conical as shown at 23, but may be cylindrical or the like and still provide the improved cutter seal arrangement of the invention.

Referring to FIG. 3, a cutter support 40 is shown having a base 41 suitable for welding or otherwise being secured to a bit head (not shown). The support 40 is in the form of a yoke or saddle having legs 42 and 43. A bearing journal 44 extends between legs 42 and 43 and may be secured to the support by bolt means 45.

A roller cutter 46 is rotatably mounted on the journal 44 on roller bearings 47, 48 and 49 and ball bearings 50 in suitable races. Toward one end of the journal 44 is a flange 51 having a conical surface 52. The cutter 46 is counterbored as at 53 to provide a radially extending sealing surface 54. A seal ring 55 encircles the journal 44 and conical surface 52 and has a sealing face engaging the surface 54. The seal ring has a conical inner surface 56 oppositely disposed to the conical surface 52. A resilient ring 57 is disposed between these conical surfaces and serves to bias the seal ring against the cutter sealing surface 54 in a manner identical to that described in the structures shown in FIGS. 1 and 2.

A similar seal arrangement is shown at the other end of the cutter 46 comprising a seal ring 60, a resilient ring 61 and a journal insert 62 which may be pressed on or otherwise secured to the journal 44. This seal arrangement also functions identically to that described in the construction shown in FIGS. 1 and 2.

The seal arrangement of the invention thus provides a seal ring which occupies small axial space so that more bearing capacity may be provided in the limited space available, and a cutter seal which may act somewhat as a check valve in that the seal may be forced open by a predetermined grease pressure interiorly of the cutter but which cannot readily be opened by external pressure or by detritus around the seal externally of the cutter.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A roller cutter earth boring bit comprising:
 - a bearing shaft arranged on said bit,
 - a roller cutter mounted on said shaft,
 - a seal ring encircling said shaft,
 - the seal ring having a contoured surface and a sealing face,
 - a sealing surface on said cutter,
 - resilient means between the shaft and the seal ring,
 - said resilient means being in frictional contact with said seal ring and shaft to insure that said resilient ring and seal ring will not rotate,
 - said resilient means coacting with the shaft and and contoured surface of said seal ring to bias the seal ring face into sealing engagement with the sealing surface on said cutter.
2. A roller cutter earth boring bit according to claim 1 wherein
 - the said seal ring contoured surface comprises an inner conical surface.
3. A roller cutter earth boring bit according to claim 2 wherein
 - the shaft has an oppositely tapered conical surface confronting the inner conical surface of the seal ring and said resilient means is located between said conical surfaces.
4. A roller cutter earth boring bit according to claim 1 wherein
 - the seal ring is biased into engagement with the cutter sealing surface so that there is greater contact pressure between the outer margin of the seal ring face and the cutter sealing surface than there is between the inner margin of the seal ring face and the cutter

sealing surface.

5. A roller cutter earth boring bit comprising:
 - a bearing shaft arranged on said bit,
 - a roller cutter mounted on said shaft,
 - a sealing surface on said cutter,
 - said shaft having an outer tapered surface,
 - a seal ring having an inner tapered surface and a sealing face and being in encircling relationship to the shaft tapered surface,
 - resilient means coacting with the tapered surfaces to bias the seal ring into engagement with the cutter sealing surface so that there is greater contact pressure between the outer margin of the seal ring face and the cutter sealing surface than there is between the inner margin of the seal ring face and the cutter sealing surface,
 - said resilient means being in frictional contact with said seal ring and shaft to insure that said resilient ring and seal ring will not rotate.
6. An earth boring bit cutter assembly comprising:
 - a cutter support,
 - journal means on said support,
 - a roller cutter on said journal means,
 - a sealing surface on said cutter,
 - a seal ring encircling said journal means,
 - said seal ring having an inner conical surface and a sealing face,
 - resilient means between the journal means and the seal ring,
 - said resilient means being in frictional contact with said seal ring and journal means to insure that said resilient ring and seal ring will not rotate,
 - said resilient means coacting with said journal means and conical surface of said seal ring to bias said seal ring face into sealing engagement with the sealing surface on said cutter.
7. An earth boring bit cutter assembly comprising:
 - a cutter support,
 - journal means on said support,
 - a roller cutter on said journal means,
 - a sealing surface on said cutter,
 - the journal means having an outer tapered surface,
 - a seal ring having an inner tapered surface and a sealing face and being in encircling relationship to the tapered surface on said journal means, and
 - means adapted to coact with the tapered surfaces to bias the seal ring into engagement with the cutter sealing surface so that there is greater contact pressure between the outer margin of the seal ring face and the cutter sealing surface than there is between the inner margin of the seal ring face and the cutter sealing surface and said seal ring tends to pivot about an end of its sealing face.

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