US 3,128,077 discloses a further alternative BOP operating system in which the downhole pressure created by a blowout is used to assist in closing the BOP.

In order to prevent a blowout from occurring, it is important that the BOP can be closed as quickly as possible, to ensure that the annulus or wellbore is closed as soon as possible after a kick is detected.

US 4,317, 57 discloses the use of an auxiliary BOP closing system in addition to a conventional BOP control system, which may be operated to close the BOP should the main system fail or malfunction. The source of pressurised fluid for the auxiliary closing system is independent from the source of pressurised fluid for the main control system, and in the example given comprises at least one bottle of compressed nitrogen gas which can supply 2340 psi of pressure to the close chamber, and it is claimed that the auxiliary closing system can close a 10 inch annular BOP in less than 20 seconds.

It is an object of the present invention to provide an alternative configuration of apparatus for operating a BOP which provides for rapid closing of the BOP.

Summary of the Invention

~~According to a first aspect of the invention we provide~~Herein disclosed is a blow out preventer assembly comprising a blow out preventer and control apparatus, the blowout preventer comprising a housing, a sealing element, and a fluid pressure operated actuator mounted in the housing, the actuator dividing the interior of the housing into two chambers, namely an open chamber and a close chamber, substantially preventing flow of fluid between the two chambers, and being movable, by means of the supply of pressurised fluid to the close chamber, to urge the sealing element into sealing engagement with a drill pipe extending through the blow out preventer, the control apparatus including a close line which extends from the exterior of the housing to the close chamber, and a source of pressurised fluid which is connected to the close line, wherein

the source of pressurised fluid is located adjacent to the housing. Preferably the source of pressurised fluid is less than 15 foot from the close chamber

In accordance with one aspect, there is provided a blowout preventer assembly comprising a blowout preventer and control apparatus, the blowout preventer comprising a housing, a sealing element, and a fluid pressure operated actuator mounted in the housing, the actuator dividing the interior of the housing into an open chamber and a close chamber, substantially preventing flow of fluid between the two chambers, and being movable, by supplying pressurised fluid to the close chamber, to urge the sealing element into sealing engagement with a drill pipe extending through the blow out preventer, the control apparatus including a close line which extends from the exterior of the housing to the close chamber, and a source of pressurised fluid which is connected to the close line, wherein the source of pressurised fluid is located adjacent to the housing, the control apparatus further comprising an open line which extends from the exterior of the housing to the open chamber, wherein the open line is provided with an exhaust valve which is located adjacent to the housing, and which is movable between a first position in which flow of fluid along the open line into the open chamber is permitted, and a second position in which the open line is substantially blocked upsteam of the exhaust valve relative to the open chamber, and the open chamber is connected to a low pressure region.

The source of pressurised fluid preferably comprises at least one accumulator.

Advantageously, the control apparatus further comprises a close control valve which is located in the close line between the source of pressurised fluid and the close chamber, the close control valve being movable between an open position in which flow of fluid from the source of pressurised fluid to the close chamber is permitted, and a closed position in which flow of fluid from the source of pressurised fluid to the close chamber is substantially prevented.

The source of pressurised fluid is advantageously so close to the housing that the time between opening the close control valve and closing of the blow out preventer is 3 seconds or less where a drill string is present in the blowout preventer or 5 seconds or less where there is no drill string present in the blowout preventer.

The close control valve is preferably electrically or electronically operable. In this case, the control valve may move from the closed to position to the open position when supplied with electrical power.

Supply of electrical power to the close control valve may be controlled by an electronic control unit which is remote from the blow out preventer and control apparatus.

The control apparatus may further comprise a pump which has an inlet which draws fluid from a fluid reservoir and an outlet which is connected to the close line.

~~The~~ As mentioned in the above aspect, the control apparatus ~~may~~ further comprises an open line which extends from the exterior of the housing to the open chamber.

The pump may be connected to the open line in addition to the close line. In this case, the control apparatus advantageously includes a further valve which is movable from an open configuration in which flow of fluid from the pump to the close line is permitted whilst flow of fluid from the pump to the open line is substantially prevented, and a closed configuration in which flow of fluid from the pump to the open line is permitted whilst flow of fluid from the pump to the close line is substantially prevented.

~~The~~ As mentioned in the above aspect, the open line ~~may be~~ is provided with an exhaust valve which is located adjacent to the housing, and which is movable between a first position in which flow of fluid along the open line into the open chamber is permitted, and a second position in which the open line is substantially blocked upstream of the exhaust valve relative to the open chamber, and the open chamber is connected to a low pressure region.

The low pressure region may be the atmosphere at the exterior of the housing.

The low pressure region may comprise an exhaust conduit which has a greater cross-sectional area than the open line, and which is connected to a fluid reservoir.

The close line may be at least 2 inches in diameter.

The open line may be at least 2 inches in diameter.

~~According to a second aspect of the invention we provide~~Then is also disclosed a blow out preventer assembly comprising a blow out preventer and control apparatus, the blowout preventer comprising a housing, a sealing element, and a fluid pressure operated actuator mounted in the housing, the actuator dividing the interior of the housing into two chambers, namely an open chamber and a close chamber, substantially preventing flow of fluid between the two chambers, and being movable, by means of the supply of pressurised fluid to the close chamber, to urge the sealing element into sealing engagement with a drill pipe

extending through the blow out preventer, the control apparatus including an open line which extends from the exterior of the housing to the open chamber wherein the control apparatus further includes an exhaust valve which is located adjacent to the housing, and which is movable between a first position in which flow of fluid along the open line into the open chamber is permitted, and a second position in which the open line is substantially blocked upstream of the exhaust valve relative to the open chamber, and the open chamber is connected to a low pressure region.

The low pressure region may be the atmosphere at the exterior of the housing.

The low pressure region may comprise an exhaust conduit which has a greater cross-sectional area than the open line, and which is connected to a fluid reservoir.

The blow out preventer assembly according to the second aspect of the invention may have any of the features of the blowout preventer assembly according to the first aspect of the invention.

~~According to a third aspect of the invention we provide~~Then is disclosed a riser assembly comprising a riser and a blowout preventer assembly according to the first or second aspect of the invention, the blowout preventer being mounted on an uppermost end of the riser, wherein the source of pressurised fluid is mounted on the riser adjacent to the blowout preventer.

The riser assembly may further include a flow spool which is mounted on the upper end of the riser between the blowout preventer and the riser. In this case, the source of pressurised fluid may be mounted on (preferably at the bottom of) or below the flow spool.

Preferably the length of the close line between the source of pressurised fluid and the close chamber is less than 15ft.

CLAIMS

1. A blowout preventer assembly comprising a blowout preventer and control apparatus, the blowout preventer comprising a housing, a sealing element, and a fluid pressure operated actuator mounted in the housing, the actuator dividing the interior of the housing into ~~two chambers, namely~~ an open chamber and a close chamber, substantially preventing flow of fluid between the two chambers, and being movable, by ~~means of the supply of~~ supplying pressurised fluid to the close chamber, to urge the sealing element into sealing engagement with a drill pipe extending through the blow out preventer, the control apparatus including a close line which extends from the exterior of the housing to the close chamber, and a source of pressurised fluid which is connected to the close line, wherein the source of pressurised fluid is located adjacent to the housing~~.~~, the control apparatus further comprising an open line which extends from the exterior of the housing to the open chamber, wherein the open line is provided with an exhaust valve which is located adjacent to the housing, and which is movable between a first position in which flow of fluid along the open line into the open chamber is permitted, and a second position in which the open line is substantially blocked upsteam of the exhaust valve relative to the open chamber, and the open chamber is connected to a low pressure region.

~~2. A blowout preventer assembly according to claim 1 wherein the source of pressurised fluid is less than 15 foot from the close chamber.~~

~~3~~2. A blowout preventer assembly according to claim 1 ~~or 2~~ wherein the source of pressurised fluid comprises at least one accumulator.

~~4~~3. A blowout preventer assembly according to ~~any preceding~~ claim 1 wherein the control apparatus further comprises a close control valve which is located in the close line between the source of pressurised fluid and the close chamber, the close control valve being movable between an open position in

which flow of fluid from the source of pressurised fluid to the close chamber is permitted, and a closed position in which flow of fluid from the source of pressurised fluid to the close chamber is substantially prevented.

~~5. A blowout preventer assembly according to claim 4 wherein the time between opening the close control valve and closing of the blowout preventer is 3 seconds or less where there is a drillstring in the blowout preventer or 5 seconds or less where there is no drillstring present.~~

~~6~~4. A blowout preventer assembly according to claim ~~4 or 5~~ 3 wherein the close control valve is electrically operable.

~~7~~5. A blowout preventer assembly according to claim 4~~, 5 or 6~~ wherein the control valve moves from the close position to the open position when supplied with electrical power.

~~8~~6. A blowout preventer assembly according to claim ~~6 or 7~~5 wherein the control apparatus further comprises an electronic control unit which is remote from the blow out preventer and control apparatus, and supply of electrical power to the close control valve is controlled by the electronic control unit.

~~9~~7. A blowout preventer assembly according to ~~any preceding~~ claim 1 wherein the control apparatus further comprises a pump which has an inlet which draws fluid from a fluid reservoir and an outlet which is connected to the close line.

~~10. A blowout preventer assembly according to any preceding claim wherein the control apparatus further comprises an open line which extends from the exterior of the housing to the open chamber.~~

~~11~~8. A blowout preventer assembly according to claim ~~10~~1 wherein the control apparatus further comprises a pump, the pump ~~is~~being connected to the open line in addition to the close line.

~~12~~9. A blowout preventer assembly according to claim ~~11~~8 wherein the control apparatus advantageously includes a further valve which is movable from an open configuration in which flow of fluid from the pump to the close line is permitted whilst flow of fluid from the pump to the open line is substantially prevented, and a closed configuration in which flow of fluid from the pump to the open line is permitted whilst flow of fluid from the pump to the close line is substantially prevented.

~~13. A blowout preventer assembly according to claim 10, 11 or 12 wherein the open line is provided with an exhaust valve which is located adjacent to the housing, and which is movable between a first position in which flow of fluid along the open line into the open chamber is permitted, and a second position in which the open line is substantially blocked upstream of the exhaust valve relative to the open chamber, and the open chamber is connected to a low pressure region.~~

~~14~~10. A blowout preventer assembly according to claim ~~13~~1 wherein the low pressure region is the atmosphere at the exterior of the housing.

~~15~~11. A blowout preventer assembly according to claim ~~13~~1 wherein the low pressure region comprises an exhaust conduit which has a greater cross-sectional area than the open line, and which is connected to a fluid reservoir.

~~16~~12. A blowout preventer assembly according to ~~any preceding~~ claim 1 wherein the close line is at least 2 inches in diameter.

~~17~~13. A blowout preventer assembly according to ~~any preceding~~ claim 1 wherein the close line comprises a plurality of pipes which together provide a flow area equal to or greater than that provided by a single 2 inch diameter cylindrical pipe.

~~18~~14. A blowout preventer assembly according to ~~any one of~~ claim~~s 8 to 17~~1 wherein the open line is at least 2 inches in diameter.

~~19~~15. A blowout preventer assembly according to ~~any one of~~ claim~~s 8 to 17~~1 wherein the open line comprises a plurality of pipes which together provide a flow area equal to or greater than that provided by a single 2 inch diameter cylindrical pipe.

~~20. A blowout preventer assembly comprising a blowout preventer and control apparatus, the blowout preventer comprising a housing, a sealing element, and a fluid pressure operated actuator mounted in the housing, the~~

~~actuator dividing the interior of the housing into two chambers, namely an open chamber and a close chamber, substantially preventing flow of fluid between the two chambers, and being movable, by means of the supply of pressurised fluid to the close chamber, to urge the sealing element into sealing engagement with a drill pipe extending through the blow out preventer, the control apparatus including an open line which extends from the exterior of the housing to the open chamber wherein the control apparatus further includes an exhaust valve which is located adjacent to the housing, and which is movable between a first position in which flow of fluid along the open line into the open chamber is permitted, and a second position in which the open line is substantially blocked upstream of the exhaust valve relative to the open chamber, and the open chamber is connected to a low pressure region.~~

~~21. A blowout preventer assembly according to claim 20 wherein the low pressure region is the atmosphere at the exterior of the housing.~~

~~22. A blowout preventer assembly according to claim 20 wherein the low pressure region comprises an exhaust conduit which has a greater cross-sectional area than the open line, and which is connected to a fluid reservoir.~~

~~23. A blowout preventer assembly according to any one of claims 20 to 22 further including a close line which extends from the exterior of the housing to the close chamber, and a close control valve which is located in the close line and which is moveable between an open position in which flow of fluid to the close chamber is permitted and a closed position in which flow of fluid to the close chamber is substantially prevented.~~

~~24~~16. A riser assembly comprising a riser and a blowout preventer assembly according to ~~any preceding~~ claim 1, the blowout preventer being mounted on an uppermost end of the riser, wherein the source of pressurised fluid is mounted on the riser adjacent to the blowout preventer.

~~25~~17. A riser assembly according to claim ~~24~~16 further including a flow spool which is mounted on the upper end of the riser between the blowout preventer and the riser.

~~26~~18. A riser assembly according to claim ~~25~~17 wherein the source of pressurised fluid is mounted on the flow spool.

~~27~~19. A riser assembly according to ~~any one of~~ claim~~s 24 to 26~~22 wherein the riser includes a slip joint, the blowout preventer being mounted below the slip joint.