Claims

1 A roller device for incorporation into a wireline tool string for use in an oil or gas well, the roller device having a body with at least one connector suitable for connection of the roller device body into the string, and having a plurality of rollers on the outer surface of the body, wherein the rollers comprise captive bearings arranged to rotate around more than one axis relative to the body, and wherein the plurality of rollers are arranged in at least one helix extending around the body.

2 A roller device as claimed in claim 1, wherein the rollers are arranged in at least two helices, each helix starting at a circumferentially spaced position on the body, and each helix extending around the body.

3 A roller device as claimed in any one of claims 1-2, wherein the at least one helix completes at least one full circumferential turn around the body.

4 A roller device as claimed in any one of claims 1-3, wherein the pitch of the at least one helix ranges from 30 and 40 degrees with respect to an axis of the body.

5 A roller device as claimed in any one of claims 1-4, wherein axially spaced rollers on the body circumferentially overlap one another on the body, so that when the body engages an inner wall of a wellbore in the well, substantially the whole circumference of the body is supported by at least two or more rollers, which are axially spaced from one another.

6 A roller device as claimed in claim 5, wherein the two or more rollers supporting the body and spacing it from the inner wall of the wellbore are circumferentially offset from one another.

7 A roller device as claimed in claim 5 or claim 6, wherein the rollers are arranged in at least two helices, each helix starting at a circumferentially spaced

position on the body and each helix extending around the body, and wherein rollers on one helix overlap circumferentially with rollers on another helix.

8 A roller device as claimed in any one of claims 1-7, wherein the plurality of rollers are mounted on at least one helical ridge extending from the body in a radial direction with respect to the axis of the body.

9 A roller device as claimed in claim 8, wherein the rollers are spaced along the helical ridge.

10 A roller device as claimed in claim 8 or claim 9, wherein each roller on the helical ridge is axially and circumferentially spaced away from adjacent rollers on the ridge.

11 A roller device as claimed in any one of claims 8-10, having at least three separate helical ridges on the outer surface of the body, each ridge having a plurality of helically spaced rollers.

12 A roller device as claimed in claim 11, wherein the helical ridges are substantially parallel to one another.

13 A roller device as claimed in any one of claims 8-12, wherein the roller device has at least one helical channel extending along the body between adjacent helical ridges.

14 A roller device as claimed in claim 13, wherein the walls of the channels diverge from one another as they extend radially away from the body.

15 A roller device as claimed in any one of claims 1-14 wherein the body has a through bore to allow passage of cables or fluid along the body, and wherein the through bore extends through the end connectors, allowing communication with through bores in the string.

16 A roller device as claimed in any one of claims 1-15, wherein at least one end of the body is tapered.

17 A roller device as claimed in any one of claims 1-15, wherein each roller comprises a roller assembly in the form of a ball held captive in a socket but free to rotate within the socket.

18 A roller device as claimed in claim 17, wherein the socket is recessed into the outer surface of the body.

19 A roller device as claimed in claim 18, wherein the plurality of rollers are mounted on at least one helical ridge extending from the body in a radial direction with respect to the axis of the body, and wherein the sockets are recessed into the ridge.

20 A roller device as claimed in any one of claims 17-19, wherein the socket allows the ball to protrude from the outer surface of the body so that the ball engages the inner surface of a wall of the wellbore when the roller device is moving, and so that the balls rotate freely within the sockets to reduce the friction between the body and the wellbore during movement of the roller device within the wellbore.

21 A roller device as claimed in any one of claims 17-20, wherein the socket has an annular formation on its inner face, which aligns with a matching annular formation in the roller assembly when the roller assembly is received in the socket, and wherein the aligned annular formations on the socket and roller assembly retain a retaining member extending across a break line of the aligned formations thereby resisting movement of the roller assembly out of the socket when the retaining member is in place in the aligned formations.

22 A roller device as claimed in claim 21, wherein the retaining member is resilient and is energised by insertion into the aligned formations, so that it expands within the aligned formations as a function of its resilience and resists removal from the aligned formations.

23 A roller device as claimed in claim 21 or claim 22, wherein the retaining member comprises a split ring, with a joint adapted to expand and contract circumferentially within the aligned formations, and wherein the retaining member is biased to expand in the groove.

24 A roller device as claimed in any one of claims 21-23, wherein each socket has at least one access port connecting an outer face of the recess with at least one of the aligned formations, to enable intervention to free the retaining member from the formation.

25 A roller device as claimed in claim 24, wherein the access port comprises an access channel formed in the outer face of the ridge.

26 A roller device as claimed in claim 25, wherein the channel connects adjacent sockets.

27 A roller device as claimed in any one of claims 24-26, wherein the access port intersects with at least one of the aligned formations.

28 A roller device as claimed in any one of claims 17-27, wherein the ball is non-metallic.

29 A roller device as claimed in any one of claims 17-28, wherein the ball comprises a non-galling material.

30 A roller device as claimed in any one of claims 17-29, wherein the ball comprises a ceramic material.

31 A roller device as claimed in any one of claims 17-30, wherein the ball is supported in the roller assembly on a race of bearings, having a smaller diameter than the ball.

32 A roller device as claimed in claim 31, wherein the race of bearings is retained in a cup forming part of the roller assembly, and wherein the roller assembly comprises a cap covering the cup, wherein the cap has an aperture for the ball to protrude from the roller assembly, and a seal to seal the ball to the roller assembly, sealing off the port from the race and the cup.

33 A roller device as claimed in any one of claims 1-32, wherein the roller assembly comprises a ferrous metal, and so can be attracted by a magnet to assist removal of the roller assembly from the socket.

34 A roller device as claimed in any one of claims 1-33, where the roller is free to rotate in any direction with respect to the body, but is fixed against lateral and radial movement of the roller relative to the body.

35 A method of deploying a wireline tool string in a wellbore of an oil or gas well, the method comprising including in the wireline tool string a roller device, the roller device having a body, and having a plurality of rollers on the outer surface of the body, wherein the rollers comprise captive bearings arranged to rotate around more than one axis relative to the body, and wherein the rollers are helically arranged on the body, and supporting the body in the wellbore by the rollers.

Claims

1 A roller device for incorporation into a wireline tool string for use in an oil or gas well, the roller device having a body with an axis, and at least one connector suitable for connection of the roller device body into the string, and having a plurality of rollers on the outer surface of the body and spaced apart along the axis of the body, wherein the axially spaced rollers comprise captive bearings arranged to rotate around more than one axis relative to the body, and wherein the plurality of axially spaced rollers are arranged in at least one helix extending around the body completing at least one full circumferential turn; and wherein two or more axially spaced rollers on the body circumferentially overlap one another along a line parallel to the axis of the body.

2 A roller device as claimed in claim 1, wherein the rollers are arranged in at least two helices, each helix starting at a circumferentially spaced position on the body, and each helix extending around the body.

3 A roller device as claimed in any one of claims 1-2, wherein the pitch of the at least one helix ranges from 30 and 40 degrees with respect to an axis of the body.

4 A roller device as claimed in any one of claims 1-3, wherein when the body engages an inner wall of a wellbore in the well, substantially the whole circumference of the body is supported by at least two or more rollers, which are axially spaced from one another.

5 A roller device as claimed in claim 5, wherein the two or more rollers supporting the body and spacing it from the inner wall of the wellbore are circumferentially offset from one another.

6 A roller device as claimed in any one of claims 1-5, wherein the rollers are arranged in at least two helices, each helix starting at a circumferentially spaced position on the body and each helix extending around the body, and wherein at

least one roller on one helix overlaps circumferentially with at least one roller on another helix.

7 A roller device as claimed in any one of claims 1-6, wherein the plurality of rollers are mounted on at least one helical ridge extending from the body in a radial direction with respect to the axis of the body.

8 A roller device as claimed in claim 7, wherein the rollers are spaced along the helical ridge.

9 A roller device as claimed in claim 7 or claim 8, wherein each roller on the helical ridge is axially and circumferentially spaced away from adjacent rollers on the ridge.

10 A roller device as claimed in any one of claims 7-9, having at least three separate helical ridges on the outer surface of the body, each ridge having a plurality of helically spaced rollers.

11 A roller device as claimed in claim 10, wherein the helical ridges are substantially parallel to one another.

12 A roller device as claimed in any one of claims 7-11, wherein the roller device has at least one helical channel extending along the body between adjacent helical ridges.

13 A roller device as claimed in claim 12, wherein the walls of the channels diverge from one another as they extend radially away from the body.

14 A roller device as claimed in any one of claims 1-13 wherein the body has a through bore to allow passage of cables or fluid along the body, and wherein the through bore extends through the end connectors, allowing communication with through bores in the string.

15 A roller device as claimed in any one of claims 1-14, wherein at least one end of the body is tapered.

16 A roller device as claimed in any one of claims 1-14, wherein each roller comprises a roller assembly in the form of a ball held captive in a socket but free to rotate within the socket.

17 A roller device as claimed in claim 16, wherein the socket is recessed into the outer surface of the body.

18 A roller device as claimed in claim 17, wherein the plurality of rollers are mounted on at least one helical ridge extending from the body in a radial direction with respect to the axis of the body, and wherein the sockets are recessed into the ridge.

19 A roller device as claimed in any one of claims 16-18, wherein the socket allows the ball to protrude from the outer surface of the body so that the ball engages the inner surface of a wall of the wellbore when the roller device is moving, and so that the balls rotate freely within the sockets to reduce the friction between the body and the wellbore during movement of the roller device within the wellbore.

20 A roller device as claimed in any one of claims 16-19, wherein the socket has an annular formation on its inner face, which aligns with a matching annular formation in a recess when the roller assembly is received in the recess, and wherein the aligned annular formations on the recess and roller assembly retain a retaining member extending across a break line of the aligned formations thereby resisting movement of the roller assembly out of the recess when the retaining member is in place in the aligned formations.

21 A roller device as claimed in claim 20, wherein the retaining member is resilient and is energised by insertion into the aligned formations, so that it

expands within the aligned formations as a function of its resilience and resists removal from the aligned formations.

22 A roller device as claimed in claim 20 or claim 21, wherein the retaining member comprises a split ring, with a joint adapted to expand and contract circumferentially within the aligned formations, and wherein the retaining member is biased to expand in the groove.

23 A roller device as claimed in any one of claims 20-22, wherein each recess has at least one access port connecting an outer face of the recess with at least one of the aligned formations, to enable intervention to free the retaining member from the formation.

24 A roller device as claimed in claim 23, wherein the access port comprises an access channel formed in the outer face of the ridge.

25 A roller device as claimed in claim 24, wherein the channel connects adjacent recesses.

26 A roller device as claimed in any one of claims 23-25, wherein the access port intersects with at least one of the aligned formations.

27 A roller device as claimed in any one of claims 16-26, wherein the ball is non-metallic.

28 A roller device as claimed in any one of claims 16-27, wherein the ball comprises a non-galling material.

29 A roller device as claimed in any one of claims 16-28, wherein the ball comprises a ceramic material.

30 A roller device as claimed in any one of claims 16-29, wherein the ball is supported in the roller assembly on a race of bearings, having a smaller diameter than the ball.

31 A roller device as claimed in claim 30, wherein the race of bearings is retained in a cup forming part of the roller assembly, and wherein the roller assembly comprises a cap covering the cup, wherein the cap has an aperture for the ball to protrude from the roller assembly, and a seal to seal the ball to the roller assembly, sealing off the port from the race and the cup.

32 A roller device as claimed in any one of claims 1-31, wherein the roller assembly comprises a ferrous metal, and so can be attracted by a magnet to assist removal of the roller assembly from the recess.

33 A roller device as claimed in any one of claims 1-32, where the roller is free to rotate in any direction with respect to the body, but is fixed against lateral and radial movement of the roller relative to the body.

34 A method of deploying a wireline tool string in a wellbore of an oil or gas well, the method comprising including in the wireline tool string a roller device, the roller device having a body with an axis, and having a plurality of rollers on the outer surface of the body and spaced apart along the axis of the body, wherein the axially spaced rollers comprise captive bearings arranged to rotate around more than one axis relative to the body, and wherein the rollers are helically arranged such that the helix completes at least one full circumferential turn on the body, and supporting the body in the wellbore by at least two axially spaced rollers on the body which circumferentially overlap one another along a line parallel to the axis of the body..

35 A method as claimed in claim 34, including supporting the body by more than two rollers on the body.

36 A method as claimed in claim 34 or claim 35, wherein the rollers are arranged in at least two helices, each helix starting at a circumferentially spaced position on the body, and each helix extending around the body.

37 A method as claimed in any one of claims 34-36, including spacing the whole of the circumference of the body from an inner wall of the wellbore by two or more rollers.

38 A method as claimed in claim 37, wherein the two or more rollers are circumferentially offset from one another.

39 A method as claimed in claim 37 or claim 38, wherein the two or more rollers are arranged in at least two helices, each helix starting at a circumferentially spaced position on the body and each helix extending around the body, and wherein at least one roller on one helix overlaps circumferentially with at least one roller on another helix.

40 A method as claimed in any one of claims 34-39, wherein the plurality of rollers are mounted on at least one helical ridge extending from the body in a radial direction with respect to the axis of the body.

41 A method as claimed in any one of claims 34-40, including stabilising the body against rocking movement in the wellbore by supporting the body by at least two rollers aligned with the axis, and by at least two overlapping rollers that are circumferentially spaced towards opposite sides of a line intersecting the rollers aligned with the axis.