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(54) **CHOKE FOR CONTROLLING THE FLOW OF DRILLING MUD**

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(57) **ABSTRACT**

The invention relates to a drilling system and method for drilling a well bore into an earth formation, comprising: drilling means for drilling a well bore; pumping means for pumping drilling fluid into the well bore during drilling; and a drilling fluid outlet system for retrieving drilling fluid from the well bore, said drilling fluid outlet system comprising choke means for choking the return flow of retrieved drilling fluid, and alternating means for alternating the flow direction through the choking means.

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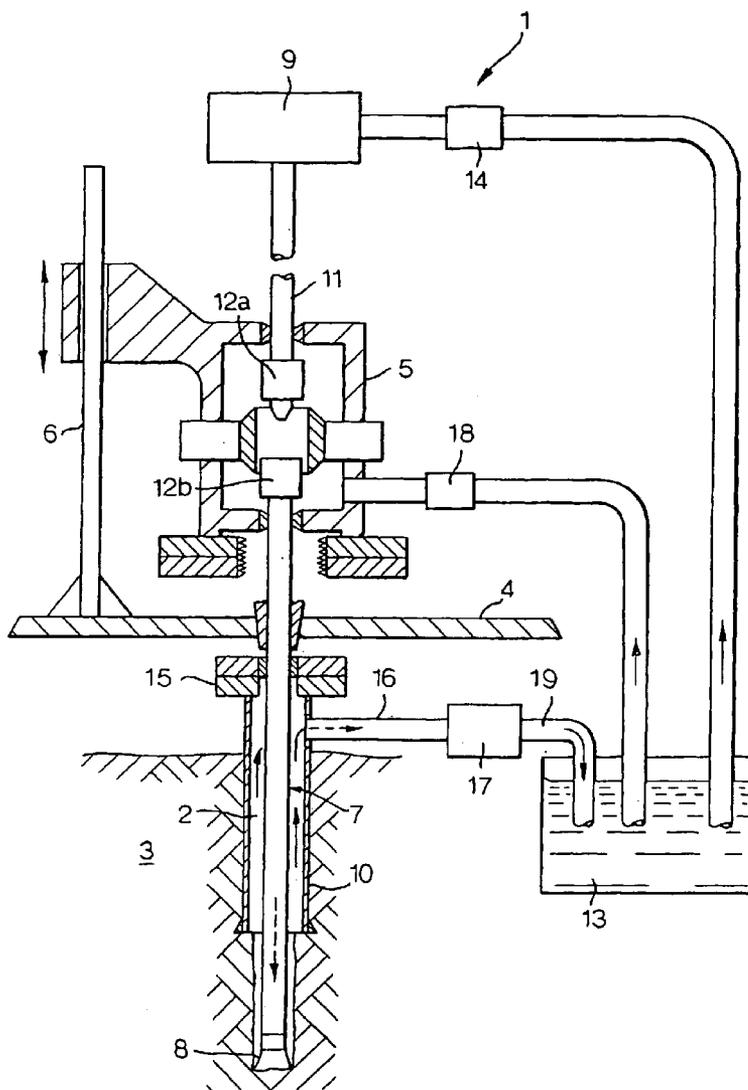


Fig. 1.

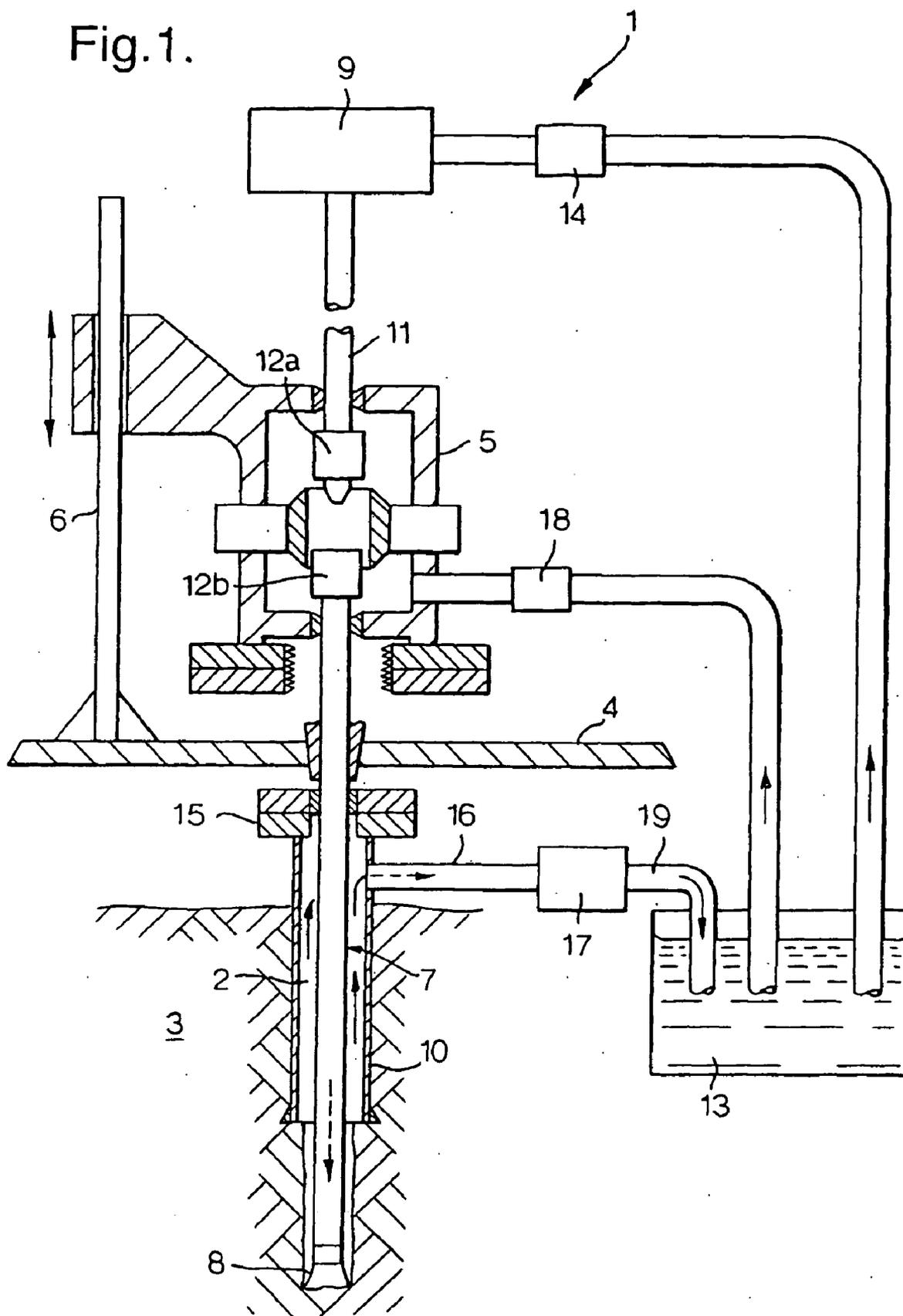


Fig.2.

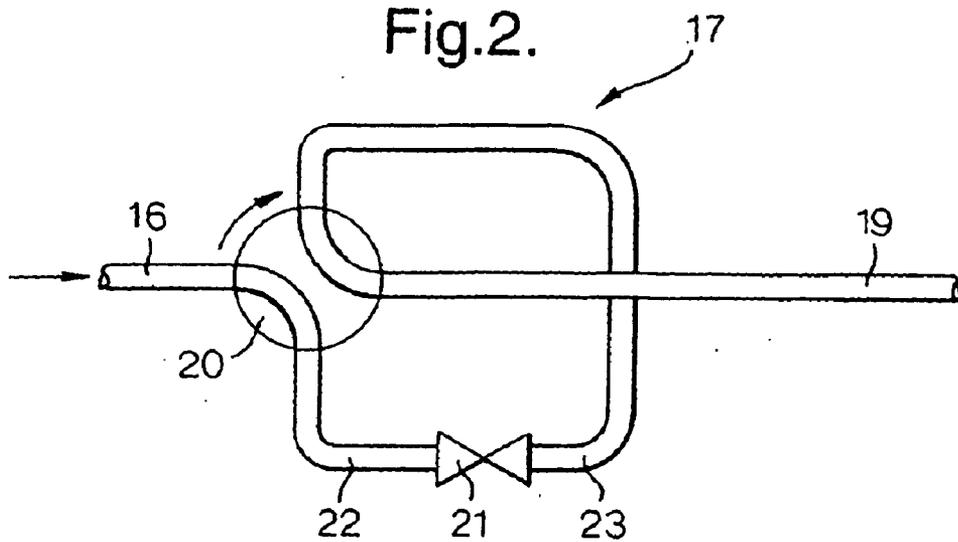
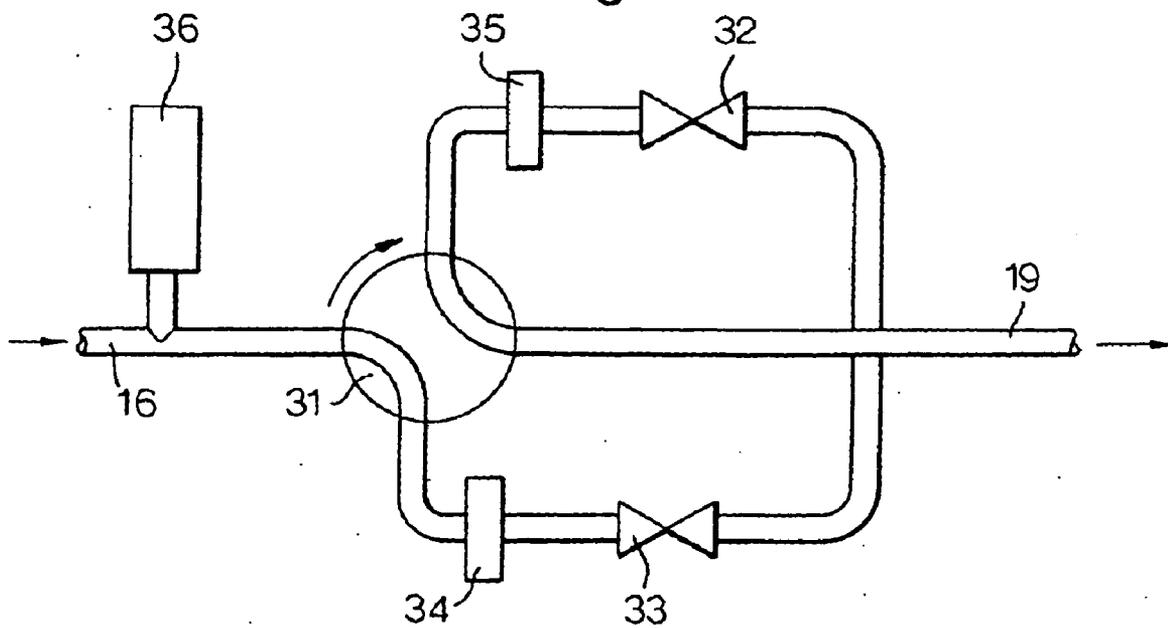


Fig.3.



CHOKE FOR CONTROLLING THE FLOW OF DRILLING MUD

[0001] The invention relates to a drilling system for drilling a well bore into an earth formation, comprising:

[0002] drilling means for drilling a well bore;

[0003] pumping means for pumping drilling fluid into the well bore during drilling; and

[0004] a drilling fluid outlet system for retrieving drilling fluid from the well bore.

[0005] Such a drilling system is for example known from WO-00 79092. In this publication it is disclosed that the drilling fluid outlet system is used to maintain control over the fluid pressure at the well bore wall, especially when drilling is stopped or during tripping of the drill string out of the bore hole. Without maintaining control over the pressure, there is a potential danger that undesired fluid flows from the earth formation into the bore hole, or that the borehole wall collapses.

[0006] According to prior art systems, the pressure is controlled by pumping fluid into the bore hole, via the annulus. Such a drilling fluid outlet system could further comprise a safety choke, in case the pump fails.

[0007] However due to large rock debris or contaminated mud, the safety choke could get clogged or could be damaged, which jeopardises correct control over the pressure in the well bore.

[0008] It is an object of the invention to alleviate the disadvantages of the prior art and to provide a system that is capable of regulating the pressure while the flow may contain large rock debris or contaminated mud.

[0009] This object is achieved by a drilling fluid outlet system comprising choke means for choking the returned flow of retrieved drilling fluid and alternating means for alternating the flow direction through the choke means.

[0010] So if the choke means would get clogged, the returned flow is alternated, such that the choke means are cleaned and the debris is discharged.

[0011] According to a preferred embodiment the drilling fluid outlet system comprises an inlet and an outlet, the choke means comprise a first inlet/outlet connection, a second outlet/inlet connection and the alternating means connect the inlet alternately to the first or second connection and the outlet alternately to the second or first connection. So with these alternating means it is possible to connect the choke means such that the inlet is used as an inlet or outlet and that at the same time the outlet is used as outlet or inlet.

[0012] In another embodiment of the drilling system according to the invention filter means are arranged in the first and second connection of the choke means.

[0013] These filter means block large pieces, which could damage the choke means. Upon alternating the flow direction blocked pieces at the filter means are discharged.

[0014] In again another embodiment of the drilling system according to the invention, the alternating means comprise a four way valve, having four connections and wherein the connections are connected two by two. With such a valve,

which could be actuated automatically, alternating of the flow is performed quickly. This will provide a minimum interruption of the flow.

[0015] Preferably the drilling fluid outlet system comprises an accumulator. This accumulator secures a constant flow at the moment that the flow direction is alternated.

[0016] In yet another embodiment of the drilling system according to the invention, the choking means comprises a bi-directional choke. Such a bi-directional choke provides a choking action in both flow directions. This provides for a compact design.

[0017] In another embodiment the choking means comprise at least two uni-directional chokes. Such uni-directional chokes provide a choking action in only one flow direction. Therefore two chokes are necessary to provide a choking action in both flow directions.

[0018] The invention relates also to a drilling fluid outlet system.

[0019] In another aspect the invention relates to a method of drilling a well bore into an earth formation.

[0020] In accordance with this aspect of the invention, the method comprises:

[0021] drilling the well bore by operating drilling means;

[0022] pumping drilling fluid into the well bore during said drilling; and

[0023] retrieving drilling fluid from the well bore in a drilling fluid outlet system, said drilling fluid outlet system comprising choke means for choking the return flow of retrieved drilling fluid, whereby the flow direction of retrieved drilling fluid through the choking means is alternated for flushing away any debris from the choke means.

[0024] The invention will be now illustrated by way of example and in conjunction with the accompanying drawings, wherein

[0025] **FIG. 1** shows a schematic view of a drilling system according to the invention;

[0026] **FIG. 2** shows a schematic view of a first embodiment of a drilling fluid outlet system according to the invention; and

[0027] **FIG. 3** shows a second embodiment of a drilling fluid outlet system according to the invention.

[0028] **FIG. 1** shows a schematic view of a drilling system **1** according to the invention. With this drilling system **1** a well bore **2** is drilled into the earth formation **3**.

[0029] The drilling system **1** comprises a frame **4** onto which a fluid chamber **5** is slidably arranged along a guide **6**. A drill string **7** with on its bottom end a drill bit **8** is rotated by a top drive **9** in order to drill the well bore **2**. The well bore **2** is partially lined with a casing **10**. The drill string **7** is composed out of a plurality of drill string joints **11**, which are interconnected by connectors **12a** and **12b**. Drill mud contained in a reservoir **13** is pumped by pump **14** into the drill string **7** to the drill bit **8**. The drilling mud **10** flows into the annulus between the well bore wall and the drill string **7** upwards. The annulus is closed off by a rotating blow out preventer **15**. The drilling mud is returned via pipe **16** and drilling fluid outlet system **17** back to the reservoir **13**. When

connecting another drill string joint **11** the feed of drilling mud is taken over by pump **18**, which pumps the drilling fluid into the chamber **5**, such that it can flow into the drill string **7**.

[0030] The drilling fluid outlet system **17** ensures that a certain pressure is maintained in the well bore **2** by choking the flow in the pipe **16**.

[0031] In FIG. 2 the drilling fluid outlet system **17** is shown in more detail. The system **17** comprises a valve **20** and a bi-directional choke **21**. In the position of the valve **20** as shown in FIG. 2 the inlet pipe **16** is connected to the first connection pipe **22** of the choke **21**. The outlet pipe **19** is connected to the second connection **23** of the choke **21**. When the choke **21** gets clogged, the valve **20** is rotated, such that the inlet pipe **16** is connected to the second connection **23** of the choke **21** and the outlet pipe **19** is connected to the first connection **22** of the choke **21**. In this way the flow direction is alternated and any debris, which is clogging the choke **21** is flushed away through outlet pipe **19**.

[0032] In FIG. 3 a second embodiment **30** of a drilling fluid outlet system according to the invention is shown. The system **30** again comprises a valve **31** and two uni-directional chokes **32** and **33**. Such chokes **32,33** have a choking action in just one flow direction. Furthermore, the system **30** comprises filter means **34,35** which filter large debris in the mud, which could damage the chokes **32,33**. To the inlet pipe **16** an accumulator **36** is connected, which ensures that a constant flow is maintained while the flow direction of the system **30** is alternated by turning the valve **31**. Upon alternating the flow direction of the system **30** any debris present on the filter means **34,35** or in the chokes **32,33** is flushed away through outlet pipe **19**.

1. A drilling system for drilling a well bore into an earth formation, comprising:

- drilling means for drilling a well bore;
- pumping means for pumping drilling fluid into the well bore during drilling; and

a drilling fluid outlet system for retrieving drilling fluid from the well bore, said drilling fluid outlet system comprising choke means for choking the return flow of retrieved drilling fluid, and alternating means for alternating the flow direction through the choking means.

2. The drilling system according to claim 1, wherein the drilling fluid outlet system comprises an inlet and an outlet, the choke means comprise a first inlet/outlet connection, a second outlet/inlet connection, and the alternating means connect the inlet alternatingly to the first or second connection and the outlet alternatingly to the second or first connection.

3. The drilling system according to claim 2, wherein filter means are arranged in the first and second connection of the choke means.

4. The drilling system according to claim 1, wherein the alternating means comprise a four way valve, having four connections and wherein the connections are connected two by two.

5. The drilling system according to claim 1, wherein the drilling fluid outlet system comprises an accumulator.

6. The drilling system according to claim 1, wherein the choking means comprise a bi-directional choke.

7. The drilling system according to claim 1, wherein the choking means comprise at least two unidirectional chokes.

8. (canceled)

9. A method of drilling a well bore into an earth formation, comprising:

- drilling the well bore by operating drilling means;
- pumping drilling fluid into the well bore during said drilling; and
- retrieving drilling fluid from the well bore in a drilling fluid outlet system, said drilling fluid outlet system comprising choke means for choking the return flow of retrieved drilling fluid, whereby the flow direction of retrieved drilling fluid through the choking means is alternated for flushing away any debris from the choke means.

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