

sizes and pressure ratings and several units serving various functions are typically combined to compose a blowout preventer stack. Blowout preventers may perform any of a variety of functions such as confining well fluid to the wellbore, providing means to add fluid to the wellbore, allowing controlled volumes of fluid to be withdrawn from the wellbore, regulating and monitoring wellbore pressure, centering and hanging off the drill string in the wellbore, shutting in the well, preventing the flow of formation fluid, and sealing the well.

[0007] Blowout preventers are critical to the safety of crew, rig and environment, and to the monitoring and maintenance of well integrity. Thus, blowout preventers are intended to be fail-safe devices. As recommend by authorities and required by various regulations, blowout preventers must be regularly tested, inspected, and refurbished. Blowout preventers typically include one set of corresponding ram blocks, and when the ram blocks need to be replaced or refurbished, companies are required by law to retest the entire blowout preventer stack. This may take long periods of time and may incur great expenses. A number of blowout preventers, including different types of ram blocks, are typically needed on the blowout preventer stack in order to serve a variety of different functions.

SUMMARY

[0008] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[0009] According to a first aspect of the present invention, there is provided a ram block carrier, comprising: an opening; an upper shelf within the opening configured to hold an upper ram block; ~~and~~ a lower shelf within the opening configured to hold a lower ram block, and an extension tab configured to be attached to a carrier hydraulic actuator for moving the ram block carrier.

[00010] According to a second aspect of the present invention, there is provided a housing of a blowout preventer, comprising: a bore; a first cavity on a side of the bore; a second cavity on another side of the bore; and inside walls, adjacent to the first and second cavities, each comprising an opening which allows a ram block to access the bore, wherein the first cavity and the second cavity are each configured to receive a ram block carrier that is movable within the housing.

[00011] According to a third aspect of the present invention, there is provided a blowout preventer, comprising: a housing; a ram block carrier configured to move within the housing; and one or more ram blocks configured to be placed within the ram block carrier.

[00012] According to a fourth aspect of the present invention, there is provided a method of operating a blowout preventer, the method comprising: moving a ram block carrier within the blowout preventer; and moving a ram block of the ram block carrier towards a bore of the blowout preventer.

BRIEF DESCRIPTION OF THE DRAWINGS

[00013] The foregoing summary, as well as the following detailed description, will be better understood when read in conjunction with the appended drawings. For the purpose of illustration, certain examples of the present description are shown in the drawings. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate an implementation of system, apparatuses, and methods consistent with the present description and, together with the description, serve to explain advantages and principles consistent with the invention.

[00014] FIG. 1 is a diagram illustrating a perspective view of an example of a blowout preventer.

[00015] FIG. 2 is a diagram illustrating a perspective view of an example of a blowout preventer in an open-door configuration.

[00016] FIG. 3 is a diagram illustrating a perspective view of an example of a housing of a blowout preventer.

[00017] FIG. 4 is a diagram illustrating a perspective view of an example of a ram block carrier of a blowout preventer.

[00018] FIGS. 5A and 5B are diagrams illustrating front and top cross-sectional views of an example of a blowout preventer including a hydraulic actuator and mechanical override mechanism for movement of the ram blocks.

[00019] FIG. 5C is a diagram illustrating an example of a ram block including a T-slot for connection to an actuating rod.

~~WHAT IS CLAIMED IS:~~ CLAIMS

1. A ram block carrier, comprising:
 - an opening;
 - an upper shelf within the opening configured to hold an upper ram block; and
 - a lower shelf within the opening configured to hold a lower ram block; and
 - an extension tab configured to be attached to a carrier hydraulic actuator for moving the ram block carrier.
- ~~2. The ram block carrier of claim 1, further comprising an extension tab configured to be attached to a carrier hydraulic actuator for moving the ram block carrier.~~
- ~~32.~~ 32. The ram block carrier of claim 1, further comprising a rack configured to contact a pinion for moving the ram block carrier.
- ~~43.~~ 43. The ram block carrier of claim 1, further comprising a detent button configured to be pressed in response to the ram block carrier moving, inserted into an upper groove in response to the ram block carrier being in an upper position, and inserted into a lower groove in response to the ram block carrier being in a lower position.
- ~~54.~~ 54. A housing of a blowout preventer, comprising:
 - a bore;
 - a first cavity on a side of the bore;
 - a second cavity on another side of the bore; and
 - inside walls, adjacent to the first and second cavities, each comprising an opening which allows a ram block to access the bore,wherein the first cavity and the second cavity are each configured to receive a ram block carrier that is movable within the housing.

~~6~~5. The housing of claim ~~5~~4, further comprising outside walls, adjacent to the first and second cavities, each comprising:

a pinion which is configured to contact the ram block carrier and to move the ram block carrier within each cavity; and

an indicator which is configured to indicate a position of the ram block carrier.

~~7~~6. The housing of claim ~~5~~4, wherein a length of each of the cavities is at least two times greater than a length of each of the openings.

~~8~~7. The housing of claim ~~5~~4, further comprising outside walls, adjacent to the first and second cavities, each comprising:

an upper detent groove; and

a lower detent groove,

wherein the upper detent groove is configured to receive a detent button of the ram block carrier in response to the ram block carrier being in an upper position and the lower detent groove is configured to receive the detent button of the ram block carrier in response to the ram block carrier being in a lower position.

~~9~~8. The housing of claim ~~5~~4, further comprising outside walls, adjacent to the first and second cavities, each comprising a hole configured to receive a ram block hydraulic actuator for moving one or more ram blocks towards the bore.

~~10~~9. A blowout preventer, comprising:

a housing;

a ram block carrier configured to move within the housing; and

one or more ram blocks configured to be placed within the ram block carrier.

~~11~~10. The blowout preventer of claim ~~10~~9, further comprising a carrier hydraulic actuator for moving the ram block carrier within the housing.

- ~~12~~11. The blowout preventer of claim ~~10~~9, further comprising:
a piston; and
an actuating stem attached to the piston,
wherein the ram block carrier comprises an extension tab which is attached to the
actuating stem for moving the ram block carrier.
- ~~13~~12. The blowout preventer of claim ~~10~~9, further comprising a carrier mechanical actuator for
moving the ram block carrier within the housing.
- ~~14~~13. The blowout preventer of claim ~~10~~9, further comprising:
a pinion installed on the housing;
a rotating pin for rotating the pinion; and
a rack installed on the ram block carrier and contacting the pinion,
wherein the ram block carrier moves within the housing in response to the pinion
rotating.
- ~~15~~14. The blowout preventer of claim ~~10~~9, further comprising an indicator for monitoring a
position of the ram block carrier.
- ~~16~~15. The blowout preventer of claim ~~10~~9, wherein the one or more ram blocks comprises a
plurality of ram blocks.
- ~~17~~16. The blowout preventer of claim ~~10~~9, further comprising:
a central bore extending through the housing;
another ram block carrier configured to move within the housing; and
one or more ram blocks configured to be placed within the other ram block carrier,
wherein the ram block carrier is on one side of the central bore and the other ram block
carrier is on another side of the central bore.

~~18~~17. The blowout preventer of claim ~~17~~16, wherein the one or more ram blocks of the ram block carrier comprises a plurality of ram blocks, and the one or more ram blocks of the other ram block carrier comprises another plurality of ram blocks.

~~19~~18. The blowout preventer of claim ~~18~~17, wherein each of the plurality of ram blocks of the ram block carrier corresponds to one of the other plurality of ram blocks of the other ram block carrier.

~~20~~19. The blowout preventer of claim ~~19~~9, further comprising a ram block hydraulic actuator configured to move the one or more ram blocks.

~~21~~20. The blowout preventer of claim ~~19~~9, further comprising:
a piston;
an exterior actuating rod attached to the piston;
an interior actuating rod attached to the piston; and
a connector on an end of the interior actuating rod for making contact with and moving the one or more ram blocks.

~~22~~21. The blowout preventer of claim ~~19~~9, further comprising a ram block mechanical actuator configured to move the one or more ram blocks.

~~23~~22. The blowout preventer of claim ~~21~~20, further comprising:
a mechanical actuator stem; and
a push rod threadedly engaged to the mechanical actuator stem,
wherein in response to rotating the mechanical actuator stem, the push rod pushes the exterior actuating rod into the piston and the interior actuating rod, and the one or more ram blocks are moved.

~~24~~23. The blowout preventer of claim ~~19~~9, further comprising one or more doors attached to the housing by fasteners.

~~25~~24. The blowout preventer of claim ~~10~~9, wherein the one or more doors are circular doors configured to be opened by removing the fasteners.

~~26~~25. The blowout preventer of claim ~~25~~24, wherein the one or more circular doors comprise a covering member, a top plate, and a bottom plate, and pressure within the blowout preventer is released in response to an opening of the covering member.

~~27~~26. A method of operating a blowout preventer, the method comprising:
moving a ram block carrier within the blowout preventer; and
moving a ram block of the ram block carrier towards a bore of the blowout preventer.

~~28~~27. The method of claim ~~27~~26, wherein the moving of the ram block carrier comprises injecting hydraulic fluid into a carrier hydraulic actuator, and the moving of the ram block comprises injecting hydraulic fluid into a ram block hydraulic actuator.

~~29~~28. The method of claim 26, wherein the moving of the ram block carrier comprises rotating a pin on an outside of the blowout preventer and attached to a pinion on an inside the blowout preventer, and moving the ram block comprises rotating an actuator stem on an outside of the blowout preventer.

~~28~~29. The method of claim 26, wherein the moving of the ram block carrier comprises moving the ram block carrier into an upper position in order to use a lower ram block installed on a lower shelf of the ram block carrier.

~~29~~30. The method of claim ~~28~~26, wherein the moving of the ram block carrier comprises moving the ram block carrier into a lower position in order to use an upper ram block installed on an upper shelf of the ram block carrier.

~~303~~1. The method of claim ~~292~~6, wherein the moving of the ram block carrier into the upper position causes a connector of a ram block actuator to engage with the lower ram block, and the moving of the ram block carrier into the lower position causes a connector of a ram block actuator to engage with the upper ram block.