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(54) Roller reamer assembly.

(57) The invention relates to a drill member and particularly to a so called roller reamer. Roller reamers are known to form part of a drill string whereby to maintain the gauge of a hole during drilling, and known to comprise a number of roller cutters each mounted on the spindle and located in equal spaced relationship around a carrier body. Ordinarily the spindle is mounted in bearing blocks themselves located on a carrier body, and it is known to pack grease around the spindle to minimise wear between the roller cutter and the spindle during use. In use it is known for damage to be occasioned to the bearing box and equally during long usage there can be a loss of lubricant grease from between the roller cutter and the spindle. The object of the invention is to provide an improved cutter assembly for a roller reamer which objective is met by a construction comprising a cutter assembly for a roller reamer comprising a tubular spindle bearing blocks secured to the ends of the spindle and a rotary cutter rotatably mounted on the spindle characterised by rotary seals 11 between the cutter 9 and the spindle 4 at each end of the cutter, a spring loaded piston 12 mounted within the tubular spindle 4, a passageway 16 through one bearing member 5 communicating with the interior of the tubular spindle 4, valve or nipple means 17 closing the inlet to the passageway 16 and at least one outlet hole 18 through the wall of the spindle 4 communicating with at least one groove 19 extending along the outer face of the spindle 4 over substantially the length of the spindle 4 lying within the rotary cutter 9.

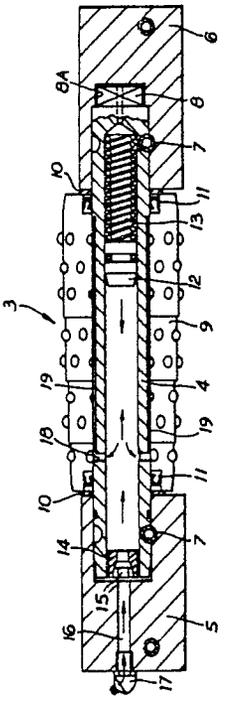

Fig. 3

EP 0 274 265 A2

DRILL MEMBER

This invention relates to a drill member and is particularly concerned with a so-called "roller reamer", a member designed to maintain the gauge of a hole during drilling.

Roller reamers are known where a number, preferably three or more, of roller cutters are each mounted on a respective spindle, and located in equal spaced relationship around a carrier body, which can be a separate body secured to a drill string member, or can be a drill string member itself, with the roller cutters strategically located along its length. The spindles are provided with bearing blocks at each end and the roller cutters freely rotatably mounted on the spindles. The bearing blocks, spindles and cutters being suitably secured in channels formed in the carrier body or the drill string member.

With conventional roller reamers, the bearing blocks protrude from the surface of the carrier body, to position the roller cutter at the required gauge diameter. Consequently, during progress of the roller reamer down a hole, the leading, and occasionally the trailing, bearing block is damaged.

During assembly of the roller reamer, it is known to pack the annular gap between the spindle and its rotary cutter with grease, but loss of grease during drilling is inevitable, resulting in heavy wear on the spindle and, even more detrimental, frequent seizure of the cutter on the spindle.

It is the object of the present invention to provide a roller reamer substantially free from the disadvantages mentioned above.

According to the present invention, a cutter assembly for a roller reamer comprises a tubular spindle, bearing blocks secured to the ends of the spindle, a rotary cutter rotatably mounted on the spindle, with rotary seals between the cutter and the spindle at each end of the cutter, a spring-loaded piston mounted within the tubular spindle, a passageway through one bearing member, communicating with the interior of the tubular spindle valve or nipple means closing the inlet to the passageway, and at least one outlet hole through the wall of the spindle communicating with at least one groove extending along the outer face of the spindle over substantially the length of the spindle lying within the rotary cutter. Thus, the invention provides a sealed unit ready for application to a carrier body or a drill string.

Preferably, thrust washers are provided at the ends of the rotary cutter to prevent wear on the bearing blocks by eliminating longitudinal movement of the cutter on the spindle. Further preferably, the spindle is removably secured to each bearing block such as by pins extending through holes in the bearing blocks and across corresponding grooves in the outer periphery of the spindle.

Thus, after assembly, and prior to location of the cutter assembly on a carrier body, grease or other suitable lubricant can be forced through the valve or nipple and into the interior of the spindle, driving the piston back against the action of the spring. During subsequent use of the cutter, the spring-loaded piston drives grease or other suitable lubricant through the at least one outlet hole into the at least one external groove on the spindle, thereby maintaining lubricant between the spindle and the rotary cutter, and hence minimising wear on the spindle during the whole of a drilling operation.

The carrier body, which can be a separate member or a drill string member, is preferably of enlarged section over the area occupied by the cutter assembly. Thus, the carrier member in the area of enlarged section, is provided with a number, preferably three, of longitudinal channels, each to receive a cutter assembly as above defined, the channels having a depth such that the outer periphery of each bearing block is flush with the outer periphery of the carrier member when secured in place. Again, the bearing blocks may be removably secured to the carrier member by pins passing through co-operating holes in the carrier member and the bearing blocks, and so located as to ensure that the axis of the spindle is parallel to the axis of the carrier member, and such as to set the outer periphery of the rotary cutters at the required gauge diameter of the hole being drilled.

The channels in the carrier member, at their ends adjacent the valves or nipples on the bearing blocks are preferably enlarged to allow access to the valves or nipples, to allow recharging of the tubular spindle with grease or other suitable lubricant, after a drill string has been removed from a hole, without the need to remove the cutter assembly from the carrier member.

It is desirable to effect routine servicing at prescribed intervals, a task considerably simplified by the securing of the bearing blocks to the carrier member and the spindles to the bearing blocks by removable pins. A further advantage of the invention is that seizure of the cutters on the spindles is prevented and if any wear is detected on the spindle at the periphery facing towards the wall of the hole, at which side there is contact with the rotary cutter, the spindle can be rotated through 180° and replaced in the bearing blocks to expose the unworn side of the spindle to contact with the rotary cutter.

One embodiment of the invention will now be

described with reference to the accompanying drawings. in which:-

Figure 1 is a side elevation of a drill string fitted with roller reamers in accordance with the invention;

Figure 2 is an exploded perspective view of a roller reamer in accordance with the invention; and

Figure 3 is a sectional side elevation of a roller reamer in accordance with the invention.

In the drawings a drill string m ember 1 has a generally central length 2 of enlarged section having three longitudinal channels in each of which a cutter assembly 3 is secured.

As is shown more particularly by Figures 2 and 3, each cutter assembly comprises a tubular spindle 4 each end of which is secured in respective bearing blocks 5 and 6 by transverse pins 7. The connection between the spindle 4 and the bearing block 6 is improved by the provision of a tang 8 engaging a corresponding recess 8Ain the bearing block 6. Surrounding the spindle 4 and freely rotatable thereon is a reamer blade 9, there being thrust washers 10 located between the reamer blade and each bearing block 5, 6 to prevent longitudinal movement of the blade on the spindle. At each end of the blade 9, a rotary seal 11 is provided between the blade and the spindle.

Within the spindle 4 a piston 12 is provided, loaded by a spring 13 in a direction towards the bearing block 5, the spindle at the end secured to the bearing block 5 having a plug 14 with a through-passage 15 co-axial with an inlet passage 16 through the bearing block, closed by a grease nipple 17.

At the end of the spindle towards its connection to the bearing block 5, transverse outlet holes 18 are provided, emerging in longitudinal grooves 19 extending along the outside of the spindle over substantially the full length of the reamer blade 9.

Thus, prior to positioning the cutter assembly in the drill string 1, where it is seacured by pins 18, lubricant is forced through the nipple 17 and into the interior of the spindle, urging the piston back against the spring, until the interior of the spindle is filled with lubricant, the lubricant passing through the holes 18 and filling the grooves 19.

With the cutter assemblies secured in the drill string member 1, and the drill string member secured in a drill string, the drill string member is progressed down the hole being drilled, the reamer blades contacting the side of the hole to maintain its gauge. Contact between the blades and the hole wall causes the blades to rotate in their spindles, with considerable assistance of the lubricant in the grooves 19, and during use, the inevitable loss of lubricant from between the spindles and the blades is compensated for by the piston drilling lubricant from within the spindle, through the holes 18 and into the grooves 19.

As is shown by Figure 1, the bearing blocks 5, 6 are flush with the exterior of the length of enlarged section, thereby preventing damage to the bearing blocks during the progression of the drill string member 1 down a hole.

On a next use of the drill string member 1, dismantling of it to allow the spindle to be filled with lubricant is avoided by providing an access hole in the drill string member 1 adjacent the bearing block 5, through which the grease nipple 17 can be reached.

Claims

1. A cutter assembly for a roller reamer comprising a tubular spindle bearing blocks secured to the ends of the spindle and a rotary cutter rotatably mounted on the spindle characterised by rotary seals (11) between the cutter (9) and the spindle (4) at each end of the cutter, a spring loaded piston (12) mounted within the tubular spindle (4), a passageway (16) through one bearing member (5) communicating with the interior of the tubular spindle (4), valve or nipple means (17) closing the inlet to the passageway (16) and at least one outlet hole (18) through the wall of the spindle (4) communicating with at least one groove (19) extending along the outer face of the spindle (4) over substantially the length of the spindle (4) lying within the rotary cutter (9).

2. A cutter assembly as in Claim 1, characterised by thrust washers (10) provided at the ends of the rotary cutter (9) to prevent wear on the bearing blocks (5, 6).

3. A cutter assembly as in Claim 1 or Claim 2, characterised by the spindle (4) being removably secured in each bearing block (5, 6) such as by pins (7) extending through holes in the bearing blocks and across corresponding grooves on the outer periphery of the spindle.

4. A cutter assembly as in any of Claims 1 to 3 characterised in that a carrier body (1) has an enlarged section (2) over the area occupied by the cutter assembly (3).

5. A cutter assembly as in Claim 4, characterised in that the carrier body (1) in the area of enlarged section (2) is provided with a number of longitudinal channels each to receive a cutter assembly (3) the channels having a depth such that the outer periphery of each bearing block (5, 6) is flush with the outer periphery of the carrier body (1) when secured in place.

6. A cutter assembly as in Claim 4 or Claim 5, characterised in that the channels in the carrier member at their ends adjacent the valves or nip-

ples (17) on the bearing blocks (5) are enlarged to allow access to the valves or nipples (17) to allow recharging of the tubular spindle with grease or other lubricant after removal of the cutter assembly from a hole and without the need to remove the cutter assembly from the carrier member.

7. A cutter assembly as in any of Claims 1 to 6 characterised in that the spindle (4) at its end secured in the bearing block (6) is provided with a tang to provide better engagement with the bearing block (6).

8. A cutter assembly as in any of Claims 1 to 7, characterised in that the carrier body is a drill string member.

9. A cutter assembly as in any of Claims 1 to 7, characterised in that the carrier body is a separate member interposed between adjacent drill string members.

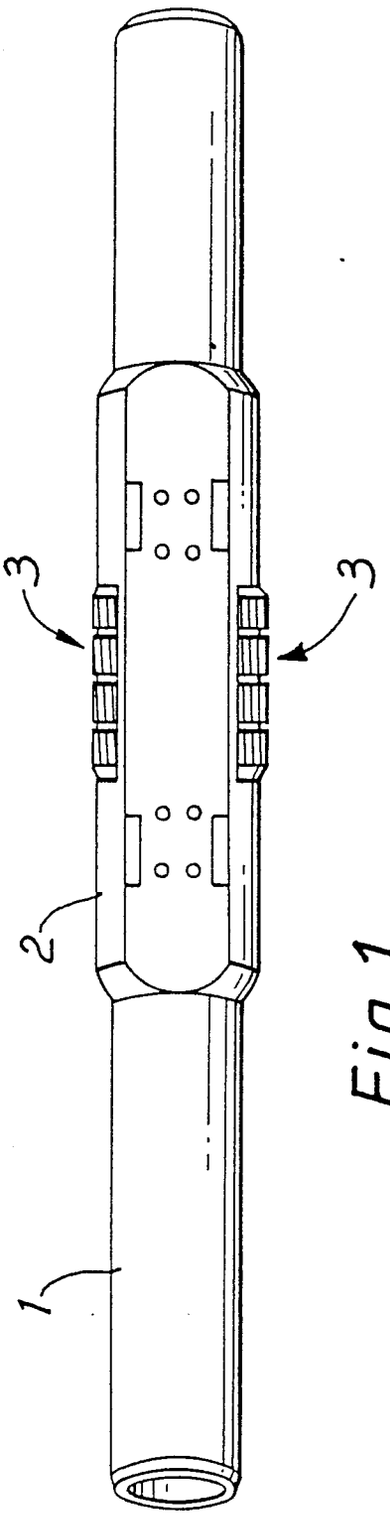

Fig. 1

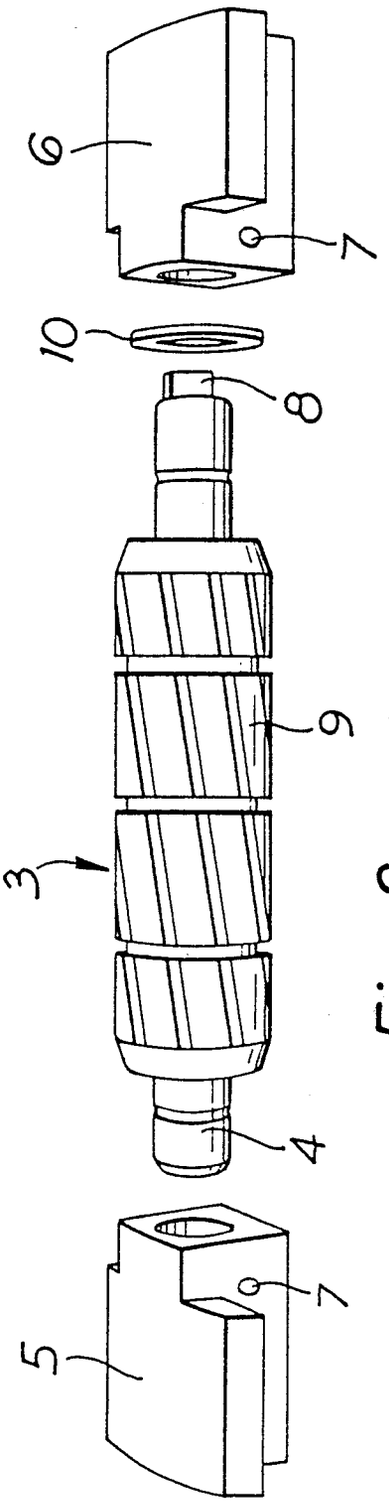

Fig. 2

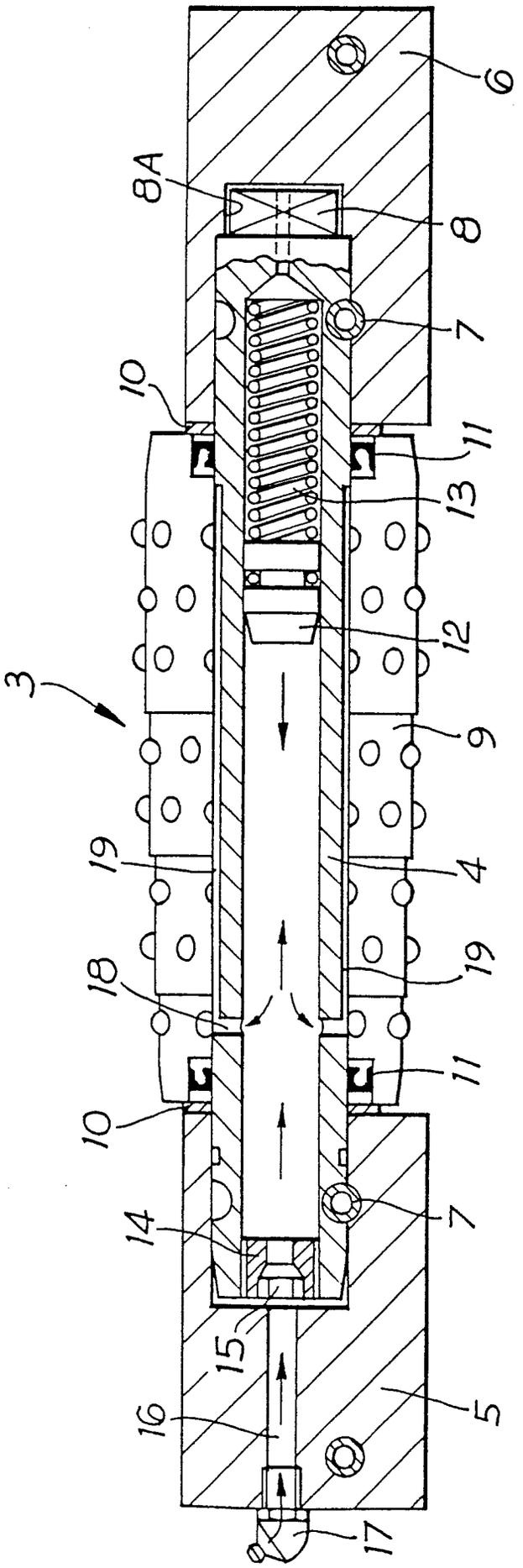

Fig. 3