United States Patent

[11] 3,601,206

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[21] Appl. No. 857,953
[22] Filed Sept. 15, 1969
[45] Patented Aug. 24, 1971
[73] Assignee King Oil Tools

[54] **SIDE INLET SWIVEL**
6 Claims, 2 Drawing Figs.

[52] U.S. Cl. 175/215, 285/190
[51] Int. Cl. E21b 21/02, E21c 7/10
[50] Field of Search 175/207, 213, 214, 215; 285/190, 16

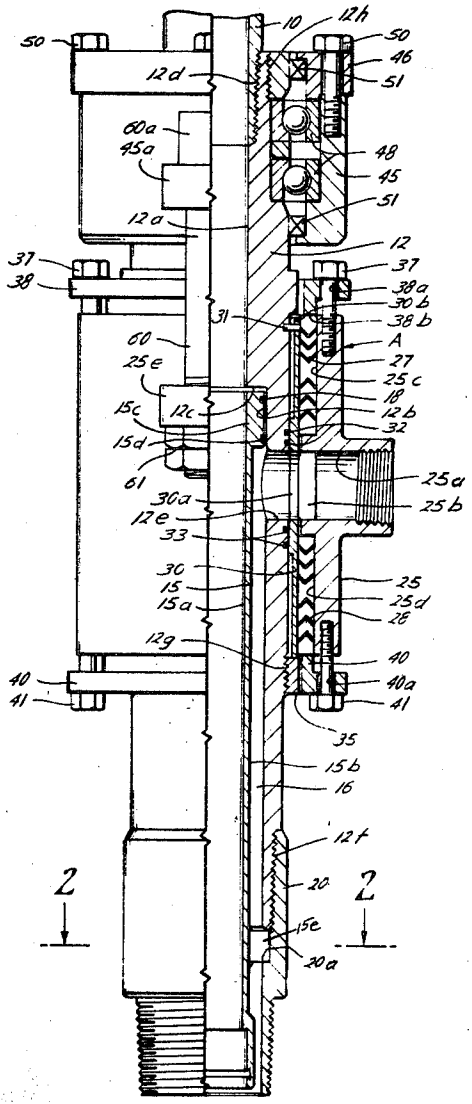
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ABSTRACT: A new and improved swivel having an inlet on the side thereof for admitting fluid to the bore of the swivel to admit fluid in addition to fluid flowing longitudinally through the bore of the swivel, or to admit a second differential fluid from that flowing longitudinally through the swivel, or to admit fluid beyond a solid drive connection such as used in road boring.



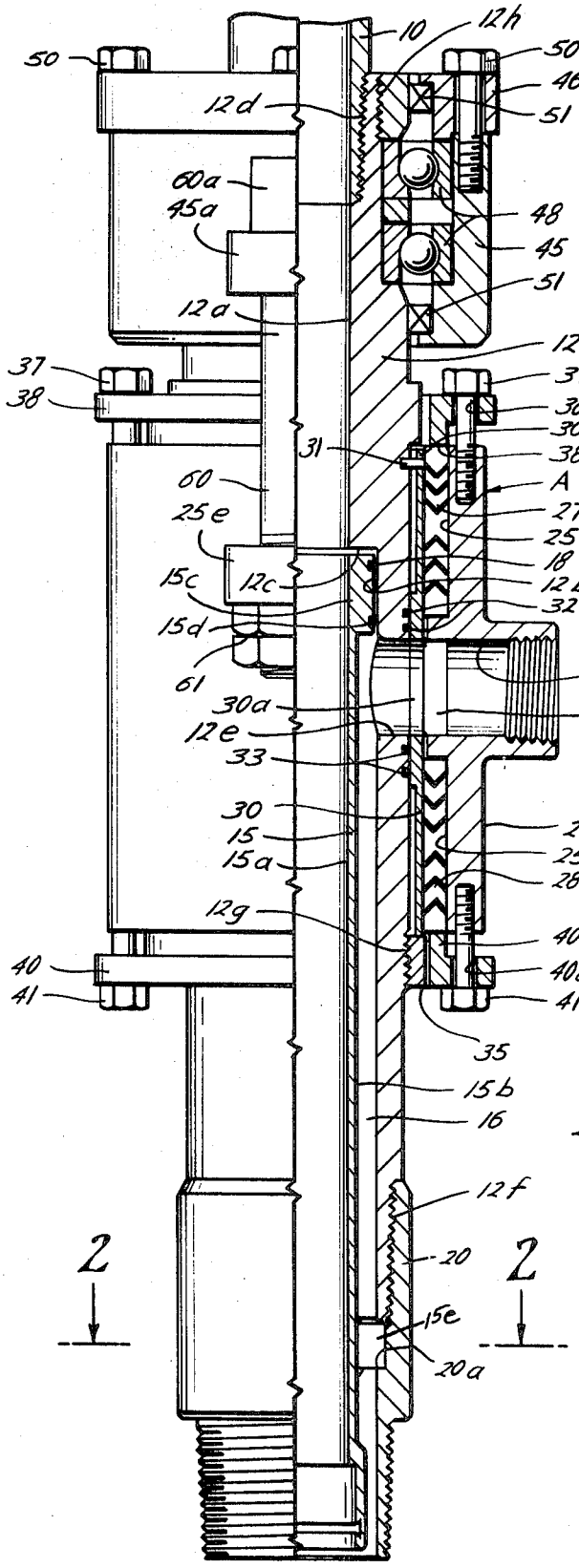


Fig. 1

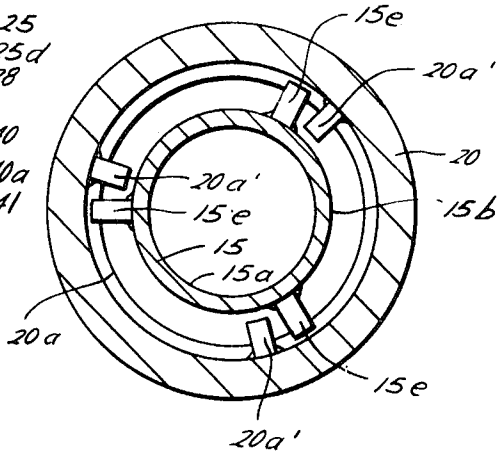


Fig. 2

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SIDE INLET SWIVEL

BACKGROUND OF THE INVENTION

The field of this invention is swivels, and particularly swivels used for drilling wells or for road boring.

In the drilling of oil wells and the like, it is customary to provide a swivel at the upper end of a drill string for supplying drilling mud or other fluid downwardly through the bore of the swivel to the drill pipe. A side inlet has been provided below an upper inlet in a swivel for countercurrent fluid flow as disclosed in U.S. Pat. No. 3,208,539.

SUMMARY OF THE INVENTION

THe present invention relates to a new and improved side inlet swivel which is adapted to be used below an upper inlet swivel in the drilling of wells, or is adapted to be used beyond a solid drive connection such as used in boring tunnels or horizontal holes under roads, The side inlet swivel of this invention has an inner tub which forms the longitudinal bore for fluid introduced at the upper end thereof and which also provides a distribution chamber from the side inlet of the swivel. The swivel of this invention has a washpipe removably mounted on the swivel body for providing a wear element which may be replaced when worn to thereby prolong the useful life of the swivel of this invention.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevation, partly in section, of the preferred form of the invention; and

FIG. 2 is a horizontal cross-sectional view taken on line 2—2 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, the letter A designates generally the side inlet swivel of this invention which is normally adapted to be disposed in a string of drill pipe below a regular upper inlet swivel, whose stem **10** (a portion of which is shown) is connected to the swivel A, as will be more evident hereinafter. The drilling mud or other fluid is normally conveyed through the regular upper inlet swivel, an example of which is illustrated in U.S. Pat. No. 3,433,388. As will be explained more in detail, the side inlet swivel A permits the introduction of additional drilling mud or fluid through the side inlet swivel A for mixing with the fluid which normally flows through the upper inlet swivel. Such additional drilling mud or fluid may be for the purpose of increasing the volume of drilling fluid for mixture with the normal drilling mud that is flowing through the drill string. In some instances, the side inlet swivel A may be used with a solid connection instead of the stem **10** so that the upper end of the swivel is closed. In such circumstances, the swivel A may be used for the boring or drilling of a tunnel or hole beneath a road or similar area. With such construction, the side inlet swivel A makes it possible to introduce the drilling fluid or mud, even though the upper end of the swivel body is closed for the drive connection.

Considering the invention more in detail the swivel A includes a swivel body **12** having a longitudinal bore **12***a*, and a counterbore **12***b*, with a shoulder **12***c* defined therebetween. In the preferred form of the invention the upper end of the bore **12***a* is provided with threads **12***d* which are adapted to receive the corresponding external threads on the lower end of the rotatable stem **10** extending from the conventional inlet swivel. If the swivel A is used for the horizontal boring of tunnels or passages underneath a road, the stem **10** is replaced by a closed drive plug which has threads engaging the threads **12***d* and which has an external portion with wrench flats or any other suitable surface thereon to provide a driving connection, as will be well understood.

The swivel body **12** has a side opening **12***e* which is disposed below the shoulder **12***c*, and which is adapted to admit drilling mud or other fluid into the body **12**, as will be more evident hereinafter.

An inner tube **15** is disposed within the counterbore **12***b* of the swivel body **12** and it has its inner bore **15***a* substantially in alignment with the bore **12***a* of the swivel body **12**. The diameter of the external surface **15***b* of the inner tube **15** is less than the diameter of the counterbore **12***b* so as to provide a longitudinal passage **16** between the inner tube **15** and the counterbore **12***b*. In the preferred form of the invention, such passage **16** is annular to provide a maximum volume area for the flow of fluid, although the passage **16** may be less than the full annular area between the inner tube **15** and the counterbore **12***b*. The upper end **15***c* of the tube **15** is preferably enlarged and has suitable grooves **15***d* for retaining O-rings **18** in such grooves **15** and in sealing contact with the upper portion of the counterbore **12***b* above the inlet opening **12***e* to thereby provide a fluid seal for controlling the flow of fluid entering through the inlet opening **12***e* so that it flows downwardly through the passage or annulus **16**.

THe lower end of the body **12** is provided with external threads **12***f* which are adapted to receive corresponding threads on a sub **20** which is provided for connecting to a conventional pipe string or kelly in the known manner. THe sub **20** has a plurality of inwardly or radially extending lugs **20***a* welded thereto for coaction with corresponding lugs **15***e* which are welded or otherwise fixed to the tube **15**. Thus, when the swivel body **12** is rotated in use, the lugs **20***a* transmit such rotational movement to the lugs **15***e* so that the tube **15** rotates with the swivel body **12**. Also, the sub **20** is preferably provided with an annular shoulder **20***a* which is adapted to receive the lower portions of the lugs **15***e* to retain the inner tube **15** at a fixed longitudinal position with respect to the swivel **12** after the sub **20** has been threaded into its position as shown in FIG. **1**. The tube **15** may be readily removed and replaced by simply removing the sub **20**.

A side inlet housing **25** surrounds the swivel body **12** at an intermediate point in proximity to the inlet opening **12***e* (FIG. 1). The housing **25** is substantially cylindrical, except that it has a side inlet **25***a* which is adapted to be connected to a pipe or other conductor for supplying drilling mud or other fluid thereto from any source (not shown). The housing **25** preferably has an annular chamber **25***b* which is formed inwardly of the housing inlet **25***a* so that regardless of the position of the inlet **215***a* with respect to the opening **12***b*, fluid will readily flow from the inlet **25***a* through the annular chamber or passage **25***b* to the opening **12***e*.

In the preferred form of the invention, the housing **25** has an upper annular recess **25***c* for receiving an upper packing **27** which may be of any suitable type such as the common chevron packing. A similar lower recess **25***d* is formed below the inlet **25***a* for receiving a lower annular packing **28** which is likewise formed of any suitable sealing material such as a chevron packing.

In the preferred form of the invention, a washpipe **30** is slidably disposed over the swivel body **12** between the external surface of the body **12** and the packing **27** and **28**. The washpipe **30** has an opening **30***a* therethrough which is in alignment with the inlet opening **12***e*, and is maintained in such alignment by any type of aligning means such as a pin **31** which is secured in the body **12** and which extends into a U-shaped slot **30***b* at the upper end of the washpipe **30**. The washpipe **30** may be readily inserted and removed by longitudinally sliding it upwardly on the body **12** so as to position the pin **31** in the slot **30***b*. At that time the opening **30***a* is aligned with the opening **12***e*. Suitable O-rings or other seal rings **32** and **33** are provided above and below the openings **30***a* and **12***e* so as to prevent the leakage of fluid between the washpipe **30** and the external surface of the swivel body **12**. The washpipe **30** is retained in the aligned position on the swivel body **12** by a washpipe holddown nut **35** which is threaded to external threads **12***g* on the body **12**.

The external surface of the washpipe **30** is preferably made of a hard material such as steel which is case hardened so as to

provide a long wearing surface, but in the event such surface becomes worn, the entire washpipe **30** may be readily replaced so as to provide a smooth surface for engagement by the packings **27** and **28**.

THe packing **27** is readily compressed to increase the effective sealing action thereof by the tightening of packing-adjusting screws **37** which are threaded into the upper end of the side inlet housing **25** and which extend through suitable openings **38***a* in a packing-adjusting gland **38**. The packing-adjusting gland has an annular lower edge or surface **38***b* which rests upon the upper end of the packing **27** and serves to compress same in the recess **25***c* for providing an effective seal between the housing **25** and the washpipe **30**. A similar packing gland **40** is provided for the lower packing **26** and it is adjustable for compressing the packing **28** by means of adjustable screws **41** which are threaded into the lower end of the housing **25** and which extend through suitable openings **40** *a* in the gland **40**.

A bearing housing **45** is secured to a bearing cap **46** which in turn is secured to the upper end of the swivel body **12** at threads **12***h*. A pair of conventional bearings **48** are carried in the housing **45** and are retained in position by the molded connection between the bearing cap **46** and the housing **45** which is provided by the removable bolt or screws **50**. Suitable grease seals **51** are provided at each end of the bearings **48**.

The housing **25** is supported from the bearing housing **45** by means of a plurality of connecting bolts **60** which extend through a suitable eye or ring **45***a* secured to the external surface of the bearing housing **45** and a similar eye or ring **25***e* which is welded or is otherwise secured to the external surface of the housing **25**. Each of such bolts **60** has a head **60***a* to limit its downward movement with respect to the eye or ring **45***a*, and each is provided with one or more nuts **61** which are threaded thereto for adjusting the relative position of the housing **25** with respect to the bearing housing **45**.

In the operation or use of the side inlet swivel A of this invention, the side inlet **25** is connected to any suitable fixed pipe or conductor (not shown) so that the bearing housing **45** and the side inlet housing **25** do not rotate due to their interconnection through the bolt or bolts **60**. THe swivel body **12** is rotated, normally through the rotation of the stem **10** from a conventional swivel thereabove or a suitable drive connection. The washpipe **30** rotates with the swivel body **12** and relative to the packing **27** and **28**. Thus, the fluid seal is maintained at the inlet **25***a* so that fluid which is directed through such inlet **25***a* is caused to flow through the opening **30***a* and the opening **12***e* into the longitudinal passage **16**. The inner tube **15** may be connected to tubes therebelow, so that the fluid which is introduced through the side inlet opening **25***a* passes downwardly in the passage **16** and then flows upwardly through the open lower end of the longitudinal bore of the swivel body **12** for discharge upwardly through a suitable outlet (not shown).

The inner tube **15** may be readily replaced by simply unthreading the sub **20**, which completely releases the tube **15** from the swivel body **12** for replacement or repair. The packings **27** and **28** may be readily replaced by loosening the packing glands **38** and **40** respectively. Also, as previously explained, the washpipe **30** may be readily replaced by simply removing the nut **35** and then allowing the washpipe **30** to drop downwardly. With the diameters as illustrated in FIG. **1**, the sub **20** is removed prior to removing the washpipe **30** so that the nut **35** and the washpipe **30** can clear the lower end of the swivel body **12** and thus be in a position for removal.

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 without departing from the spirit of the invention.

I claim:

1. A side inlet swivel, comprising:

a swivel body having a longitudinal bore through at least a portion thereof;

said swivel body having a side opening in communication with said longitudinal bore;

a side inlet housing adapted to be positioned around said body and having a side inlet therewith aligned with said side opening in said swivel body for admitting fluid from said side inlet housing into said longitudinal bore of said swivel body;

a bearing housing having bearings disposed between said swivel body and said housing;

means connecting said bearing housing to said side inlet housing for thereby permitting rotation of said swivel body relative to said bearing housing and said side inlet housing;

an upper annular packing between said side inlet housing and said swivel body and disposed above said side inlet;

a lower annular packing between said side inlet housing and said swivel body and disposed below said side inlet;

said longitudinal bore of said swivel body extending for the full length thereof and being formed with a lower counterbore;

an inner tube disposed in said swivel body and having its bore in fluid communication with said bore of said swivel body; and

at least a portion of said external surface of said inner tube spaced from the wall of said counterbore of said swivel body to provide a longitudinal flow passage directing fluid from said side opening of said swivel body to the lower end of said inner tube for mixing such fluid with fluid flowing through the bore of said swivel body and said inner tube.

2. The structure set forth in claim **1**, including:

a washpipe disposed between said packings and the external surface of said swivel body;

said washpipe having a lateral opening in alignment with said inlet opening in said swivel body; and

means for releasably securing said washpipe to said swivel body whereby the washpipe may be readily replaced when wear thereon occurs due to the engagement by said packings during the relative rotation therebetween.

3. The structure set forth in claim **1**, including:

a washpipe disposed between said packings and the external surface of said swivel body; and

means mounted on the external surface of said swivel body for releasably securing said washpipe to said swivel body whereby the washpipe may be readily replaced when wear thereon occurs due to the engagement by said packings during the relative rotation therebetween.

4. The structure set forth in claim **1**, including:

lock means for locking said inner tube to said swivel body for rotation therewith. rotation

5. The structure set forth in claim **4**, wherein said lock means includes:

a releasable sub releasably mounted on the lower end of said swivel body; and

coacting lugs on said inner tube and said sub for engagement with each other to transmit rotation from said swivel body to said inner tube.

6. The structure set forth in claim **5**, wherein:

said sub has an internal shoulder for receiving the lugs on said inner tube for preventing longitudinal movement of said inner tube relative to said sub and swivel body when said sub is secured to said swivel body.