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(54) IMPROVEMENTS IN OR RELATING TO A TUBULAR CONNECTION FOR A DRILLING CROWN

(71) We, FORACO FORAGE RATIONNEL CONSTRUCTION, Societe Anonyme, a French corporate body of 24 Avenue George V, 75008 Paris, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a tubular connection for a drilling crown and is more specifically concerned with a drill connector which is attached to the lower end of a hollow drilling pipe assembly during drilling, and has the drilling crown attached to its underside. The drill connector is hollow to receive a cylindrical core cut out by the drilling crown and is provided with passageways through which a drilling fluid, such as air or mud, can be fed to the drilling crown to irrigate it and to remove cuttings from its vicinity.

A large number of drilling crowns exist, certain ones being adapted to provide cores having large well-determined dimensions, but, whatever type of drill connector is used, the difficulty of completely removing the cuttings coming from the advancing crown always remains. If complete disengagement of the cuttings from the drill hole wall immediately above the crown is defective, the speed of drilling is slowed considerably, whatever the kind of drilling fluid used: mud or air under pressure.

In accordance with the present invention there is provided a tubular drill connector having an upper end provided with first means for attaching it to a drilling pipe system, a tube providing an axial downward extension of the drilling pipe system and having at its lower end second means for attaching to it an annular drilling crown having bits for cutting out a cylindrical core, a central passage defined by the tube for receiving the cut out core, an external shouldered portion of the tube spaced upwardly from the second means by a portion of the tube of narrower external diameter, a port extending upwardly and inwardly through the tube wall from a position beneath the shouldered portion so as to communicate with the central passage, and a channel extending downwards through the tube wall from a position above the shouldered portion to a position adjacent to the crown whereby, when the connector is in use, drilling fluid can be passed down the channel to remove cuttings from the vicinity of the crown and to carry at least some of such cuttings upwards around the outside of the extension tube to the position of the port through which the cuttings are conveyed inwardly and upwardly to the central passage in the connector.

It is sufficient, therefore, to provide, in the central passage, a conventional second means for attaching the drilling crown that it is desired to use and, at the upper end of the connector, a conventional first means. Preferably, the upper portion of the drill connector is provided by two concentric sleeves defining between them an annulus into the lower part of which opens the upper end of said channel. Drilling fluid is fed into the annulus to supply the channel or channels. This fluid removes all the cuttings coming from the drilling by the rotation or percussion of the crown, through the lateral port in the tube. An extremely convenient and efficient second means may therefore be provided enabling various types of crown to be fixed by conventional techniques and all the cuttings to be completely removed by the drilling fluid flowing from the annular passage and which lubricates the crown and carries the cuttings back to the core via the lateral port passing through the tube wall. Such cuttings rise up with the core through the central passage. Thus, a core accompanied by cuttings surrounding the core at the level considered is brought up to the surface through the interior of the drilling pipe system.

Preferably the port opens through the outside of the tube partly in the underside of

the shouldered portion and partly in the narrower tube portion. By having part of the port opening outwardly through the underside of the shouldered portion of the tube, the risk of cuttings banking up against the underside of the shouldered portion and impeding operation of the drill is greatly reduced or avoided altogether.

The invention further includes a drill connector as described in outline above and having a drilling crown fitted to the underside of the tube and which has alternate arcuate portions of a radius substantially equal to that of the shoulder portion of the tube and the remaining arcuate portions of a smaller radius substantially equal to that of the periphery of the narrower portion of the tube.

Under these conditions, the advance speed of the drilling crown is increased, as the drilling fluid carries the cuttings upwardly through the wide arcuate passages defined between the drill hole wall and the peripheries of the arcuate portions of the crown of said smaller diameter. The space between the shouldered portion of the tube and the drill hole wall is sufficiently small for the drilling fluid pressure beneath the shouldered portion to lift the cuttings away from the crown vicinity and to result in the core being more easily raised.

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:—

FIGURE 1 is a vertical partially diagrammatic section through a drill connector and taken on the line indicated at I—I in Figure 2; and,

FIGURE 2 is an under plan view of a drilling crown screwed into the lower end of the drill connector.

The drill connector 1 shown in the Figures 1 and 2 is of tubular form providing a central passage 5 and has its lower end-portion internally threaded at 26 to receive a drilling crown 11, and its upper end-portion internally threaded at 22 to receive the lower end-portion of a tubular drilling pipe (not shown). The drilling pipe comprises two cylindrical tubes concentrically arranged to provide an annulus between them through which a drilling fluid, such as air or mud, is pumped downwardly to irrigate the crown and to convey upwards the drill cuttings produced. These cuttings are carried upwards through the bore of the tubular drilling pipe.

The upper part of the connector is provided by an outer sleeve 2 concentrically arranged around an inner sleeve 28 so that an annulus 3 is formed between them. Adjacent to their upper end-portions the two sleeves are provided with inter-engaging means (not referenced) which hold the inner sleeve 28 concentric with respect to the outer sleeve. The inter-engaging means do not, however, obstruct the flow of drilling fluid down through the annulus 3.

The lower part of the connector 1 is provided by a thick-walled tube 4 having an annular spigot at its upper end which locates in the lower end of the annulus 3. The tube 4 is welded to the lower ends of the sleeves 28 and 2 and its external surface is shouldered or stepped at 12 so that the upper portion of the tube 4 is wider than the sleeve 2 sor the lower portion of the tube 4.

A number of sloping ports 8 connect the interior of the tube 4 with its exterior at and beneath the level of the step 12. Each port 8 slopes outwardly and downwardly so that part of its outer end overlaps the step 12, as shown at 14, and the remainder overlaps the lower portion of the tube 4. The threaded portion 26 is provided within the lower portion of the tube 4.

Spaced between the ports 8 are vertical upper channels 7 extending downwardly into the thick wall of the tube 4. These are eccentrically arranged with respect to continuation channels 7. Radial bores 27, plugged at their outer ends, overlap the lower ends of the upper channels 7 and the upper ends of the continuation channels 7 so as to establish a flow path between them without a sudden constriction being encountered. The lower ends of the continuation channels 7 open into an arcuate manifold groove 10 arranged above an arcuate distribution channel 25 formed in the outer upper part of the crown 11. Arcuately-spaced, vertical, irrigation ducts 21 extend downwardly from the channel 25 and open at their lower ends between the positions of radially extending tungsten cutting bits 20 in the underside of the crown 11, as shown in Figure 2.

The underside of the crown 11 has arcuate portions 24 of large radius 15 alternating with arcuate portions 23 of a smaller radius 17. Each arcuate portion has a radial slot containing a bit 20, and the bits 20 in the arcuate portions 24 project outwardly slightly beyond the radius of the associated arcuate portions whereas the remaining bits 20 project inwardly sufficiently to overlap the central passage 5. The large radius 15 of the crown 11 is substantially equal to the radius 16 of the upper portion of the tube 4 and the smaller radius 17s of the crown 11 is substantially equal to the radius 19 of the lower portion of the tube 4.

When the drill is in use, drilling fluid travels downwards through the annulus 3, the channels 7 and ducts 21 to discharge into the spaces between the bits 20. Some of the fluid acts to facilitate the flow of a central core cut by the crown 11, into the central passage 5 while the remainder discharges

outwardly and upwardly around the lower end of the crown 11 by way of the arcuate gaps defined between the wall of the drill hole and the arcuate portions 23. This outward flow of drilling fluid entrains within it much of the cuttings and carries them upwardly around the lower portion of the tube 4 until the step or shoulder 12 is encountered. The gap between the upper portion of the tube 4 and the drill hole is only small, so that the cuttings and drilling fluid flow inwardly and upwardly through the ports 8 into the central passage 5. The overlapping portion 14 of the ports 8 with the shoulder 12 assists the passage of the cuttings into the drill connector interior by preventing any tendency for the cuttings to bank up against the underside of shoulder 12.

If desired the drill connector can be modified so as to be fitted to the lower end of a drilling pipe system employing a simply tube only. The drilling fluid is passed down the outside of the drilling system tube until the upper portion of the tube 4 is encountered. The fluid then enters the channels 7 and follows the path above described.

WHAT WE CLAIM IS:—

1. A tubular drill connector having an upper end provided with first means for attaching it to a drilling pipe system, a tube providing an axial downward extension of the drilling pipe system and having at its lower end second means for attaching to it an annular drilling crown having bits for cutting out a cylindrical core, a central passage defined by the tube for receiving the cut out core, an external shouldered portion of the tube spaced upwardly from the second means by a portion of the tube of narrower external diameter, a port extending upwardly and inwardly through the tube wall from a position beneath the shouldered portion so as to communicate with the central passage, and a channel extending downwards through the tube wall from a position above the shouldered portion to a position adjacent to the crown whereby, when the connector is in use, drilling fluid can be passed down the channel to remove cuttings from the vicinity of the crown and to carry at least some of such cuttings upwards around the outside of the extension tube to the position of the port through which the cuttings are conveyed inwardly and upwardly to the central passage in the connector.

2. A drill connector as claimed in Claim 1, in which the port opens through the outside of the tube partly in the underside of the shouldered portion and partly in the narrower tube-portion.

3. A drill connector as claimed in Claim 1 or Claim 2, in which the upper portion of the drill connector is provided by two concentric sleeves defining between them an annulus into the lower part of which opens the upper end of said channel.

4. A drill connector as claimed in Claim 3, in which the outer of the two sleeves has its upper end-portion internally threaded to provide said first means, and the lower end-portion of the tube is internally threaded to provide said second means.

5. A drill connector as claimed in any one of the preceding claims, in which more than one channel is provided and more than one port is provided, the channels extending vertically and being arcuately spaced around the tube wall from the ports.

6. A drill connector as claimed in any one of the preceding claims, in which the lower end of the or each channel opens into an arcuate manifold groove.

7. A drill connector as claimed in any one of the preceding claims, having a drilling crown fitted to the underside of the tube and which has alternate arcuate portions of a radius substantially equal to that of the shoulder portion of the tube and the remaining arcuate portions of a smaller radius substantially equal to that of the periphery of the narrower portion of the tube.

8. A drill connector as claimed in Claim 7, in which the crown is provided with upright ducts communicating at their upper ends with the lower ends of the channels and opening at their lower ends between the positions of drilling bits provided on the underside of the crown.

9. A drill connector as claimed in Claim 8, in which the drilling bits carried by said alternate arcuate portions of the crown extend radially outwards beyond its periphery and the drilling bits carried by said remaining arcuate portions of the crown extend radially inwards beyond the surface of the central passage.

10. A drill connector as claimed in any one of the preceding claims, in which the or each channel comprises two misaligned channel sections which communicate with one another by way of a radial bore formed in the outside of the tube and having its outer end plugged.

11. A drill connector arranged and adapted substantially as described with reference to the accompanying drawings.

12. A drill connector as claimed in Claim 11, in combination with a drilling crown substantially as described with reference to the accompanying drawings.

outwardly and upwardly around the lower end of the crown 11 by way of the arcuate gaps defined between the wall of the drill hole and the arcuate portions 23. This outward flow of drilling fluid entrains within it much of the cuttings and carries them upwardly around the lower portion of the tube 4 until the step or shoulder 12 is encountered. The gap between the upper portion of the tube 4 and the drill hole is only small, so that the cuttings and drilling fluid flow inwardly and upwardly through the ports 8 into the central passage 5. The overlapping portion 14 of the ports 8 with the shoulder 12 assists the passage of the cuttings into the drill connector interior by preventing any tendency for the cuttings to bank up against the underside of shoulder 12.

If desired the drill connector can be modified so as to be fitted to the lower end of a drilling pipe system employing a simply tube only. The drilling fluid is passed down the outside of the drilling system tube until the upper portion of the tube 4 is encountered. The fluid then enters the channels 7 and follows the path above described.

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2. A drill connector as claimed in Claim 1, in which the port opens through the outside of the tube partly in the underside of the shouldered portion and partly in the narrower tube portion.

3. A drill connector as claimed in Claim 1 or Claim 2, in which the upper portion of the drill connector is provided by two concentric sleeves defining between them an annulus into the lower part of which opens the upper end of said channel.

4. A drill connector as claimed in Claim 3, in which the outer of the two sleeves has its upper end-portion internally threaded to provide said first means, and the lower end-portion of the tube is internally threaded to provide said second means.

5. A drill connector as claimed in any one of the preceding claims, in which more than one channel is provided and more than one port is provided, the channels extending vertically and being arcuately spaced around the tube wall from the ports.

6. A drill connector as claimed in any one of the preceding claims, in which the lower end of the or each channel opens into an arcuate manifold groove.

7. A drill connector as claimed in any one of the preceding claims, having a drilling crown fitted to the underside of the tube and which has alternate arcuate portions of a radius substantially equal to that of the shoulder portion of the tube and the remaining arcuate portions of a smaller radius substantially equal to that of the periphery of the narrower portion of the tube.

8. A drill connector as claimed in Claim 7, in which the crown is provided with upright ducts communicating at their upper ends with the lower ends of the channels and opening at their lower ends between the positions of drilling bits provided on the underside of the crown.

9. A drill connector as claimed in Claim 8, in which the drilling bits carried by said alternate arcuate portions of the crown extend radially outwards beyond its periphery and the drilling bits carried by said remaining arcuate portions of the crown extend radially inwards beyond the surface of the central passage.

10. A drill connector as claimed in any one of the preceding claims, in which the or each channel comprises two misaligned channel sections which communicate with one another by way of a radial bore formed in the outside of the tube and having its outer end plugged.

11. A drill connector arranged and adapted substantially as described with reference to the accompanying drawings.

12. A drill connector as claimed in Claim 11, in combination with a drilling crown substantially as described with reference to the accompanying drawings.

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