

WHAT IS CLAIMED IS:

1. A flow control system for drilling a well, comprising:
a conduit defining a channel configured to accommodate a drill pipe and a flow of a returning drilling fluid;
an acoustic sensor array configured to detect a flow rate of the returning drilling fluid; and
a flow control device configured to control the flow rate of the returning drilling fluid and to be actuated in response to an event detected by the sensor array, the flow control device being proximate to the sensor array.
2. The flow control system of claim 1, wherein the flow control system is configured for kick prevention during drilling offshore wells, and wherein the flow control device is configured to reduce the flow of the returning drilling fluid in the conduit.
3. The flow control system of claim 1, wherein the sensor array is an ultrasonic sensor array.
4. The flow control system of claim 1, wherein the flow control device comprises a blowout prevention stack.
5. The flow control system of claim 1, wherein the flow control device comprises a first holding element configured to hold the drilling pipe in the conduit and to control the flow of the returning drilling fluid in the conduit in response to the event detected by the sensor array.
6. The flow control system of claim 5, wherein the flow control device comprises a second holding element disposed below the first holding element and configured to hold the drilling pipe in the conduit, and wherein the sensor array is disposed on the conduit and located between the first and second holding elements.
7. The flow control system of claim 6, wherein the first and second holding elements are disposed around the drilling pipe and the first and second

holding elements define a plurality of holes for the returning drilling fluid passing through in the conduit.

8. The flow control system of claim 7, wherein sizes of the holes defined on one of the first and second holding elements are adjustable to reduce the flow of the returning drilling fluid passing through the conduit in response to the event detected by the sensor array.

9. The flow control system of claim 1, wherein the flow control device comprises a holding element configured to hold the drilling pipe in the conduit and to control the flow of the returning drilling fluid in the conduit, and wherein the flow control device further comprises a by-pass subsystem configured to control the flow of the returning drilling fluid therein.

10. The flow control system of claim 9, wherein the by-pass subsystem comprises a by-pass pipe having two ends in fluid communication with the conduit and a valve disposed on the by-pass pipe to control the flow rate of the returning drilling fluid in the by-pass pipe, wherein the sensor array is disposed on the by-pass pipe, and wherein the holding element is located between the two ends of the by-pass pipe.

11. The flow control system of claim 10, wherein the holding element has an annular shape and is disposed within the conduit and around the drilling pipe.

12. The flow control system of claim 9, wherein the flow control device is configured to close the flow of the returning drilling fluid in the conduit in response to an event detected by the sensor array.

13. A flow control system for kick prevention during well drilling, comprising:

a conduit defining a channel configured to accommodate a drill pipe and a flow of a returning drilling fluid;

a sensor array configured to detect a flow rate of the returning drilling fluid; and

a first holding element configured to hold the drilling pipe in the conduit and to control the flow of the returning drilling fluid in the conduit in response to an event detected by the sensor array.

14. The flow control system of claim 13, further comprising a second holding element disposed below the first holding element and configured to hold the drilling pipe in the conduit, and wherein the sensor array is disposed on the conduit and located between the first and second holding elements.

15. The flow control system of claim 13, wherein the first and second holding elements are disposed around the drilling pipe and the first and second holding elements define a plurality of holes for the returning drilling fluid passing through.

16. The flow control system of claim 15, wherein at least one of the first and second holding elements is configured to control the flow rate of the returning drilling fluid by adjusting sizes of the respective holes thereon.

17. The flow control system of claim 15, wherein at least one of the first and second holding elements is configured to reduce the returning drilling fluid passing through the conduit in response to the event detected by the sensor array.

18. A flow control system for kick prevention during well drilling, comprising:

a conduit defining a channel configured to accommodate a drill pipe and a flow of a returning drilling fluid;

a sensor array configured to detect a flow rate of the returning drilling fluid;

a holding element configured hold the drilling pipe in the conduit; and

a by-pass subsystem in fluid communication with the conduit and configured to cooperate with the holding element to control the flow rate of the returning drilling fluid in response to an event detected by the sensor array.

19. The flow control system of claim 18, wherein the holding element is disposed around the drilling pipe and within the conduit, and configured to close the flow of the returning drilling fluid in the conduit.

20. The flow control system of claim 18, wherein the by-pass subsystem comprises a bypass pipe having two ends in fluid communication with the conduit and a valve disposed on the bypass pipe, wherein the sensor array is disposed on the bypass pipe, and wherein holding element is located between the two ends of the bypass pipe.

CLAIMS

1. A flow control system for drilling a well, the system comprising:
 - a conduit defining a channel configured to accommodate a drill pipe and a flow of a returning drilling fluid;
 - a sensor array configured to detect a flow rate of the returning drilling fluid; and
 - a flow control device comprising a first holding element and a second holding element, each configured to hold the drill pipe in the conduit and each defining a plurality of holes configured to control the flow rate of the returning drilling fluid and to be actuated in response to an event detected by the sensor array, the flow control device being proximate to the sensor array.
2. The flow control system of claim 1, wherein the flow control system is configured for kick prevention during drilling offshore wells, and wherein the flow control device is configured to reduce the flow rate of the returning drilling fluid in the conduit.
3. The flow control system of claim 1, wherein the sensor array is an ultrasonic sensor array.
4. The flow control system of claim 1, wherein the flow control device comprises a blowout prevention stack.
5. The flow control system of claim 1, wherein the first holding element is configured to hold the drilling pipe in the conduit.
6. The flow control system of claim 5, wherein the second holding element is disposed below the first holding element and configured to hold the drilling pipe in the conduit, and wherein the sensor array is disposed on the conduit and located between the first and second holding elements.
7. The flow control system of claim 6, wherein the first and second holding elements are disposed around the drilling pipe.

8. The flow control system of claim 7, wherein sizes of the holes defined on one of the first and second holding elements are adjustable to reduce the flow rate of the returning drilling fluid passing through the conduit in response to the event detected by the sensor array.

9. The flow control system of claim 1, wherein the flow control device further comprises a by-pass subsystem configured to control the flow rate of the returning drilling fluid therein.

10. The flow control system of claim 9, wherein the by-pass subsystem comprises a by-pass pipe having two ends in fluid communication with the conduit and a valve disposed on the by-pass pipe to control the flow rate of the returning drilling fluid in the by-pass pipe, wherein the sensor array is disposed on the by-pass pipe, and wherein at least one of the first holding element and the second holding element is located between the two ends of the by-pass pipe.

11. The flow control system of claim 10, wherein at least one of the first holding element and the second holding element has an annular shape and is disposed within the conduit and around the drilling pipe.

12. The flow control system of claim 9, wherein the flow control device is configured to close the flow of the returning drilling fluid in the conduit in response to the event detected by the sensor array.

13. A flow control system for kick prevention during well drilling, the system comprising:

- a conduit defining a channel configured to accommodate a drill pipe and a flow of a returning drilling fluid;

- a sensor array configured to detect a flow rate of the returning drilling fluid; and

- a first holding element and a second holding element, each configured to hold the drill pipe in the conduit and each defining a plurality of holes configured to control the flow rate of the returning drilling fluid in the conduit in response to an event detected by the sensor array.

14. The flow control system of claim 13, wherein the second holding element is disposed below the first holding element and wherein the sensor array is disposed on the conduit and located between the first and second holding elements.

15. The flow control system of claim 14, wherein the first and second holding elements are disposed around the drilling pipe.

16. The flow control system of claim 15, wherein at least one of the first and second holding elements is configured to control the flow rate of the returning drilling fluid by adjusting sizes of the respective holes thereon.

17. The flow control system of claim 15, wherein at least one of the first and second holding elements is configured to reduce the returning drilling fluid passing through the conduit in response to the event detected by the sensor array.

18. A flow control system for kick prevention during well drilling, the system comprising:

- a conduit defining a channel configured to accommodate a drill pipe and a flow of a returning drilling fluid;

- a sensor array configured to detect a flow rate of the returning drilling fluid;

- a first holding element and a second holding element, each configured to hold the drill pipe in the conduit and each defining a plurality of holes configured to control the flow rate of the returning drilling fluid; and

- a by-pass subsystem in fluid communication with the conduit and configured to cooperate with at least one of the first holding element and the second holding element to control the flow rate of the returning drilling fluid in response to an event detected by the sensor array.

19. The flow control system of claim 18, wherein the first holding element and the second holding element are disposed around the drilling pipe and within the conduit, and configured to close the flow of the returning drilling fluid in the conduit.

20. The flow control system of claim 18, wherein the by-pass subsystem comprises a bypass pipe having two ends in fluid communication with the conduit and a valve

disposed on the bypass pipe, wherein the sensor array is disposed on the bypass pipe, and wherein at least one of the first holding element and the second holding element is located between the two ends of the bypass pipe.