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QUICK-CHANGE SLUSH NOZZLE

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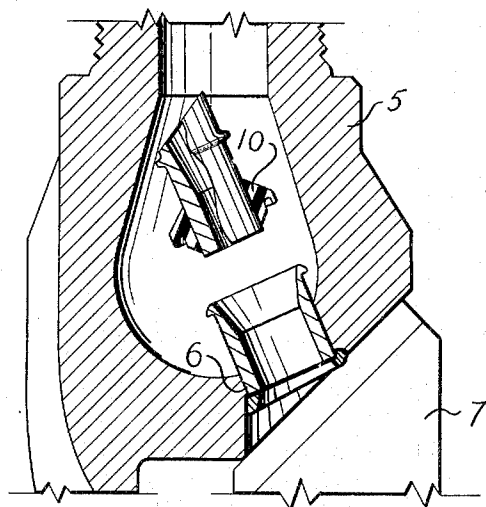


Fig. 1

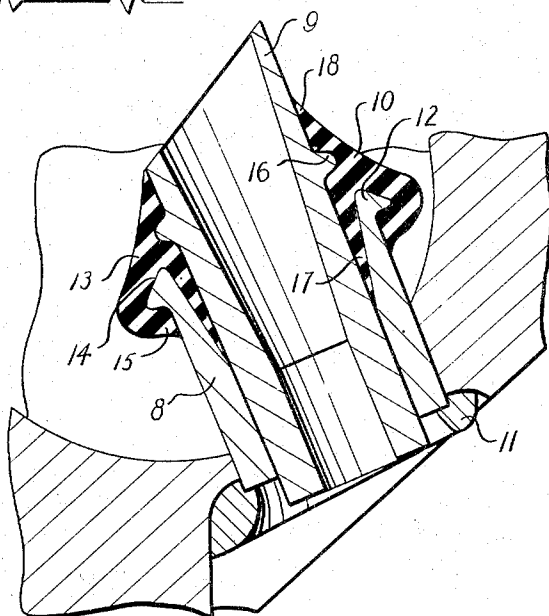


Fig. 2

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QUICK-CHANGE SLUSH NOZZLE

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12 Claims. (Cl. 285-163)

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This invention relates to improvements in interchangeable slush nozzles for rotary drill bits and refers more particularly to such an assembly wherein the nozzle element may be readily interchanged without the use of special tools.

In boring well holes with rotary bits it is the practice to maintain circulation of a drilling fluid known to the industry as mud or slush. This fluid is usually circulated downwardly through the drill stem, drill bit and out through slush ports in the bit body. The mud is preferably directed by the slush port upon the cutter elements of the bit to cleanse adhering debris therefrom and to pick up the cuttings. The mud then circulates upwardly through the well bore surrounding the bit and drill stem. The gritty character of the mud makes it desirable to use slush nozzles of wear resisting material and more recently the practice has been to provide readily interchangeable slush nozzles.

Heretofore, for quick change nozzles, it has been the practice to employ a bushing which is welded in the slush port and the interchangeable nozzle is secured within the bushing by means of a sleeve of relatively soft material, which is welded at one end to the periphery of the bushing. The other end of the sleeve is castellated to permit bending of the castellated portion over the end of the bushing so as to releasably anchor the nozzle within the bushing. The end of the sleeve which is welded to the nozzle is bell shaped to provide a seating surface for compressing sealing material between such surface and a complementary surface formed upon the bushing. While this assembly has proven satisfactory in use, from the standpoint of performance, it is nevertheless desirable to provide an assembly which is equally efficient in operation, which may be more readily changed, and in which the sleeve is eliminated to reduce the number of requisite parts.

An object of this invention is to provide an improved slush nozzle assembly in which the slush nozzle may be readily changed.

Another object is to provide a slush nozzle assembly wherein the nozzle may be readily changed in the field without the use of special tools.

A further object is to provide a slush nozzle assembly wherein the nozzle is releasably secured in operative position by use of a snap ring.

Yet another object is to provide a quick change slush nozzle for a drill bit wherein the nozzle is resiliently mounted to permit breathing thereof due to the pressure differential thereacross.

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Yet a further object is to provide a quick change slush nozzle assembly wherein the nozzle is held within a bushing by a resilient seal member secured to the nozzle and bushing wherein the seal member has a releasable connection with at least one of these.

Other and further objects of this invention will appear as the description proceeds.

In the accompanying drawings which form a part of the instant specification, are to be read in conjunction therewith, and wherein like reference numerals are used to indicate like parts in the various views;

Fig. 1 is a sectional elevation through a bit body and equipped with a slush assembly constituting an embodiment of this invention and shown in exploded view; and

Fig. 2 is an enlarged fragmentary view of the apparatus shown in Fig. 1 illustrating the slush nozzle assembly in assembled operating position.

Referring to the drawing, numeral 5 designates a bit body having a recess therein which communicates with the interior of a string of drill pipe in operation. The body has a slush or mud port 6 formed therein adjacent one of the cutter elements 7 and adapted to direct drilling fluid over the element. The bit is shown as a drag type bit having one drilling fluid outlet. However, it is contemplated that the bit may also be the type having roller cutters and a plurality of drilling fluid outlets may be provided if required, each of which may be fitted with a quick change slush nozzle assembly in accordance with this invention.

The slush nozzle assembly is made up of a bushing 8, a nozzle 9 and a flexible seal member 10. Bushing 8 is secured in place within aperture 6 and preferably a semi-permanent connection such as welding 11 is used for this purpose.

Bushing 8 has a bore therethrough with a portion of substantially constant diameter which closely fits the outer periphery of nozzle 9. The bore also has an inwardly tapering portion and at its outer edge is provided with an annular hook like portion 12. This latter part provides a means for releasably securing a seal member 13 thereto.

Seal member 13 may be fabricated from flexible plastic or sealing material and preferably is relatively stiff and resilient. Member 13 is formed with an annular recess 14 which substantially conforms to the contour of the hook part 12. The seal member also has a lip portion 15 which closely fits over the outer periphery of bushing 8 to provide a lip type seal which is made

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effective by the pressure differential thereacross.

Member 13 not only serves as a seal between the nozzle and bushing but also releasably secures the nozzle within the bushing. The manner in which the member and bushing are secured one to the other has been described and the bushing is secured to the nozzle in a similar fashion. The nozzle has an annular part or bead 16 exteriorly surrounding it which is adapted to mate with a corresponding groove upon the interior of member 13. It is to be understood that if desired the member 13 may be bonded to nozzle 9 in which case it is not absolutely requisite that bead 16 be provided.

Member 13 has an annular tapered portion 17 which substantially fills the annular tapered space provided between the bushing and nozzle adjacent the hook end of the bushing. It will be apparent that the wedging action of the flowable material of member 13 compressed into this tapered annular space by the pressure differential across the slush nozzle assembly will serve to limit sliding movement of the nozzle within the bushing. Thus, a very limited movement or breathing is permitted in response to pressure variations across the assembly and the nozzle has a cushioned or floating mounting within the bushing which greatly reduces the likelihood of failure of parts due to fatigue.

Member 13 also has a lip type portion 18 which snugly engages the periphery of nozzle 9 to provide a lip type seal.

It is believed apparent that with this arrangement of parts the nozzle 9 and ring 13 may be quickly changed when required due to wear or the like. The ring 13 performs the dual function of releasably securing nozzle 9 within bushing 8 and also sealing off the connection between the bushing and nozzle. Of course, the bushing and nozzle both may be made of wear resisting materials or the surface of the port through nozzle 9 may be hardened or otherwise treated to resist the wear of the gritty drilling fluid which will flow therethrough in operation.

It will be seen that the objects of this invention have been accomplished. There has been provided a quick change slush nozzle assembly wherein the nozzle has a cushioned or floating mounting within a bushing secured in the slush port of a drill bit. The arrangement is such that a minimum of parts are required and a single member serves to provide both a seal and an anchor for the nozzle. The construction is such that the nozzle may have slight axial movement or breathing movement relative to bushing 8 and yet this movement is resisted by a wedge of sealing material.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having described my invention, I claim:

1. A quick change slush assembly adaptable for use with a rotary drill bit comprising a bushing with a bore therethrough, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore, means for resiliently securing the nozzle within

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the bushing and providing a seal therebetween including a flexible seal member and separate parts carried by the nozzle and bushing engaging the seal member, said engagement of at least one of said parts being releasable.

2. A quick change slush assembly adaptable for use in conjunction with a rotary drill bit comprising a bushing with a bore therethrough, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore and another portion providing an annular space therebetween adjacent one end of the bushing, a flexible annular member having an integral portion formed of sealing material filling the annular space and additional portions engaging hook like parts formed on the nozzle and bushing for securing the nozzle within the bushing, the engagement of the member with at least one of the hook like parts being selectively releasable.

3. A quick change slush assembly adaptable for use in conjunction with a rotary drill bit comprising a bushing with a bore therethrough, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore and another portion providing an annular space therebetween adjacent one end of the bushing, a flexible annular member having an integral portion formed of sealing material filling the annular space and an additional sealing portion providing a lip seal with the nozzle and the nozzle and bushing being secured to the member, at least one of which is releasably secured to the member.

4. A quick change slush assembly adaptable for use in conjunction with a rotary drill bit comprising a bushing with a bore therethrough, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore and another portion providing an annular space therebetween adjacent one end of the bushing, a flexible annular member having an integral portion formed of sealing material filling the annular space and an additional sealing portion providing a lip seal with the bushing and the nozzle and bushing being secured to the member, at least one of which is releasably secured to the member.

5. A quick change slush assembly adaptable for use in conjunction with a rotary drill bit comprising a bushing with a bore therethrough, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore, a flexible annular member having integral lip like portions providing lip type seals about the nozzle and bushing and hook like parts upon the nozzle and bushing for engagement with corresponding recesses in the member, at least one of the engagements being selectively releasable.

6. A quick change slush assembly adaptable for use in conjunction with a rotary drill bit comprising a bushing with a bore therethrough, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore and another portion providing an inwardly tapered annular space therebetween adjacent one end of the bushing, means resiliently securing the nozzle within the bushing and providing a seal therebetween including a flexible seal member filling the annular space and secured to the nozzle and bushing, at least one of which is releasably secured to the seal member, whereby the nozzle is free to breathe in response

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to variations in pressure differentials thereacross.

7. In combination a rotary bit body having a slush port therein and a quick change nozzle assembly adapted to be secured in said port, the latter including a bushing with a bore there-
through, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore, means for resiliently securing the nozzle within the bushing and providing a seal therebetween including a flexible seal member and separate annular projection parts carried by the nozzle and bushing engaging the seal member, said engagement of at least one of said parts being releasable.

8. In combination a rotary bit body having a slush port therein and a quick change nozzle assembly adapted to be secured in said port, the latter including a bushing with a bore therethrough, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore and another portion providing an annular space therebetween adjacent one end of the bushing, a flexible annular member having an integral portion formed of sealing material filling the annular space and additional portions engaging hook like parts formed on the nozzle and bushing for securing the nozzle within the bushing, the engagement of the member with at least one of the hook like parts being selectively releasable.

9. In combination a rotary bit body having a slush port therein and a quick change nozzle assembly adapted to be secured in said port, the latter including a bushing with a bore there-
through, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore and another portion providing an annular space therebetween adjacent one end of the bushing, a flexible annular member having an integral portion formed of sealing material filling the annular space and additional sealing portion providing a lip seal with the nozzle, and the nozzle and bushings being secured to the member, at least one of which is releasably secured to the member.

10. In combination a rotary bit body having a slush port therein and a quick change nozzle assembly adapted to be secured in said port, the latter including a bushing with a bore there-
through, a nozzle within the bushing bore and having a portion fitting closely with a portion

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of the wall of the bushing bore and another portion providing an annular space therebetween adjacent one end of the bushing, a flexible annular member having an integral portion formed of sealing material filling the annular space and additional sealing portion providing a lip seal with the bushing, and the nozzle and bushing being secured to the member, at least one of which is releasably secured to the member.

11. In combination a rotary bit body having a slush port therein and a quick change nozzle assembly adapted to be secured in said port, the latter including a bushing with a bore there-
through, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore, a flexible annular member having integral lip like portions providing lip type seals about the nozzle and bushing and hook like parts upon the nozzle and bushing for engagement with corresponding recesses in the member, at least one of the engagements being selectively releasable.

12. In combination a rotary bit body having a slush port therein and a quick change nozzle assembly adapted to be secured in said port, the latter including a bushing with a bore there-
through, a nozzle within the bushing bore and having a portion fitting closely with a portion of the wall of the bushing bore and another portion providing an inwardly tapered annular space therebetween adjacent one end of the bushing, means resiliently securing the nozzle within the bushing and providing a seal therebetween including a flexible seal member filling the annular space and secured to the nozzle and bushing, at least one of which is releasably secured to the seal member, whereby the nozzle is free to breathe in response to variations in pressure differentials thereacross.

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The following references are of record in the file of this patent:

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