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(54) WELLHEAD ASSEMBLY QUICK INSTALL

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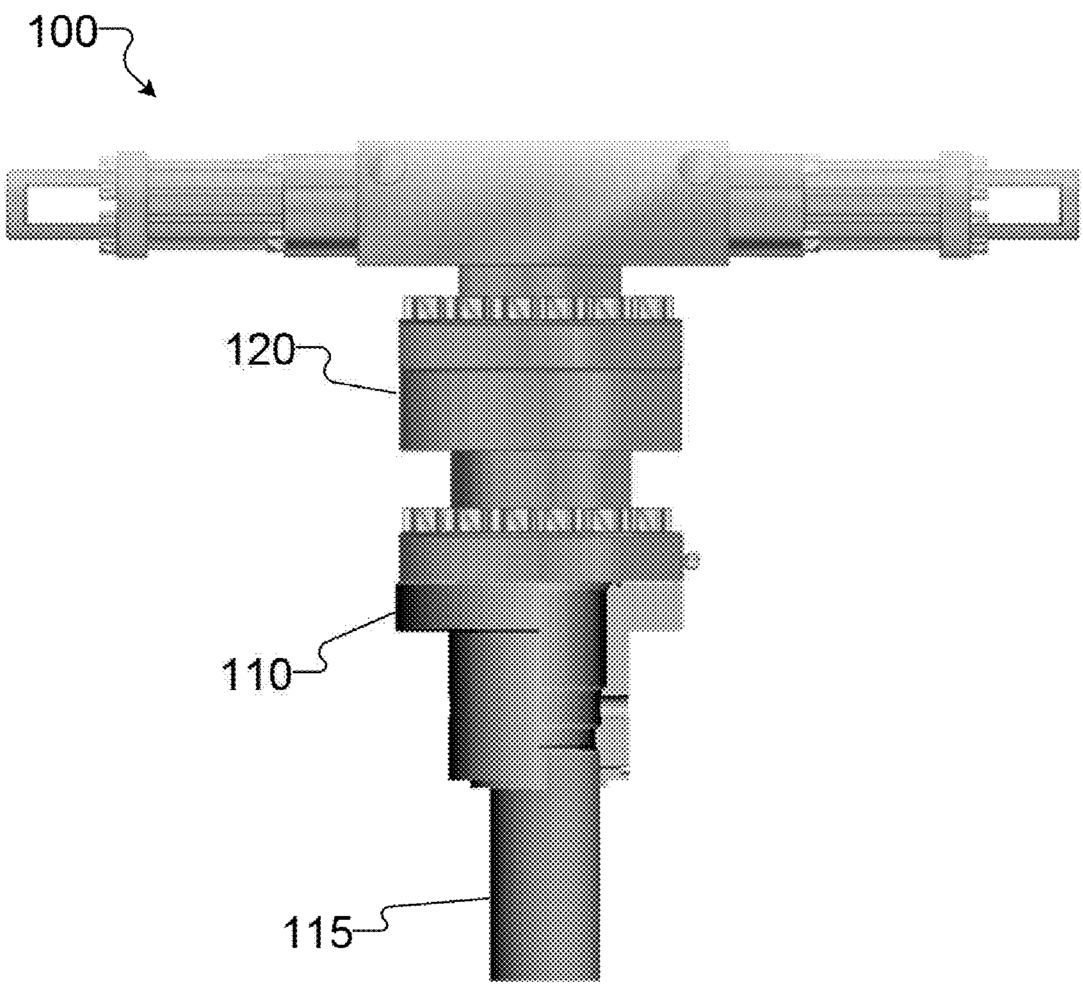
CPC ***E21B 33/038*** (2013.01); ***E21B 17/02*** (2013.01); ***E21B 33/04*** (2013.01)

(57) **ABSTRACT**

A wellhead assembly uses a plurality of pins to secure a casing head to a mandrel during installation. The mandrel is installed onto a casing string with the casing head is positioned on the mandrel so as to align a plurality of through-holes with a groove encircling the mandrel. The plurality of pins are inserted through the through-holes and into the groove of the mandrel, locking the casing head onto the mandrel so drilling can occur. Installation and tear down are faster and less labor intensive.



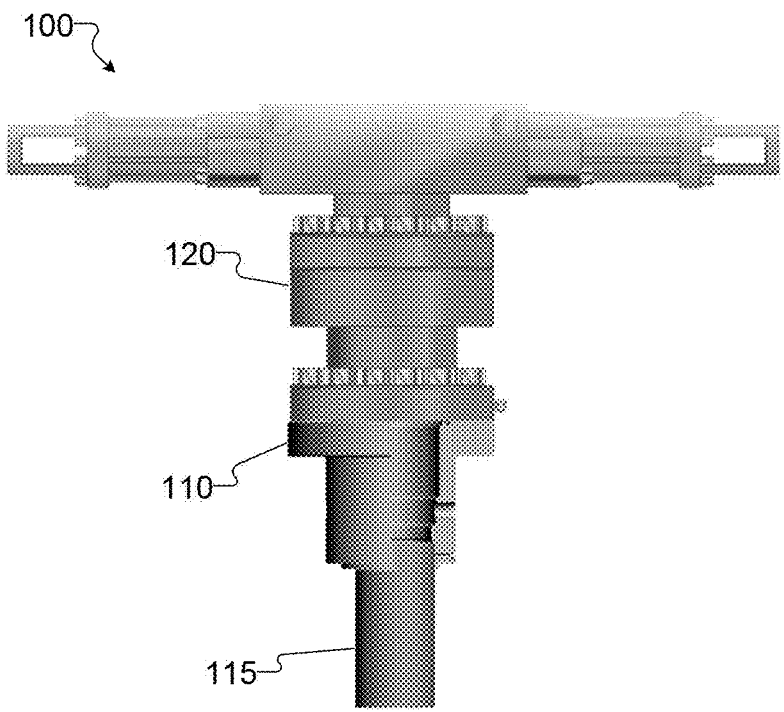


FIGURE 1

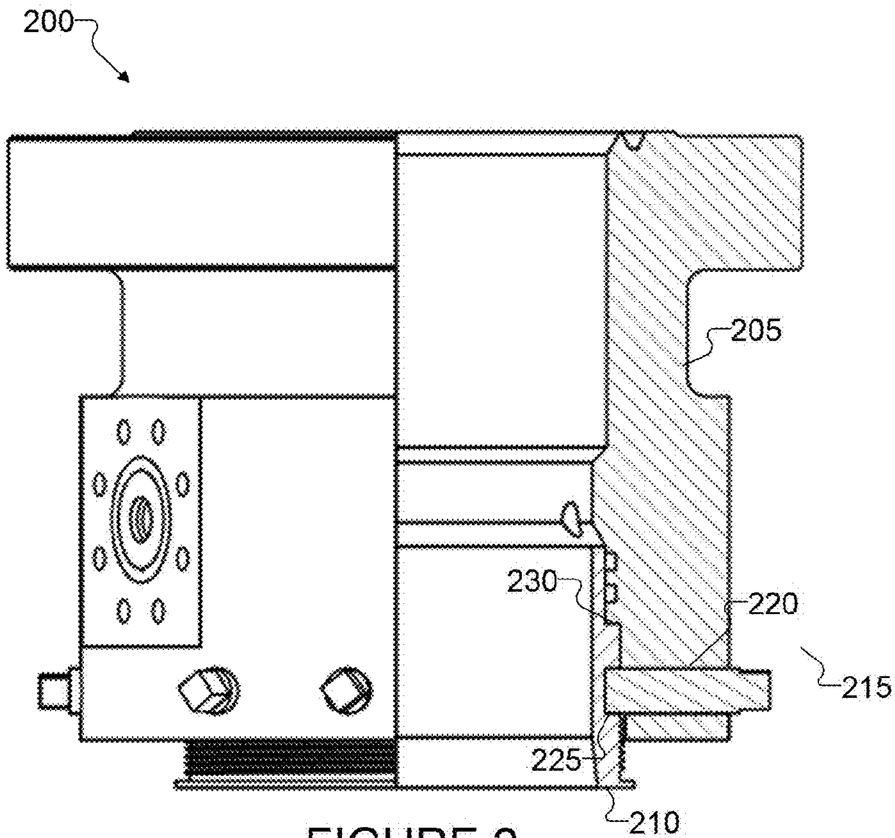


FIGURE 2

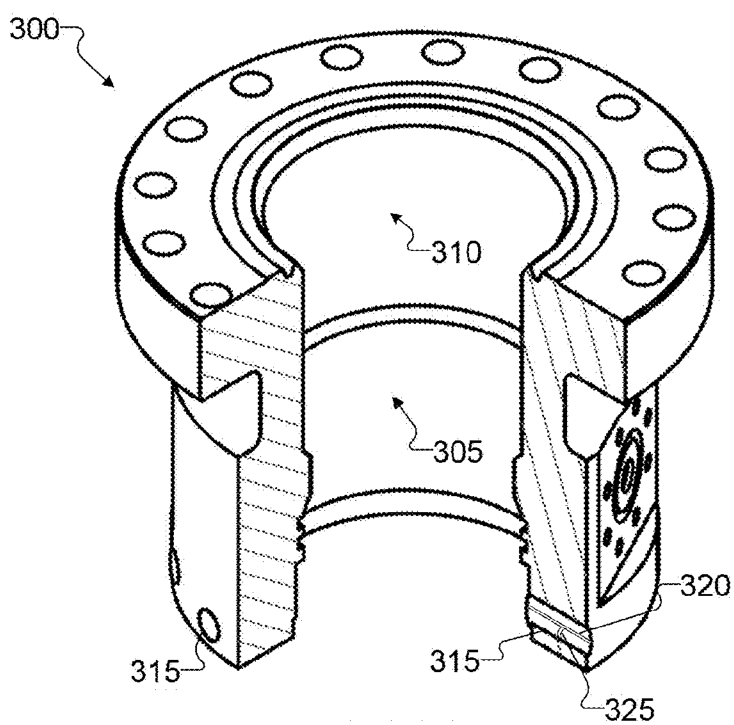


FIGURE 3

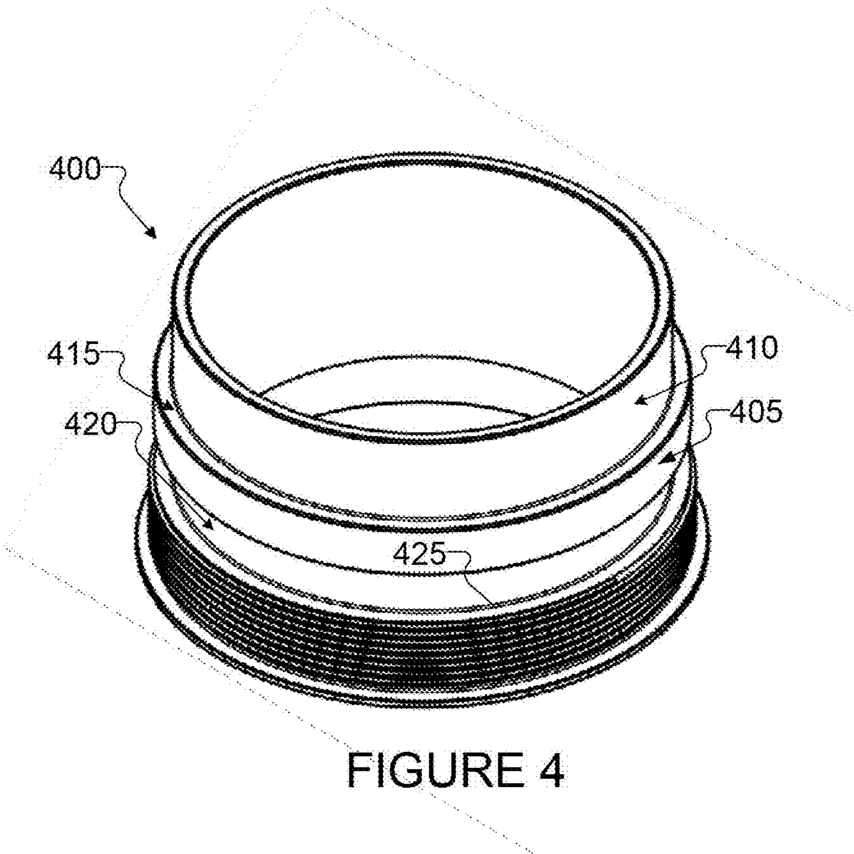


FIGURE 4

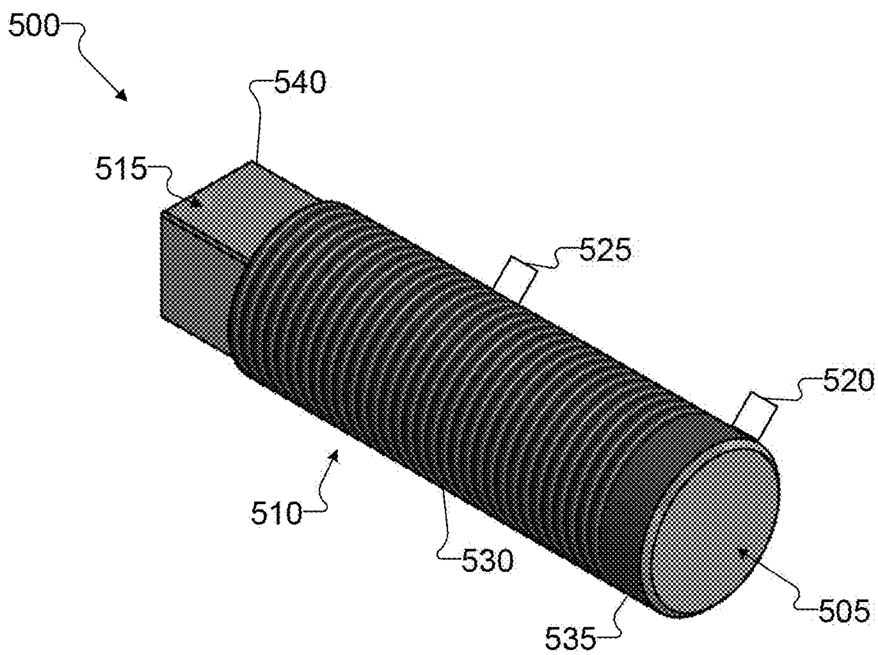


FIGURE 5

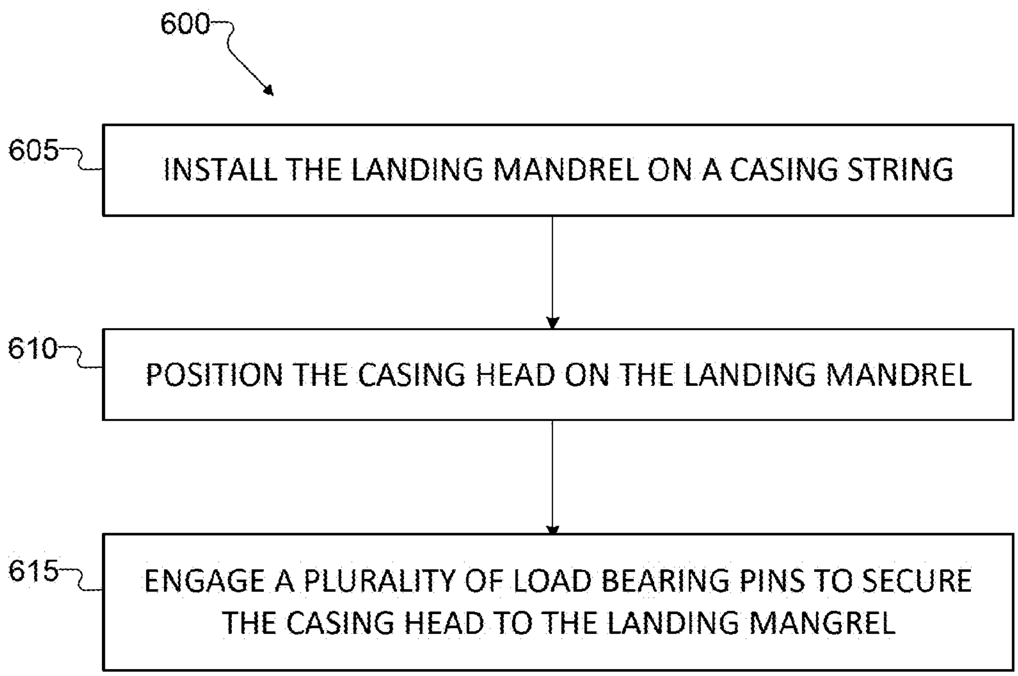

600
605
INSTALL THE LANDING MANDREL ON A CASING STRING
610
POSITION THE CASING HEAD ON THE LANDING MANDREL
615
ENGAGE A PLURALITY OF LOAD BEARING PINS TO SECURE THE CASING HEAD TO THE LANDING MANGREL

FIGURE 6

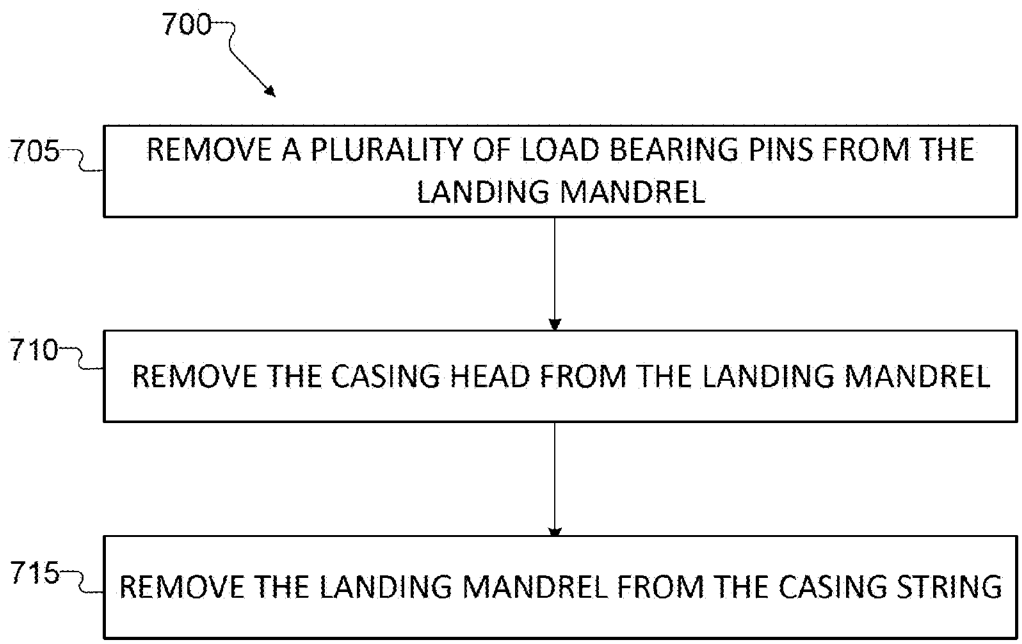

700
705
REMOVE A PLURALITY OF LOAD BEARING PINS FROM THE LANDING MANDREL
710
REMOVE THE CASING HEAD FROM THE LANDING MANDREL
715
REMOVE THE LANDING MANDREL FROM THE CASING STRING

FIGURE 7

WELLHEAD ASSEMBLY QUICK INSTALL

PRIORITY CLAIM AND CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 62/407,445 filed Oct. 12, 2016 and titled "CASING HEAD ASSEMBLY." The content of the above-identified patent document is hereby incorporated by reference.

TECHNICAL FIELD

[0002] The present application relates generally to a wellhead assembly and more particularly to a wellhead assembly using pins with a mandrel for installation and disassembly.

BACKGROUND

[0003] Well installs and tear downs are necessary steps for the production of oil and gas. In addition to the incredible forces involved during the production of oil and gas, the coupling of different components requires sealing to prevent leakage of the produced fluids and also the strength to handle the forces of the produced fluids, which sometimes exceed more than 10,000 pounds per square inch (psi). Typical conventional coupling of wellhead assemblies requires a significant amount of welding, that could add four to ten hours of labor to each installation or tear-down. Other proposed wellhead assemblies, such as that proposed in U.S. Pat. No. 9,593,549, are coupled using a locking collar coupled to the mandrel, but these solutions do not yield a perfect seal on the wellhead assembly due to the multiple portions of the locking collar. In addition, damage to any segment of the locking collar results in a failed seal, which delays the production of fluids until the locking collar is repaired or replaced.

[0004] There is, therefore, a need in the art for an improved wellhead assembly.

SUMMARY OF THE DISCLOSURE

[0005] The present application relates generally to a wellhead assembly and more particularly to a wellhead assembly using pins with a mandrel to install it.

[0006] In a first embodiment, a wellhead assembly is provided. The wellhead assembly includes a casing head, a mandrel, and a plurality of load-bearing pins. The casing head is coupled to a casing string. The mandrel inserts into the casing head. The plurality of load-bearing pins secures the casing head onto the mandrel.

[0007] In a second embodiment, a system is provided. The system includes a casing string and a wellhead assembly. The wellhead assembly includes a casing head, a mandrel, and a plurality of load-bearing pins. The casing head is coupled to a casing string. The mandrel inserts into the casing head. The plurality of load-bearing pins secures the casing head onto the mandrel.

[0008] In a third embodiment, a method is provided. The method includes coupling a casing head to a casing string; inserting a mandrel into the casing head; and securing the casing head onto the mandrel via a plurality of load-bearing pins.

[0009] Additional features and advantages of the present disclosure are described in, and will be apparent from, the following Detailed Description of the Invention and the Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] For a more complete understanding of the present disclosure and its advantages, reference is now made to the following description taken in conjunction with the accompanying drawings, in which like reference numerals represent like parts:

[0011] FIG. **1** illustrates a wellhead assembly according to various embodiments of the present disclosure;

[0012] FIG. **2** illustrates a modified wellhead assembly with a plurality of load bearing pins according to various embodiments of the present disclosure;

[0013] FIG. **3** illustrates a casing head according to various embodiments of the present disclosure;

[0014] FIG. **4** illustrates a mandrel according to various embodiments of the present disclosure;

[0015] FIG. **5** illustrates a load-bearing pin according to various embodiments of the present disclosure;

[0016] FIG. **6** illustrates an example process of assembling a wellhead assembly according to various embodiments of the present disclosure; and

[0017] FIG. **7** illustrates an example process of disassembling a wellhead assembly according to various embodiments of the present disclosure.

DETAILED DESCRIPTION

[0018] FIGS. **1** through **7**, discussed below, and the various embodiments used to describe the principles of the present disclosure are by way of illustration only and should not be construed in any way to limit the scope of the invention. Those skilled in the art will understand that these principles may be implemented in any type of suitably arranged device or system.

[0019] FIG. **1** illustrates a wellhead assembly **100** according to various embodiments of the present disclosure. The embodiment of the wellhead assembly **100** illustrated in FIG. **1** is for illustration only. FIG. **1** does not limit the scope of this disclosure to any particular implementation of an oil or gas well.

[0020] The wellhead assembly **100** includes a casing head **110**, a casing string **115**, and a blowout preventer (BOP) **120**. The casing head **110** is positioned over the casing string **115**. The BOP **120** is coupled to the top of the casing head **110**. The wellhead assembly **100** contains pressure through an interface with the BOP **120**, allows drilling and casing strings to be installed, allows for sealing to be made outside each casing string to seal off an annulus, and provides access to each intermediate casing string and the production casing string.

[0021] In a wellhead assembly, the casing head **110** must be secured onto the casing string **115**. Once the well begins producing, a significant force is introduced from rising oil and/or gas. If the casing head **110** is not secured to the casing string **115**, the force from the oil and/or gas production would cause the casing head **110** to disengage from the casing string **115**, potentially causing significant damage to the drilling rig or workers present. In extreme cases, for example ocean production, not securing the casing head **110** could cause an oil spill. In certain embodiments the casing head **110** may be secured to the casing string **115** by welding both the inside and outside of where the casing head **110** and casing string **115** come together. However, this method is very time costly. In other embodiments, the casing head **110** is secured to the casing string **115** by incorporating a mandrel **210** with a securing ring in grooves located between the mandrel **210** and the casing head **110**. The mandrel **210** is described in further detail below.

[0022] Although shown in FIG. **1** with a single blowout preventer, the BOP **120** may also represent a blowout preventer system or blowout preventer stack. One of ordinary skill in the art will understand that the components of the BOP **120** will vary depending on the type of well in which the wellhead assembly **100** is being used. For example, the specific BOP **120** will vary based on whether the wellhead assembly **100** is being used on a land well, offshore rig, and/or subsea well. The BOP **120** referenced herein may refer to any suitable BOP **120** system known in the art.

[0023] Although FIG. **1** illustrates one example of a wellhead assembly **100**, various changes may be made to FIG. **1**. For example, the components of the wellhead assembly **100** are for illustration only. Various components in FIG. **1** could be omitted, combined, or further subdivided and additional components could be added according to particular needs.

[0024] FIG. **2** illustrates a modified wellhead assembly **200** with a plurality of radial load-bearing pins **215** according to various embodiments of the present disclosure. The embodiment of the modified wellhead assembly **200** illustrated in FIG. **2** is for illustration only. FIG. **2** does not limit the scope of this disclosure to any particular implementation of an oil or gas well.

[0025] The modified wellhead assembly **200** includes a casing head **205**, a landing mandrel **210** and a plurality of load-bearing pins **215**. The casing head **205** includes a plurality of through holes **220**. The through holes **220** can be threaded or smooth. The landing mandrel is coupled to the casing string **115** to be used in the production of oil and gas. The landing mandrel **210** includes a plurality of grooves **225**. The groove **225** is smooth and runs for the circumference of the landing mandrel **210**. Although referenced in this disclosure as a landing mandrel, one of ordinary skill in the art will understand that such a component may be referenced as several different names, including but not limited to a connector, casing mandrel, landing mandrel, and/or crossover mandrel. The name used herein is exemplary and not limiting.

[0026] The casing head **205** installs onto the landing mandrel **210**. The outer profile of the landing mandrel **210** mates with the inner profile of the casing head **205** to position the landing mandrel **210**. The casing head **205** is aligned for access to different ports located on the outside structure of the casing head **205**. The size and weight of the casing head **205** requires significant initial alignment, meaning that adjusting the casing head **205** once placed is difficult. The profiles of both the interior of the casing head **205** and the exterior of the landing mandrel **210** are structured with an upper diameter less than a lower diameter. The transition between the two diameters can be gradual or use a step **230**. The mating of the casing head **205** and the landing mandrel **210** aligns the through-hole **220** with the groove **225**. A load-bearing pin **215** is inserted in the through-hole **220** and into the groove **225**. The through-hole **220** can be oriented at a downward angle to increase the force of the pins and also reduce the slip due to the vibration of producing fluids. The through holes **220** can alternate being angled downward and perpendicular to the fluid flow. Although described here as a pin, one of ordinary skill in the art will understand that such a component may be referenced as several different names, including but not limited to a bolt, screw, dowel and/or rod. The name used herein is exemplary and not limiting.

[0027] The significant forces experience by the casing head **205** during production of oil and gas determines how many load-bearing pins **215** are required to secure the casing head **205** onto the landing mandrel **210**. The plurality of load-bearing pins **215** (e.g., twelve, evenly distributed around the circumference) is determined based on the shear force for each. The strength of the load-bearing pins **215** is determined by the tensile strength of the property class and the thickness or diameter of the body. The depth of the groove **225** is determined based on the rotational force exerted on the load-bearing pins **215**. The use of load-bearing pins **215** in lieu of a collar encircling the entire circumference of circumference of the landing mandrel **210** is not a self-evident substitution, due to the very large forces involved. Mechanically, concerns regarding shearing of the load-bearing pins **215** and/or localized deformation of the landing mandrel **210** and/or the casing head **205** logically militate against using load-bearing pins **215** instead of a collar distributing the forces around the entire circumference of the landing mandrel **210** and the casing head **205**. However, the shape of the mating interface between the landing mandrel **210** and the casing head **205**, combined with the number of load-bearing pins **215** and appropriate selection of materials, provides sufficient strength to avoid shearing or significant deformation. Those skilled in the art will understand how to select, with no more experimentation and testing beyond that ordinarily required for designs of the type described herein, appropriate materials and the number of load-bearing pins, given the mating interface depicted and described. For example, the material comprising the load bearing pins **215** may be zinc, copper, and/or steel, or any other appropriate material determined by one skilled in the art.

[0028] The load-bearing pins **215** can be partially or fully threaded. In some embodiments, the front end **505** of the load-bearing pin **215** is smooth for entering the groove **225**. In this embodiment, wherein he load-bearing pins **215** can be smooth, the load-bearing pins **215** can be held in place by different means, such as magnetic or friction. The back end **515** of the load-bearing pins **215** can be shaped to mate with a tool for rotating, such as a drill, a wrench, or a screwdriver. Although not visible in FIG. **2**, the front end **505** and back end **515** of load-bearing pins **215** are discussed in greater detail below.

[0029] In certain embodiments, the load-bearing pins **215** are permanently installed in the casing head **205**. The load-bearing pins **215** can include a wider front portion and back portion in order to not allow the load-bearing pin **215** to be removed.

[0030] In certain embodiments, the load-bearing pins **215** can be functionally in the extended state, such as by use of springs or magnets on the inside of the casing head **205** around the through hole. In this embodiment, the back end of load-bearing pins **215** are functional to pull the load-bearing pin **215** with a stopper to keep the front end retracted.

[0031] In certain embodiments, the load-bearing pins **215** may include a first flange **520** at the front end **505** that act as a locking mechanism when rotated in a channel at the back end of the groove. In certain embodiments, the load-bearing pins **215** may also include a second flange **525**

located in a middle portion **510** that extend into a horizontal channel **320** of the through hole **220**. When the load-bearing pin **215** is fully inserted into the groove **225**, the flanges line up with a quarter-circumferential channel to orient the load-bearing pin **215** correctly with the groove channel. Although not visible in FIG. **2**, the first flange **520**, the second flange **525** and the horizontal channel **320** are discussed in greater detail below.

[0032] Although FIG. **2** illustrates one example of a modified wellhead assembly **200**, various changes may be made to FIG. **2**. For example, the components of the modified wellhead assembly **200** are for illustration only. Various components in FIG. **2** could be omitted, combined, or further subdivided and additional components could be added according to particular needs.

[0033] FIG. **3** illustrates a casing head **300** according to various embodiments of the present disclosure. The embodiment of the casing head **300** illustrated in FIG. **3** is for illustration only. FIG. **3** does not limit the scope of this disclosure to any particular implementation of a wellhead assembly.

[0034] The casing head **300** includes a first inner diameter **305**, a second inner diameter **310**, a plurality of through holes **315**, a horizontal channel **320**, and a quarter-circumferential channel **325**. The casing head **300** connects to a BOP **120** by welding, threading or bolting at the top of the casing head **300**. The casing head **300** is structured with an inner diameter profile that a first inner diameter **305** is greater at the bottom than a second inner diameter **310** at the top.

[0035] The casing head **300** includes the plurality of through holes **315**. The through holes **315** align the load-bearing pins **215** with the grooves **225** in the landing mandrel **210**. The through holes **315** can include the horizontal channel **320** and the quarter-circumferential channel **325**. The horizontal channel **320** is used in embodiments where the load-bearing pins **215** include one or more flanges. The horizontal channel **320** guides the first flange **520** located at the front of the load-bearing pin **215** to the groove **225** in the landing mandrel **210**. The quarter-circumferential channel **325** is located at a distance to align with the second flange **525** in the middle portion of the load-bearing pin **215** once the load-bearing pin **215** is fully inserted. When the load-bearing pin **215** is rotated, the second flange **525** limits the rotation of the load-bearing pin **215** in a manner that the first flange **520** enters a channel located at the inside of the groove **225** in the landing mandrel **210**. While the quarter-circumferential channel **325** is illustrated on the top side of the horizontal channel **320**, in certain embodiments the quarter-circumferential channel **325** could be located on the bottom side of the horizontal channel **320**. Locating the quarter-circumferential channel **325** on the bottom side of the horizontal channel **320** would avoid any forces such as vibrations from causing the load-bearing pin **215** to rotate backwards. In another embodiment, a notch could be created at the top of the quarter-circumferential channel **325** to lock the load-bearing pin **215** from rotating due to forces such as vibrations.

[0036] Although FIG. **3** illustrates one example of a casing head **300**, various changes may be made to FIG. **3**. For example, the components of the casing head **300** are for illustration only. Various components in FIG. **3** could be omitted, combined, or further subdivided and additional components could be added according to particular needs.

[0037] FIG. **4** illustrates a landing mandrel **400** according to various embodiments of the present disclosure. The embodiment of the landing mandrel **400** illustrated in FIG. **4** is for illustration only. In certain embodiments, the landing mandrel **400** is the landing mandrel **210** shown in FIG. **2**. FIG. **4** does not limit the scope of this disclosure to any particular implementation of a wellhead assembly.

[0038] The landing mandrel includes a first outer diameter **405**, a second outer diameter **410**, a step **415**, a groove **420**, and a channel **425**. In certain embodiments, the transition between the two diameters **405** and **410** can be gradual. In another embodiment, the transition between the two diameters **405** and **410** is demonstrated by a step **415**.

[0039] The landing mandrel **400** is installed on the casing string **115**. The casing head **300** inserts onto the landing mandrel **400**. The outer profile of the landing mandrel **400** mates with the inner profile of the casing head **300** to position the landing mandrel **400** in such a way as to align the plurality of through holes **315** with the groove **420**. Once the plurality of through holes **315** are aligned with the groove **420**, a load-bearing pin **215** is inserted through each of the through holes **315** and into the groove **420**. The number of load-bearing pins **215** and respective through holes **315** around the circumference of the casing head **300** and landing mandrel **400**, are selected based on the expected load, and the tensile strength and shear strength of the load-bearing pins **215**.

[0040] In certain embodiments, the interior side of the groove **420** includes a channel **425** on the top side. The channel **425** runs the entire circumference of the groove **420**. Once a load-bearing pin **215** is fully inserted and rotated to the stopping point of the first flange **520**, a second flange **525** that is oriented linearly with the first flange **520** enters the channel **425**. In this embodiment, the first flange **520** functions as a locking mechanism. In this embodiment, the second flange **525** functions to prevent the load-bearing pin **215** from being removed from the groove **420**. In embodiments where the quarter-circumferential channel **325** is located under the horizontal channel **320**, the channel **425** would similarly be located at the bottom over the groove **420**.

[0041] Although FIG. **4** illustrates one example of a landing mandrel **400**, various changes may be made to FIG. **4**. For example, the components of the landing mandrel **400** are for illustration only. Various components in FIG. **4** could be omitted, combined, or further subdivided and additional components could be added according to particular needs.

[0042] FIG. **5** illustrates a load-bearing pin **500** according to various embodiments of the present disclosure. The embodiment of the load-bearing pin **500** illustrated in FIG. **5** is for illustration only. In certain embodiments, the load-bearing pin **500** is one of the plurality of load-bearings pins **215** shown in FIG. **2**. FIG. **5** does not limit the scope of this disclosure to any particular implementation of a wellhead assembly.

[0043] The load-bearing pin **500** includes a front portion **505**, a middle portion **510**, and a back portion **515**. In certain embodiments, the load-bearing pin also includes a first flange **520**, and a second flange **525**. The front portion **505** of the load-bearing pin **500** enters the groove **420** of the landing mandrel **400**. Once the front portion **505** of the load-bearing pin **500** enters the groove **420** of the landing mandrel **400**, the middle portion **510** of the load-bearing pin **500** is located in the through hole **315** of the casing head

300. The back portion 515 of the load-bearing pin 500 remains outside the casing head 300.

[0044] Each of the front portion 505, middle portion 510, and/or back portion 515 of the load-bearing pins 500 can be partially threaded, fully threaded 530, or not threaded. In some embodiments, the middle portion 510 may only need a few threads 530 to mate with through hole 315 if through hole 315 is fully threaded. In another embodiment, the middle portion 510 is fully threaded and the through hole 315 is partially threaded. In another embodiment, the middle portion 510 is fully threaded and the through hole 315 is fully threaded.

[0045] In some embodiments, the front portion 505 of the load-bearing pin 500 is smooth 535 to facilitate insertion into the groove 420. In other embodiments, the entirety of the load-bearing pin 500 can be smooth and is held in place in the landing mandrel 400 and casing head 300 by different means, such as magnets or friction. In some embodiments, the back portion 515 of the load-bearing pin 500 can be a shape 540 to mate with a tool for rotating, such as a drill, a wrench, or a screwdriver.

[0046] In certain embodiments, the load-bearing pins 500 are permanently installed in the casing head 300. In these embodiments, the load-bearing pin 500 can include a wider front portion 505 and back portion 515 in order to not allow the load-bearing pin 500 to be removed. In this embodiment, the front portion 505 and the back portion 515 have a diameter greater than the diameter of the through hole 315.

[0047] In certain embodiments, the load-bearing pin 500 can be functionally in the extended state, such as by use of springs or magnets on the inside of the casing head 205 around the through hole 315. In this manner, the back portion 505 of load-bearing pins 500 are functional to pull the load-bearing pin 500 with a stopper to keep the front portion 505 retracted. In similar embodiments, the load-bearing pin 500 could include a tapered front portion 505. When the casing head 300 is inserted onto the landing mandrel 400, the tapered front portion 505 would interact with either the transition or step 415 between the second outer diameter 410 and the first outer diameter 405.

[0048] In certain embodiments, the load-bearing pin 500 may include a first flange 520 at the front portion 505 that acts as a locking mechanism when rotated in a channel 425 at the back end of the groove 420. In certain embodiments, the load-bearing pin 500 may also include a second flange 525 located in a middle portion 510 that extends into the horizontal channel 320 of the through hole 315. In some embodiments, the load-bearing pin 500 may include both a first flange 520 and a second flange 525. In embodiments wherein the load-bearing pin 500 includes both a first flange 520 and a second flange 525, when the load-bearing pin 500 is fully inserted the first flange is rotated in a channel 425 and the second flange 525 lines up with the quarter-circumferential channel 325 to orient the first flange 520 correctly with the groove channel 425.

[0049] Although FIG. 5 illustrates one example of a pin 500, various changes may be made to FIG. 5. For example, the components of the pin 500 are for illustration only. Various components in FIG. 5 could be omitted, combined, or further subdivided and additional components could be added according to particular needs.

[0050] FIG. 6 illustrates an example process 600 of assembling a wellhead assembly according to various embodiments of the present disclosure. For example, the process depicted in FIG. 6 could be performed using the combination of the casing head 300, the landing mandrel 400 and a plurality of load-bearing pins 500 illustrated in FIGS. 3-5.

[0051] In operation 605, the landing mandrel 400 is installed on a casing string 115 according to various embodiments of the disclosure.

[0052] In operation 610, the casing head 300 is positioned on the landing mandrel 400. The casing head 300 is structured to be positioned with through holes 315 of the casing head 300 aligned with a groove 420 of the landing mandrel 400. The outside profile of the landing mandrel 400 is structure with a first diameter 405 and a second outer diameter 410. The second diameter 410 is less than the first diameter 405 to correctly align the casing head 300 when placed onto the landing mandrel 400.

[0053] In operation 615, a plurality of load bearing pins 500 are engaged to secure the casing head 300 onto the landing mandrel 400. The type and amount of load bearing pins 500 are selected to not fail due to shear force cause by production of the oil or gas well. The load bearing pins 500 extend through the through holes 315 and into the grooves 420. In certain embodiments, once the load bearing pins 500 are in the grooves 420 they can be rotated so that a second flange 525 rotates in a quarter-circumferential channel 325 to align a first flange 520 with a channel 425 in the groove 420. In these embodiments, the first flange 520 inserted into the channel 425 keeps the load bearing pin 500 from being removed from the groove 420, essentially locking the load-bearing pin 500 in place.

[0054] In other embodiments, the load-bearing pins 500 may include a wider front portion 505 and back portion 515 in order to not allow the load-bearing pin 500 to be removed. In this embodiment, the front portion 505 and the back portion 515 have a diameter greater than the diameter of the through hole 315.

[0055] In other embodiments, the load-bearing pin 500 may be functionally in the extended state, such as by use of springs or magnets on the inside of the casing head 300 around the through hole 315. In this embodiment, the back portion 505 of load-bearing pins 500 are functional to pull the load-bearing pin 500 with a stopper to keep the front portion 505 retracted.

[0056] Although FIG. 6 illustrates and example process of assembling a wellhead assembly, various changes could be made to FIG. 6. For example, while show as a series of steps, various steps in each figure could overlap, occur in parallel, occur in a different order, or occur multiple times.

[0057] FIG. 7 illustrates an example process 700 of disassembling a wellhead assembly according to various embodiments of the present disclosure. For example, the process depicted in FIG. 6 could be performed on various embodiments of the wellhead assembly 200 illustrated in FIG. 200, or a combination of the casing head 300, the landing mandrel 400 and a plurality of load-bearing pins 500 illustrated in FIGS. 3-5. Certain embodiments may not be configured for the disassembly process 700 depicted in FIG. 7, for example embodiments where the load-bearing pins 500 include a wider front portion 505 and back portion 515 in order to not allow the load-bearing pin 500 to be removed.

[0058] In Operation 705, the plurality of load-bearing pins 500 are removed from the landing mandrel 400. In certain embodiments, springs or magnets on the inside of the casing head 205 around the through hole 315 may be removed, withdrawing the load-bearing pin 500 from its extended state. In another embodiment, the back end **515** of the load-bearing pin **500** may be reversibly rotated with a tool for rotating, such as a drill, a wrench, or a screwdriver, using the threads **530** of the load-bearing pin **500** to remove the load-bearing pin **500** from the through hole **315**.

[0059] In Operation **710**, the casing head **300** is removed from the landing mandrel **400** according to various embodiments of the present disclosure. The structure of the outside of the landing mandrel **400**, which includes a first diameter **405** and a second outer diameter **410**, allows the casing head **205** to be removed from the landing mandrel **400** when the plurality of load-bearing pins **500** are not inserted in the groove **420** through the through holes **315**.

[0060] In Operation **715**, the landing mandrel **400** is removed from the casing string **115** according to various embodiments of the present disclosure.

[0061] Although FIG. **7** illustrates and example process of assembling a wellhead assembly, various changes could be made to FIG. **7**. For example, while show as a series of steps, various steps in each figure could overlap, occur in parallel, occur in a different order, or occur multiple times.

[0062] The description in this patent document should not be read as implying that any particular element, step, or function is an essential or critical element that must be included in the claim scope. Also, none of the claims is intended to invoke 35 U.S.C. § 112(f) with respect to any of the appended claims or claim elements unless the exact words "means for" or "step for" are explicitly used in the particular claim, followed by a participle phrase identifying a function. Use of terms such as (but not limited to) "mechanism," "module," "device," "unit," "component," "element," "member," "apparatus," "machine," "system," "processor," "processing device," or "controller" within a claim is understood and intended to refer to structures known to those skilled in the relevant art, as further modified or enhanced by the features of the claims themselves, and is not intended to invoke 35 U.S.C. § 112(f).

[0063] It may be advantageous to set forth definitions of certain words and phrases used throughout this patent document. The terms "application" and "program" refer to one or more computer programs, software components, sets of instructions, procedures, functions, objects, classes, instances, related data, or a portion thereof adapted for implementation in a suitable computer code (including source code, object code, or executable code). The terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation. The term "or" is inclusive, meaning and/or. The phrase "associated with," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, have a relationship to or with, or the like. The phrase "at least one of," when used with a list of items, means that different combinations of one or more of the listed items may be used, and only one item in the list may be needed. For example, "at least one of: A, B, and C" or "at least one of: A, B, or C" includes any of the following combinations: A (alone); B (alone); and C (alone); A and B; A and C; B and C; and all three of A, B, and C.

[0064] While this disclosure has described certain embodiments and generally associated methods, alterations and permutations of these embodiments and methods will be apparent to those skilled in the art. Accordingly, the above description of example embodiments does not define or constrain this disclosure. Other changes, substitutions, and alterations are also possible without departing from the spirit and scope of this disclosure, as defined by the following claims.

What is claimed is:

1. A wellhead assembly, comprising:
a casing head coupled to a casing string;
a mandrel inserted into the casing head; and
a plurality of load-bearing pins configured to secure the casing head onto the mandrel.

2. The wellhead assembly of claim **1**, wherein the casing head and the mandrel create a shear force on each of the plurality of load-bearing pins.

3. The wellhead assembly of claim **1**, wherein the plurality of load-bearing pins are inserted at a downward angle.

4. The wellhead assembly of claim **1**, wherein:
a first load-bearing pin is inserted perpendicular to a fluid flow; and
a second load-bearing pin is inserted at a downward angle.

5. The wellhead assembly of claim **1**, wherein each of the load-bearing pins includes a notch to orient the load-bearing pins.

6. The wellhead assembly of claim **1**, wherein:
the casing head includes a plurality of through holes,
the mandrel includes a groove that aligns with the plurality of through holes, and
each of the load-bearing pins is inserted through a through hole into the groove.

7. The wellhead assembly of claim **6**, wherein the load-bearing pins are inserted into the groove to secure the mandrel once a production fluid is producing.

8. A system, comprising:
a casing string; and
a wellhead assembly, the wellhead assembly further comprising:
a casing head coupled to the casing string;
a mandrel inserted into the casing head; and a plurality of load-bearing pins configured to secure the casing head onto the mandrel.

9. The system of claim **8**, wherein the casing head and the mandrel create a shear force on each of the plurality of load-bearing pins.

10. The system of claim **8**, wherein the plurality of load-bearing pins are inserted at a downward angle.

11. The system of claim **8**, wherein:
a first load-bearing pin is inserted perpendicular to a fluid flow, and
a second load-bearing pin is inserted at a downward angle.

12. The system of claim **8**, wherein each of the load-bearing pins includes a notch to orient the load-bearing pins.

13. The system of claim **8**, wherein:
the casing head includes a plurality of through holes,
the mandrel includes a groove that aligns with the plurality of through holes, and
each of the load-bearing pins is inserted through a through hole into the groove.

14. The system of claim **13**, wherein the load-bearing pins are inserted into the groove to secure the mandrel once a production fluid is producing.

15. A method of assembling a wellhead, comprising:
coupling a casing head to a casing string;
inserting a mandrel into the casing head; and
securing the casing head onto the mandrel via a plurality of load-bearing pins.

16. The method of claim **15**, wherein the casing head and the mandrel create a shear force on each of the plurality of load-bearing pins.

17. The method of claim **15**, wherein the plurality of load-bearing pins are inserted at a downward angle.

18. The method of claim **15**, wherein:
a first load-bearing pin is inserted perpendicular to a fluid flow, and
a second load-bearing pin is inserted at a downward angle.

19. The method of claim **15**, wherein:
the casing head includes a plurality of through holes,
the mandrel includes a groove that aligns with the plurality of through holes, and
each of the load-bearing pins is inserted through a through hole into the groove.

20. The method of claim **19**, wherein the load-bearing pins are inserted into the groove to secure the mandrel once a production fluid is producing.

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