BLOWOUT PREVENTER WITH LOCKING RAM ASSEMBLY AND METHOD OF USING SAME

BACKGROUND

[0001] This present disclosure relates generally to techniques for performing wellsite operations. More specifically, the present disclosure relates to techniques for preventing blowouts involving, for example, a blowout preventer, ram assembly, a door assembly, and/or a lock.

[0002] Oilfield operations may be performed to locate and gather valuable downhole fluids. Oil rigs are positioned at wellsites, and downhole tools, such as drilling tools, are deployed into the ground to reach subsurface reservoirs. Once the downhole tools form a wellbore to reach a desired reservoir, casings may be cemented into place within the wellbore, and the wellbore completed to initiate production of fluids from the reservoir. Downhole tubular devices may be positioned in the wellbore to enable the passage of subsurface fluids to the surface.

[0003] Leakage of subsurface fluids may pose an environmental threat if released from the wellbore. Equipment, such as blow out preventers (BOPs), may be positioned about the wellbore to form a seal about a tubular therein to prevent leakage of fluid as it is brought to the surface. BOPs may have selectively actuatable rams or ram bonnets, such as pipe rams or shear rams, that may be activated to seal and/or sever a tubular in a wellbore. Some examples of BOPs are provided in U.S. Patent/Application Nos. 20110000670; 7,814,979; and 7,367,396.

[0004] It may be desirable to provide BOPs with various features, such as seals, ram blocks, doors and/or lock mechanisms, etc., for use in wellsite operations. Examples of BOPs and/or features may be provided in Patent Application Nos. US13/018,217 (not yet published at the time of filing), US2010/0243926, US2011/0012311, US5897094, US7044430, US7051989, US5575452, WO 2012/012192, WO 2012/012193, US 7195224 and US7798466.

SUMMARY

[0005] In at least one aspect, ~~the disclosure relates to~~there is provided a lock assembly for a blowout preventer of a wellsite having a tubular extending from a wellbore. The blowout preventer includes a housing and a ram assembly. The housing has a bore and a channel therethrough. ~~A~~ The tubular is positionable through the bore and engageable therein. The ram assembly is slidably positionable in the channel and engageable with the tubular, and

includes a ram block, a ram cylinder, and a ram shaft operatively connecting the ram block to the ram cylinder. The lock assembly includes a lock cylinder and a lock piston. The lock cylinder is operatively connectable to the ram cylinder. The ram shaft has an end slidably extendable into a lock cavity of the lock cylinder. The lock piston is slidably positionable in the lock cylinder and separating the lock cavity into a variable volume lock chamber and a variable volume closing chamber, and is movable between a locked and unlocked position, the lock piston having a ram surface engageable with ~~an~~ the end of the ram shaft when the lock piston is in the locked position and having a ram hole therethrough to receive the end of the ram shaft when the lock piston is in the unlocked position whereby the ram block is selectively lockable about the tubular.

[0006] The lock assembly may also include a guide piston extending into a guide cavity in the lock piston and slidably engageable therewith, and/or a lock ring slidably positionable in the closing chamber about the lock piston. The lock ring separates the closing chamber into a variable volume ring chamber and a variable volume ring fluid chamber, the ring fluid chamber fluidly connected to a ram chamber in the ram cylinder. The lock assembly may also include a ram piston slidably positionable in the ram cylinder and define the ram chamber therein, the ram chamber having a variable volume. The lock assembly may also include a valve fluidly coupled to the ring chamber to selectively vent fluid therefrom, and/or a valve fluidly coupled to the lock chamber to selectively vent fluid therefrom. The lock assembly may also include a ram piston slidably positionable in the ram cylinder and defining a variable volume ram chamber therein, the ram chamber fluidly connectable to the closing chamber. The lock assembly may also include fasteners operatively connecting the lock cylinder to an end of the ram cylinder.

[0007] In another aspect, ~~the disclosure relates to~~there is provided a blowout preventer for sealing about a tubular extending from a wellbore of a wellsite. The blowout preventer includes a housing having a bore and a channel therethrough, ~~(with~~ the tubular positionable through the bore and engageable therein~~),~~; a plurality of ram assemblies slidably positionable in the channel and engageable with the tubular, ~~(~~each of the plurality of ram assemblies comprising a ram block, a ram cylinder, and a ram shaft operatively connecting the ram block to the ram cylinder~~),~~; and a plurality of locking assemblies for locking the plurality of ram assemblies. Each of the plurality of locking ~~assembly~~ assemblies includes a lock cylinder operatively ~~to~~ connectable the ram cylinder, ~~(~~the ram shaft having an end slidably extendable into a lock cavity of the lock cylinder~~)~~ and a lock piston. The lock piston is slidably

positionable in the lock cylinder and separates the lock cavity into a variable volume lock chamber and a variable volume closing chamber. The lock piston is movable between a locked and unlocked position, and has a ram surface engageable with the end of the ram shaft when the lock piston is in the locked position and having a ram hole therethrough to receive the end of the ram shaft when the lock piston is in the unlocked position whereby the ram block is selectively lockable about the tubular.

[0008] The blowout preventer may also include a fluid source operatively connectable to the lock chamber and/or the closing chamber, and selectively provided fluid pressure thereto. The blowout preventer may also include an actuator operatively connectable to one of the blowout preventer, the ram assemblies, and/or the lock assemblies for selective activation thereof. The blowout preventer may also include a door positionable about the ram assembly and the channel, and providing selective access thereto.

[0009] In another aspect, ~~the disclosure relates to~~there is provided a method of locking a blowout preventer of a wellsite having a tubular extending from a wellbore. The blowout preventer includes a housing and a ram assembly. The housing has a bore and a channel therethrough, with the tubular positionable through the bore and engageable therein. The ram assembly is slidably positionable in the channel and engageable with the tubular. The ram assembly includes a ram block, a ram cylinder, and a ram shaft operatively connecting the ram block to the ram cylinder. The method involves providing ~~the~~ a lock assembly about the ram assembly, the lock assembly comprising: a lock cylinder operatively connectable to the ram cylinder, the ram shaft having an end slidably extendable into a lock cavity of the lock cylinder; and a lock piston slidably positionable in the lock cylinder and separating the lock cavity into a variable volume lock chamber and a variable volume closing chamber, the lock piston movable between a locked and unlocked position, the lock piston having a ram surface engageable with the end of the ram shaft when the lock piston is in the locked position and having a ram hole therethrough to receive the end of the ram shaft when the lock piston is in the unlocked position; and selectively locking the ram block about the tubular by selectively applying pressure to one of the lock chamber and the closing chamber.

[0010] The lock assembly may also include a guide piston extending into a cavity in the lock piston and slidably engageable therewith and a lock ring slidably positionable in the closing chamber about the lock piston. The method may involve increasing a force of the lock piston by slidably moving the lock ring adjacent the lock piston. The method may also involve selectively venting fluid from the lock chamber and/or the closing chamber and/or moving the ram block by

fluidly coupling the closing chamber to a ram chamber in the ram cylinder to selectively drive a ram piston therein.

[0011] The disclosure may also relate to a blowout preventer for sealing about a tubular. The blowout preventer includes a housing, a ram assembly and a lock assembly. The lock assembly