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(54) **TUBING HANGER CONNECTION**

(76) Inventors: **Jon B. Kahn**, Spring, TX (US); **David C. Baskett**, Houston, TX (US)

Correspondence Address:
HOWREY LLP
C/O IP DOCKETING DEPARTMENT
2941 FAIRVIEW PARK DRIVE, SUITE 200
FALLS CHURCH, VA 22042-7195 (US)

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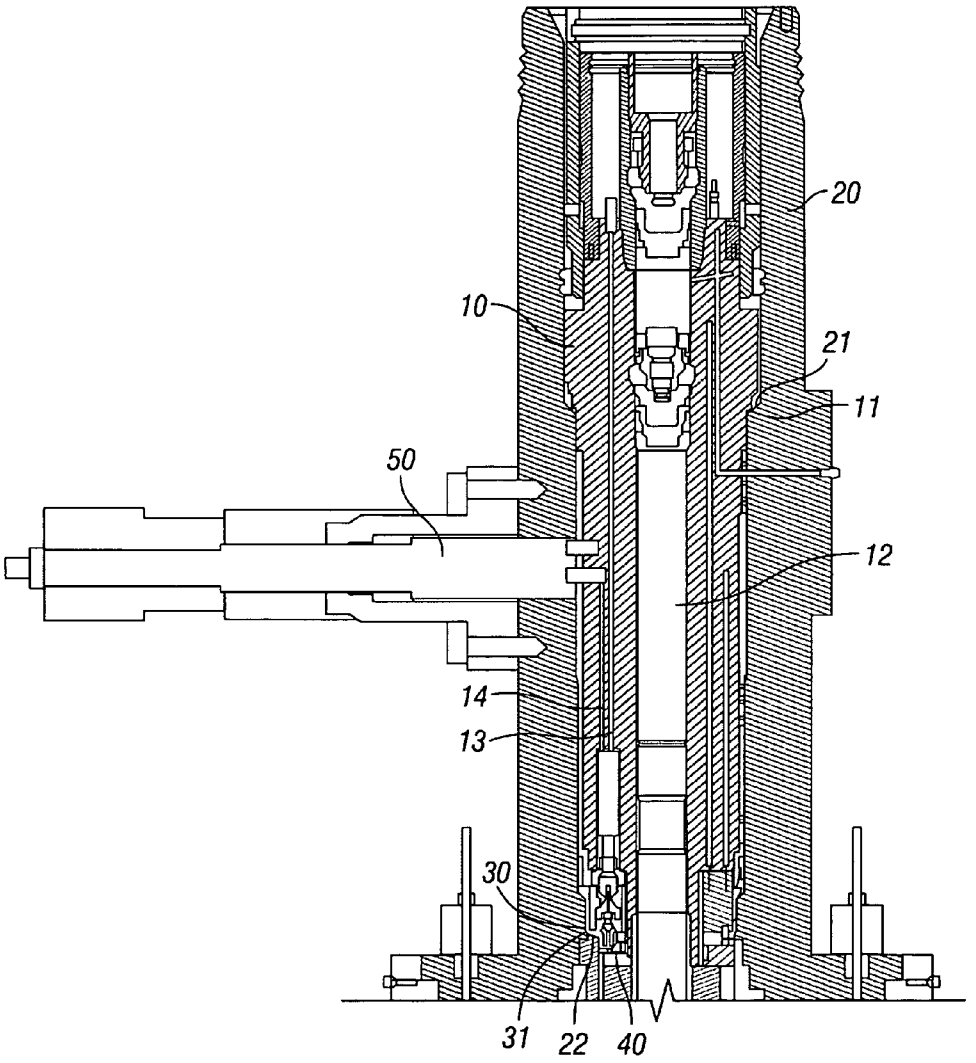
(57) **ABSTRACT**

Subsea oil and gas production methods and apparatus and, more particularly, a tubing hanger design for facilitating the control of downhole hydraulic and electrical controls while running the tubing hanger. The tubing hanger may include means for switching hydraulic and/or electrical controls to a side penetrator before the hanger is landed in a tree body. The hanger may include alignment means to ensure proper positioning of hanger prior to landing in a casing. The present disclosure of a method of soft landing a tubing hanger to provide better control prior to landing in the tree body.



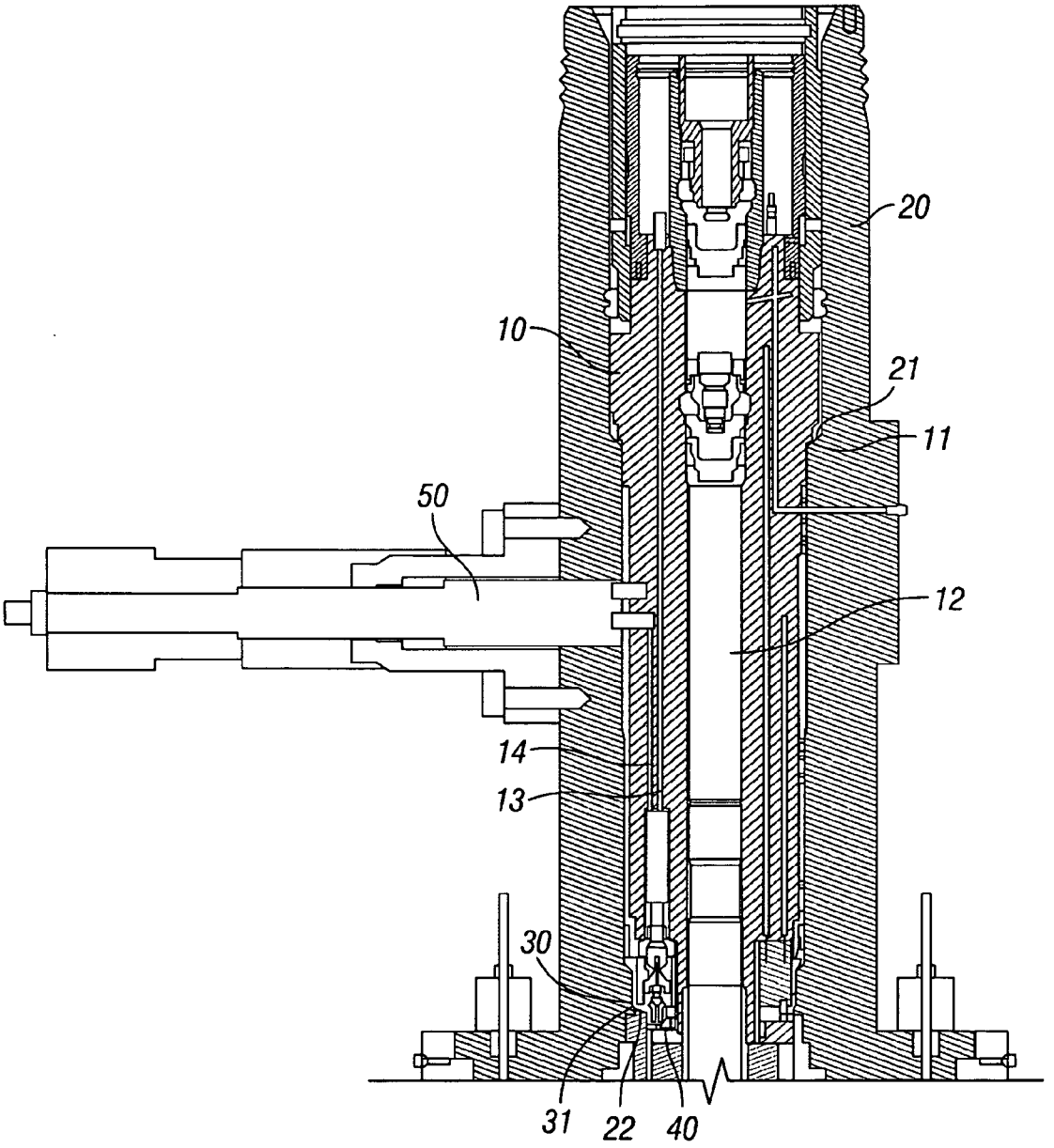


FIG. 1

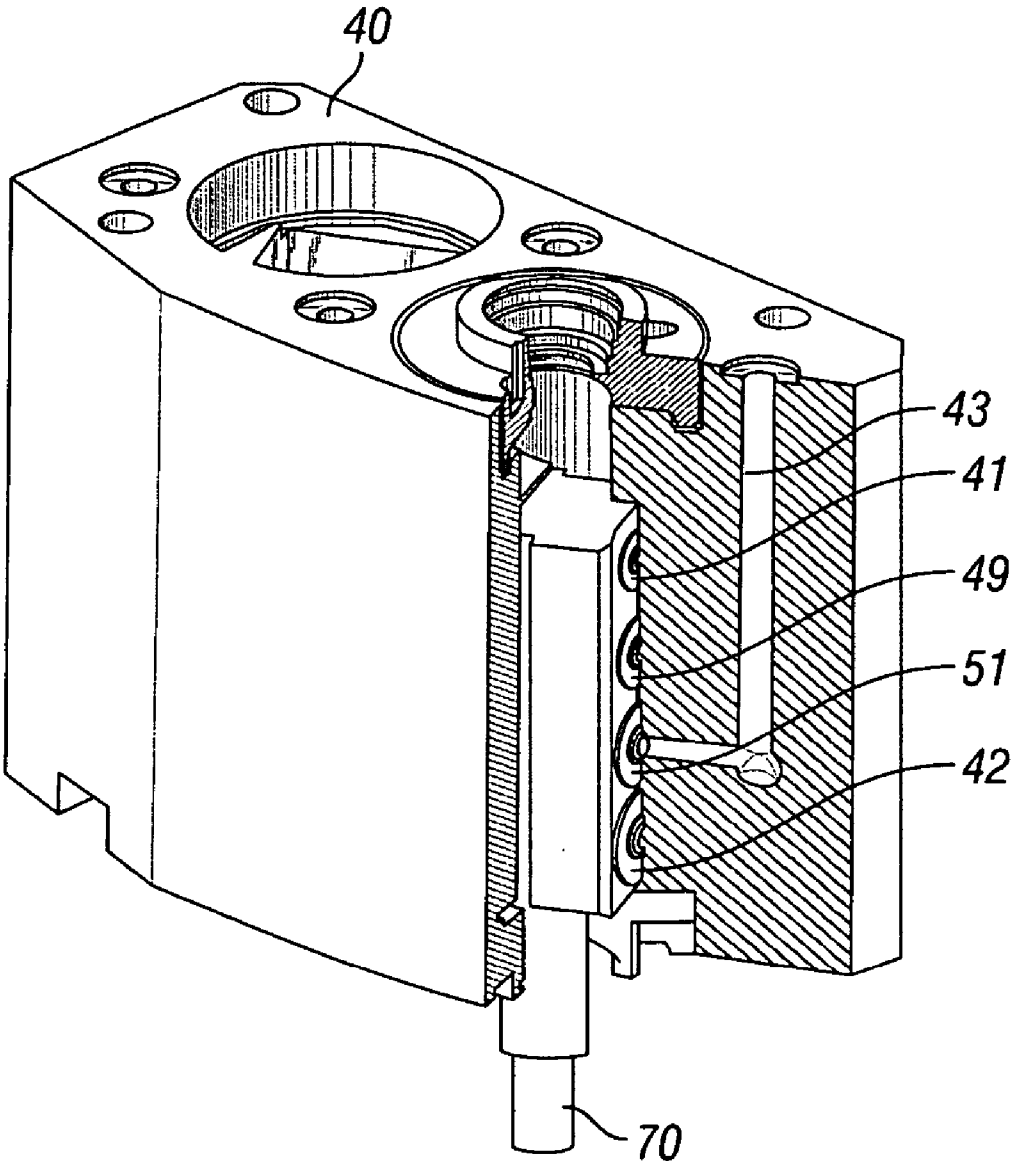
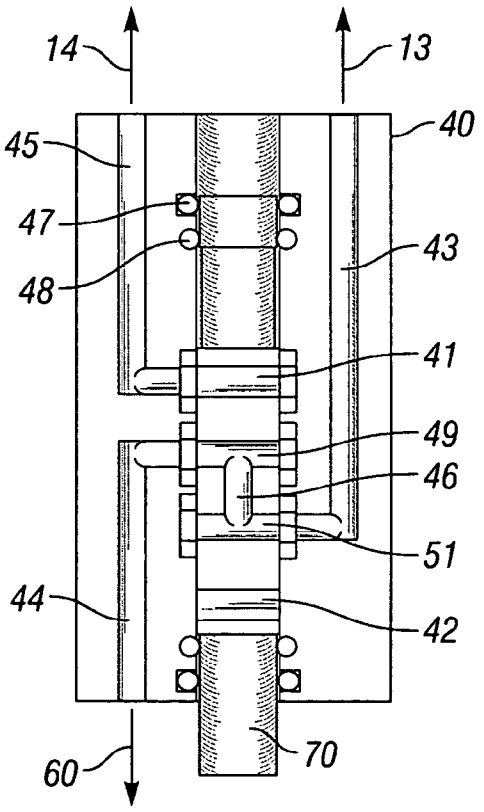


FIG. 2


14
13
40
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47
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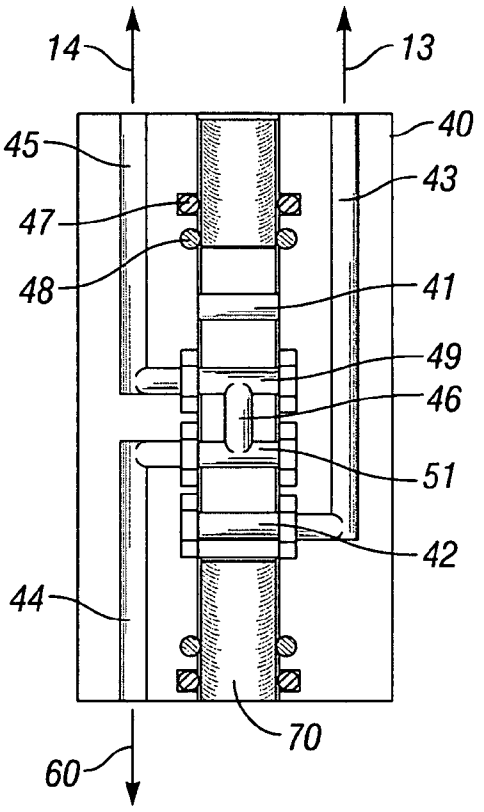
60

FIG. 3A


14
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70
60

FIG. 3B

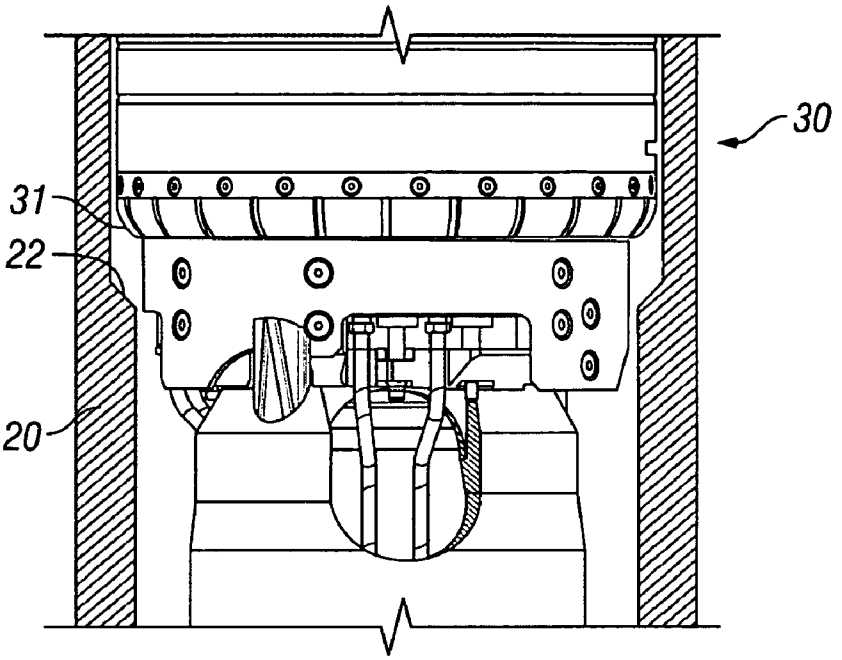

FIG. 4A

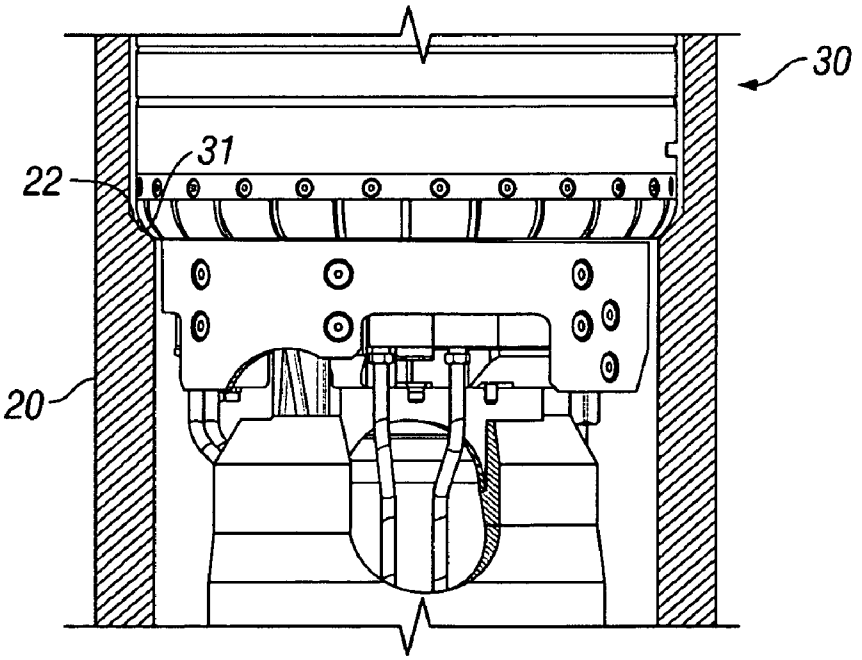

FIG. 4B

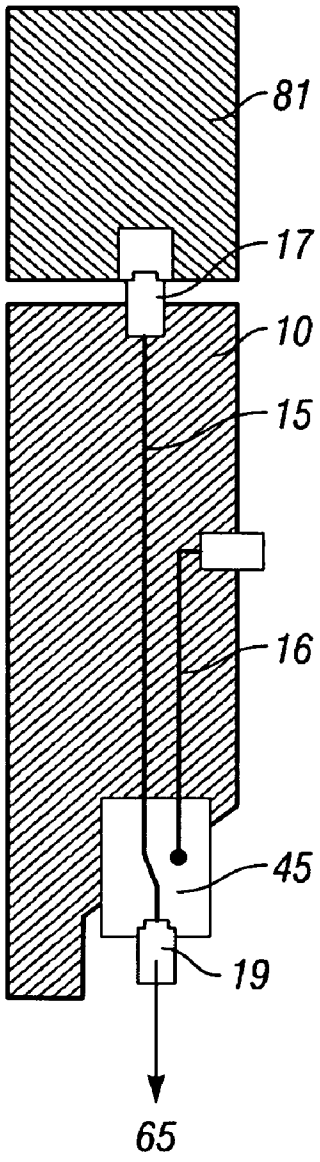

FIG. 5A

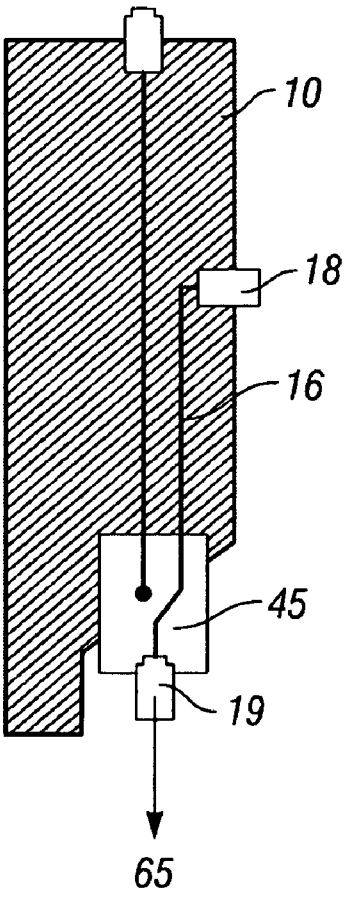

FIG. 5B

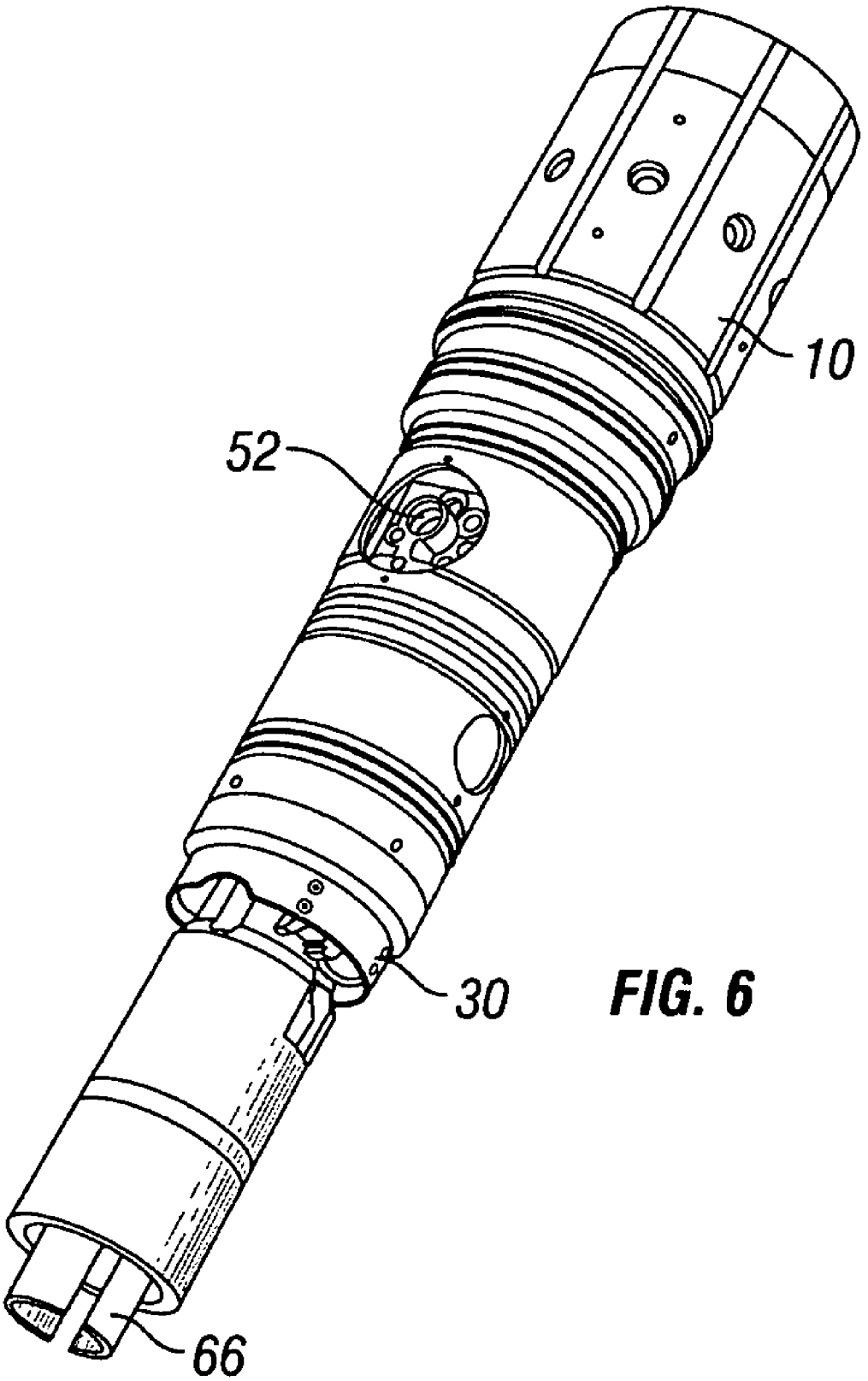

FIG. 6

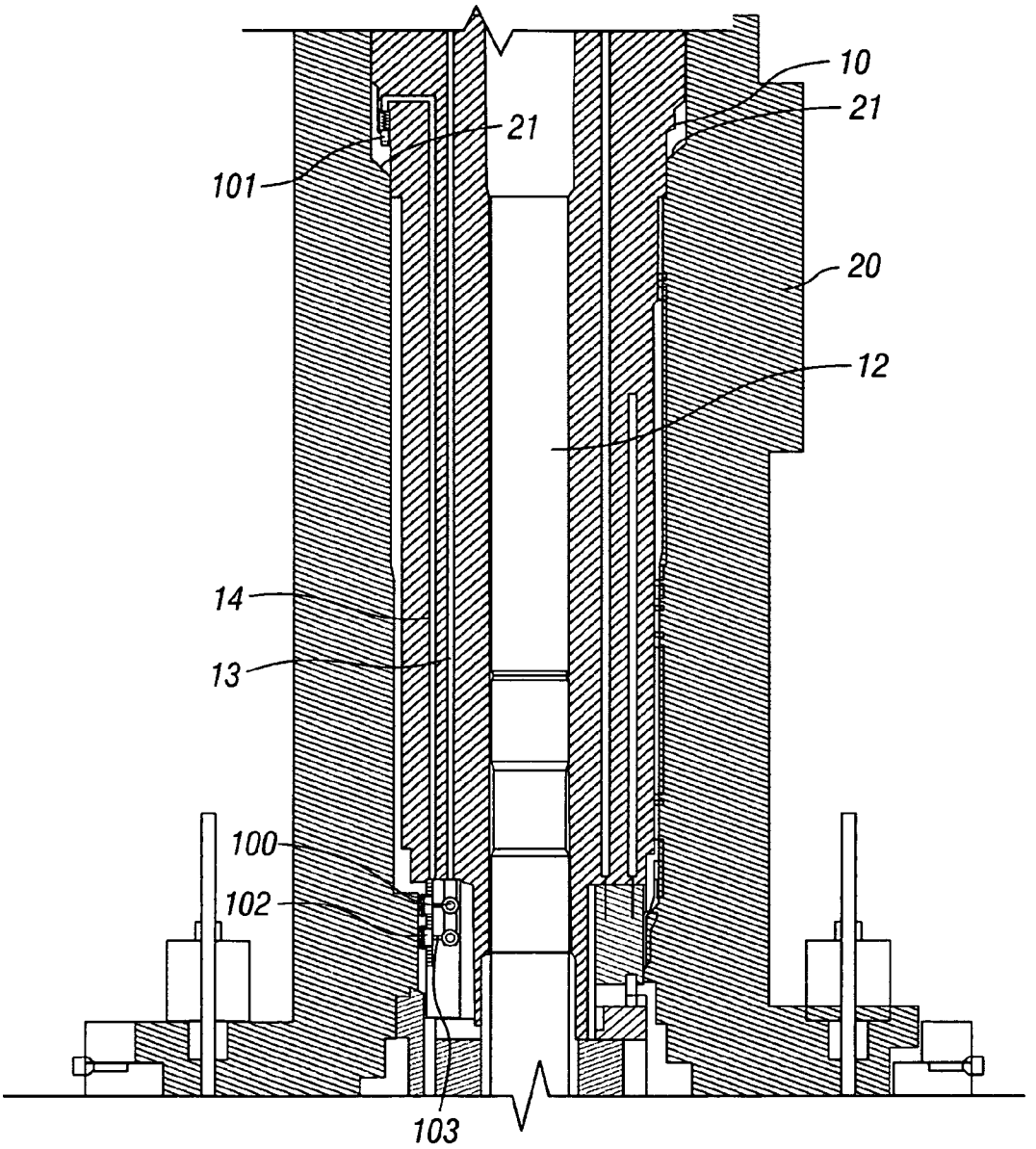

FIG. 7

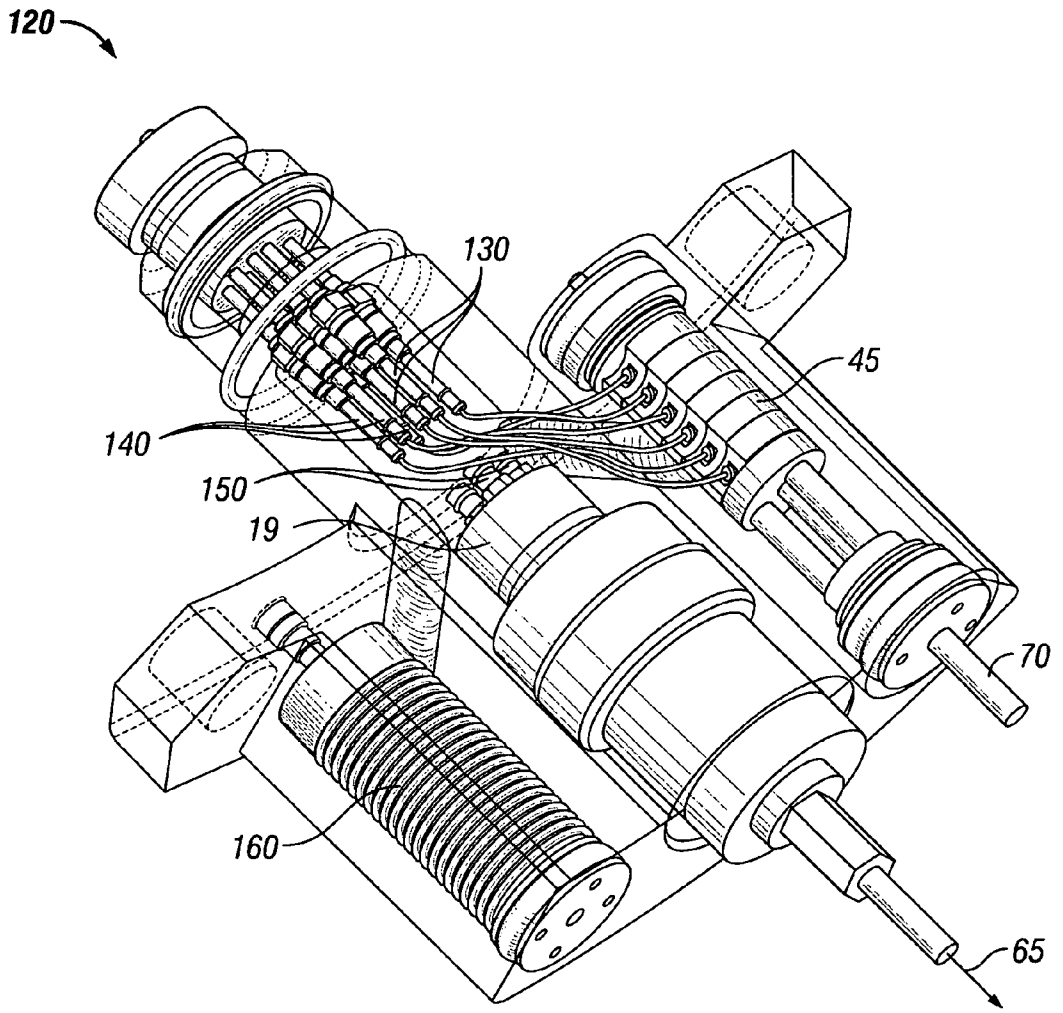

FIG. 8

TUBING HANGER CONNECTION

TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates generally to subsea oil and gas production methods and apparatus and, more particularly, to a tubing hanger design for facilitating the control of downhole hydraulic and electrical functions while running the hanger.

BACKGROUND AND OBJECTS OF THE INVENTION

[0002] In subsea oil and gas production it is critical to control and/or monitor downhole functions and conditions at all times if possible. These downhole functions and conditions include, for example, controlling safety valves, monitoring temperature, monitoring pressure, injecting chemicals, actuating a sleeve, and controlling downhole tools, but would include any downhole function or condition that would be appreciated by one of ordinary skill in the art having the benefit of this disclosure. In the past, control and/or monitoring of downhole hydraulic functions were not possible while running a tubing hanger into a downhole housing, such as a well casing, spool, or tree body, for example. Instead, control was interrupted by the running procedure and resumed after the hanger was landed in the housing. If a downhole problem existed while running the hanger, such a problem, which may require the removal of the hanger, could not be detected until after landing the hanger. This could increase the cost and complexity of the operation. Similarly, the control and monitoring of electrical functions has not been possible while running a tubing hanger into a downhole housing.

[0003] A critical issue in the landing of a hanger in a downhole housing is the proper alignment of downhole connections with corresponding hanger connections. This problem often causes substantial time and expense to manipulate the running tool to properly align the hanger.

[0004] The present invention provides for the monitoring and controlling of downhole functions, both electrical and hydraulic, while running the hanger. If necessary to address a problem, the hanger can be withdrawn before landing. The present invention also provides for improved alignment of the hanger with downhole hydraulic and electrical systems.

SUMMARY OF THE INVENTION

[0005] In accordance with the present disclosure, the above disclosed disadvantages may be overcome with a system comprising a housing having upper and lower landing seats, a hanger which is run into the housing, the hanger having a landing shoulder, which lands on the upper landing seat of the housing, an axial bore, a first annulus bore, and a second annulus bore. As used herein, housing may be utilized interchangeably with well casing, spool, tree body, and the like, and each term is to be given its ordinary meaning. A sleeve may be connected to the hanger, the sleeve having a landing shoulder that lands on the lower landing seat of the housing actuating a valve in the hanger from a first position to a second position. The first annulus bore may be in hydraulic communication with the surface while the hanger is lowered into the housing.

[0006] In some embodiments, the valve hydraulically connects the first annulus bore of the hanger with the downhole hydraulic functions while closing off the second annulus bore of the hanger when the valve is in the first position. When in the second position, the valve may hydraulically close off the first annulus bore of the hanger and hydraulically connect the second annulus bore of the hanger with the downhole hydraulic functions. Additionally, the valve may be move to a third position. In the third position, the valve may hydraulically close off both the first and second annulus bores. Further, downhole hydraulic functions may be connected and/or controlled at the surface through the first annulus bore. Additionally, this embodiment may include a side penetrator in communication with the surface, which connects to the second annulus bore of the hanger. The housing may be a tree body or a wellhead casing, for example. The sleeve may be circular and connected externally to the hanger. Further, the sleeve may be disposed at or near the bottom of the hanger and the size of the sleeve may be adjustable. The sleeve may include a push rod that contacts the lower landing seat to move the sleeve from a first position to a second position. The sleeve may land on the lower landing seat before the hanger lands on the upper landing seat.

[0007] In one embodiment the valve consists of a gate valve. In yet another embodiment the valve consists of a ball valve. In yet another embodiment the valve may be a one-way valve wherein both the first and second annuluses are connected to downhole functions while the hanger is ran into the casing. Upon landing or shortly before, the side penetrator may be hydraulically connected to the second annulus and the one-way valve may hydraulically close off the first annulus so downhole control is connected to the side penetrator via the second annulus. Various valves for controlling the fluid flow through the first and second annulus may be utilized as would be realized by one of ordinary skill in the art having the benefit of this disclosure. Further, the valve may have at least a third position to which it could be actuated.

[0008] In some embodiments, the housing may consist of a tree body, but in other embodiments the housing may be a wellhead casing, for example. The valve could be actuated by a cylindrical sleeve connected to the bottom exterior of a tubing hanger. However, various other means for actuating the valve may be utilized as would be realized by one of ordinary skill in the art having the benefit of this disclosure such as a hydraulic piston or push rod, for example. The sleeve may include a push rod that contacts the lower landing seat. In some embodiments, the sleeve may be adjustable to attach to various sizes of hangers as well as compensate for manufacturing buildup.

[0009] In one embodiment of the present disclosure, a method for monitoring downhole functions in a well is provided. The method may comprise running a tubing hanger into the well, the tubing hanger having a production bore, a first annulus bore fluidly connected to the downhole functions, and a second annulus bore. The method may include monitoring downhole functions through the first annulus bore. Further, the method may include establishing a fluid connection to the second annulus bore and actuating a valve to close the first annulus bore. Additionally, the step may include monitoring the downhole functions through the second annulus bore. In some embodiments, the method further includes landing the tubing hanger into the wellhead casing. The tubing hanger may be “soft landed” into the

wellhead casing before actuating the valve. The method may also include removing the tubing hanger if a problem is detected downhole.

[0010] In an embodiment of the disclosure, a tubing hanger is run into a tree body with a cylindrical sleeve surrounding the lower end of the tubing hanger. The cylindrical sleeve may include a shoulder or push rod that lands on the lower landing seat of the tree body before the tubing hanger shoulder lands onto the upper landing seat of the tree body. The landing of the sleeve onto the lower seat actuates a valve from a first position to a second position, which moves downhole control from the first annulus bore to the second annulus bore through the side penetrator. In an alternative embodiment, the tubing hanger may be "soft landed" before the sleeve lands on the lower landing seat of the tree body. The tree body and tubing hanger may be designed to trap fluid between the upper landing seat and landing shoulder of the tubing hanger as the tubing hanger approaches the upper landing seat. The tubing hanger "soft lands" on the trapped fluid between the upper landing seat and the landing shoulder as the fluid is substantially incompressible. The trapped fluid may be slowly bled off to gradually descend the tubing hanger until the sleeve shoulder lands on the lower landing seat actuating the valve and switching downhole control through the second annulus bore and side penetrator. The use of a "soft landing" and the bleeding off of the trapped fluid may provide more control while landing the tubing hanger.

[0011] Some embodiments include running a hanger into a well casing. However, in other embodiments the hanger could be a tubing hanger and the casing could be a tree, tree body, or simply be the wellhead.

[0012] In one embodiment, the disclosure is a system for controlling downhole hydraulic functions while running a hanger that comprises, a casing, a hanger having a production bore and two annulus bores, a side penetrator, a valve, and means for actuating the valve to open one annulus bore to communicate downhole while closing off other annulus bore.

[0013] An embodiment of the present disclosure is an apparatus for use in a subsea well that includes a wellhead bore, at least one casing hanger supported in the wellhead for supporting a hanger, and a hydraulic control line. The apparatus may include a hanger having a landing shoulder, a production bore, a first annulus bore and a second annulus bore. The apparatus may further include a side penetrator connectable to the second annulus bore of the hanger. A valve may be connectable to the hydraulic control line and both the first and second annulus bores of the hanger. The apparatus may include means for actuating the valve from a first position, wherein the valve provides a flowpath between the first annulus bore and the hydraulic control line, and a second position, wherein the valve provides a flowpath between the second annulus bore and the hydraulic control line. In some embodiments, the hanger may be a tubing hanger. Further, the valve may be a gate valve, a ball valve, or a one-way valve. The first annulus bore of the hanger may extend generally longitudinally through the hanger. The means for actuating the valve may comprise a movable sleeve connected to the exterior of the hanger, a push rod, a hydraulic piston, or other means as would be appreciated by one of ordinary skill in the art having the benefit of this disclosure. The means for actuating the valve may further comprise means for actuating the valve before the hanger had landed onto the casing hanger. The bottom of the hanger may include an alignment structure.

[0014] Another embodiment of the present disclosure is a method of moving fluid through a wellhead by running a tubing hanger into the wellhead casing. The tubing hanger may contain a production bore, a first annulus bore connected downhole, and a second annulus bore. Fluid may be moved downhole through the first annulus bore. The embodiment may include connecting a side penetrator to the second annulus bore and actuating a valve that closes off the first annulus bore from downhole while fluidly connecting the second annulus bore to downhole, thus fluid may be moved downhole through the side penetrator via the second annulus bore. The embodiment may include landing the tubing hanger onto the wellhead casing.

[0015] One alternative embodiment of the disclosure is a tubing hanger comprising a production bore and a first annulus conduit that extends generally longitudinally through the tubing hanger, wherein the first annulus conduit is connectable at one end to a running tool connection and is connectable at the other end to a downhole well connection. The tubing hanger may include a second annulus conduit that intersects the first annulus conduit and extends generally laterally through the tubing hanger to a port for a side penetrator. Fiber optics may be inserted into the first annulus conduit and at the intersection of the first and second conduits a portion of the fiber optics may extend into the remainder of the first annulus conduit while the rest of the fiber optics extends into the second annulus conduit. As the tubing hanger is lowered into a casing the fiber optics in the first annulus conduit may be connected to downhole functions and may be used to control or monitor downhole functions. The fiber optics in the second annulus conduit may be connected to a side penetrator shortly before or after the hanger has landed within the casing. Once the side penetrator has been connected to the fiber optics the side penetrator can be used to monitor or control the downhole functions.

[0016] Another embodiment of the disclosure comprises a hanger having a production bore and multiple annulus bores, each filled with fluid, and a push rod located at the bottom of the hanger corresponding to each annulus bore. The push rods located at the bottom of the hanger may be spring loaded. While the hanger is run into the casing, a valve in each annulus bore closes the fluid path that if open would flow out of connections on the bottom of the hanger. When each push rod lands on a lower landing shoulder of a casing, the spring is compressed and the rods move upward compressing the fluid contained in each annulus bore. The compressed fluid actuates the valve contained in each annulus bore completing the fluid path to a corresponding downhole hydraulic control line. In some embodiments, the compressed fluid moves a cylinder, which actuates the valve. The cylinder may cause the rotation of a pinion, which actuate the valve. The hanger may include multiple annuluses spread around its perimeter.

[0017] In one embodiment, the inventions comprises a well assembly comprising a casing having upper and lower landing seats, a hanger which is run into the casing, the hanger having a landing shoulder, which lands on the upper

landing seat of the casing, a production bore, a first electrical annulus conduit, and a second electrical annulus conduit, wherein the first annulus bore is in connected to the surface while the hanger is ran into the casing. Further, downhole electrical functions are also connected and controlled through the first annulus bore. Additionally, this embodiment comprises a side penetrator, which is in communication with the surface and connects to the second electrical annulus conduit of the hanger. A sleeve may be connected to the outside of the hanger, the sleeve having a landing shoulder that lands on the lower landing seat of the casing. The landing of the sleeve move the sleeve up the hanger and actuates a switch from a first position to a second position; the first position of the switch connects the first electrical annulus conduit with the downhole electrical functions and disconnects the second electrical annulus conduit; the second switch position disconnects first electrical annulus conduit and connects the second electrical annulus conduit with the downhole electrical functions.

[0018] Another embodiment of the present disclosure is the presence of an alignment structure on the bottom of the tubing hanger. The alignment structure will only mate with the downhole mating connection such that the tubing hanger hydraulic and/or electrical connectors are properly aligned with corresponding downhole connectors.

[0019] These and other objects and advantages of the present invention will be made apparent from the following detailed description, with reference to the accompanying drawings. In the drawings, the same reference numbers are used to denote similar components in the various embodiments.

BRIEF DESCRIPTION OF THE DRAWING

[0020] The following figures form part of the present specification and are included to further demonstrate certain aspects of the present invention. The invention may be better understood by reference to one or more of these figures in combination with the detailed description of specific embodiments presented herein.

[0021] FIG. **1** is a cross section of a tubing hanger landed in a tree body in accordance with and a one aspect of the present disclosure.

[0022] FIG. **2** is one embodiment of a gate valve that may be connected to a first annulus bore and a second annulus bore in a tubing hanger.

[0023] FIG. **3**A is a schematic of a valve assembly shown while a hanger is being lowered into a housing.

[0024] FIG. **3**B is a schematic of a valve assembly shown after a hanger sleeve has landed onto the lower seat of a housing.

[0025] FIG. **4**A depicts the hanger sleeve in the lower position while the hanger is being lowered into a housing.

[0026] FIG. **4**B depicts the hanger sleeve landed on the lower landing seat of a housing.

[0027] FIG. **5**A depicts a schematic of the system used to monitor or control downhole electrical functions while running a hanger.

[0028] FIG. **5**B depicts a schematic of the system used to monitor or control downhole electrical functions through a side penetrator after a hanger sleeve has landed onto a lower landing seat of a housing.

[0029] FIG. **6** depicts the lower end of a hanger having a valve unit with the actuating means, side penetrator connection, and alignment key.

[0030] FIG. **7** depicts an embodiment of a tubing hanger design of the present disclosure.

[0031] FIG. **8** is an electrical switch block illustrating one possible embodiment of the present disclosure.

[0032] While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. It should be understood, however, that the description herein of specific embodiments is not intended to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the scope of the invention as defined by the appended claims.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0033] Illustrative embodiments of the invention are described below as they might be employed in the use of designs for a hanger or methods of running a hanger into a casing. In the interest of clarity, not all features of an actual implementation are described in this specification. It will of course be appreciated that in the development of any such actual embodiment, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill in the art having the benefit of this disclosure. Further aspects and advantages of the various embodiments of the invention will become apparent from consideration of the following description and drawings.

[0034] Further aspects and advantages of the various embodiments of the invention will become apparent from consideration of the following description and drawings.

[0035] In the preferred and illustrated embodiment, as shown in FIG. **1**, a tubing hanger **10** is run into a tree body **20** and a cylindrical sleeve **30** surrounds the lower end of the tubing hanger **10**. (Although the tubing hanger **10** is shown landed in a tree body, the invention applies to running a hanger into any devices in which hangers are landed and downhole devices are required to be controlled, such as spools, wellheads, etc.) The tubing hanger **10** has a landing shoulder **11**, which lands on the upper landing seat **21** of the tree body **20**. The tubing hanger also has an axial bore **12**, a first annulus bore **13**, and a second annulus bore **14**, wherein the first annulus bore **13** is in communication with the surface while the tubing hanger **10** is ran into the tree body **20**. The axial bore **12** may allow flow of hydrocarbon production (e.g., a "production bore") in some applications. The cylindrical sleeve **30** has a shoulder **31**, which lands on the lower landing seat **22** of the tree body **20** before the tubing hanger landing shoulder **11** lands onto the upper landing seat **21** of the tree body **20**. The landing of the sleeve **30** onto the lower landing seat **22** actuates a valve **40** from a first position to a second position, which moves downhole

control from the first annulus bore **13** to the second annulus bore **14** through the side penetrator **50**. The tubing hanger **10** may be soft landed into the casing by trapping fluid between the tubing hanger **10** and the tree body **20**. The fluid is substantially incompressible, thus allowing the tubing hanger **10** to land or rest on the trapped fluid. The fluid can then be slowly bled off gradually lowering tubing hanger **10** until sleeve **30** lands onto landing seat **22** and finally until the tubing hanger **10** lands onto the tree body **20** at the upper landing seat **21**.

[**0036**] FIGS. **2**, **3**A, and **3**B illustrate one embodiment of valve **40** that may be used to connect a tubing annulus with downhole hydraulic functions while closing off another tubing annulus. Specifically, the first annulus bore **13** connects to gate valve fluid path **43**, downhole hydraulic functions are connected to gate valve fluid path **44**, and the second annulus bore **14** is connected to gate valve fluid path **45**. As shown, gate valve **40** contains gates **41**, **42**, **49**, and **51**. Further, gates **49** and **51** are connected via gate fluid path **46**. While the hanger **10** (not shown) is being run into a housing, gate valve **40** is in a first position (as shown in FIG. **3**A) in which the first annulus bore **13**, in communication with the surface, is connected through to downhole hydraulic functions **60** through fluid path **43**, gate **51**, fluid path **46**, gate **49**, and fluid path **44**. While in the first position, second annulus bore **14** connected to path **45** is closed off by gate **41**.

[**0037**] In one embodiment, a push rod **70** actuates the gate valve when the push rod **70** lands on a shoulder in the casing. FIG. **3**B depicts the second position of the gate valve **40** after the push rod **70** has landed and actuated the gate valve **40**. In the second position, the second annulus bore **14** is connected to downhole hydraulic functions **60** through fluid path **45**, gate **49**, fluid path **46**, gate **51**, and fluid path **44** while the first annulus bore **13** connected to fluid path **43** is closed off by gate **42**. The gate valve uses seals **47** to prevent fluid leakage and bearings **48** to facilitate movement.

[**0038**] In another embodiment of the invention, a valve **40** is connected to both first annulus bore **13** and second annulus bore **14**. The valve **40** is actuated by a cylindrical sleeve **30** connected to the end of a hanger. FIG. **4**A depicts the sleeve **30**, which may be used in such an embodiment with the sleeve, in the "down" position, which is the position of the sleeve while running the hanger into a housing **20**. FIG. **4**B depicts the sleeve **30** in the "up" position which occurs after the shoulder **31** lands onto the lower landing seat **22** of the housing **20**. The movement of the sleeve **30** to the "up" position may actuate a valve **40** (not shown), electrical switch **80** (not shown), or other function as would be appreciated by one of ordinary skill in the art having the benefit of this disclosure. The sleeve **30** may be adapted to accommodate hangers of various sizes. Further, the sleeve **30** may be adjustable to adapt to manufacturing variations between sleeves of the same design.

[**0039**] As depicted schematically in FIG. **5**A, while running a hanger **10** into a casing **20** (not shown), downhole electrical functions **65** are controlled at the surface via a running tool **81** and electrical connection **17** that is connected to a first electrical annulus **15** in hanger **10**, which is connected to downhole electrical functions **65** through an electrical switch block **45** and electrical connection **19**. FIG. **5**B depicts the control of downhole electrical functions **65** after the landing of a sleeve **30** (not pictured) has actuated the electrical switch block **45** connected electrically to downhole electrical functions **65** though electrical connection **19**. As would be appreciated by one of ordinary skill in the art having the benefit of this discloser, the electrical switch block **45** could be actuated by other means such as a push rod, for example. Once actuated, the electrical switch block **45** connects downhole electrical functions **65** with a second electrical annulus **16** in hanger **10**. The downhole electrical functions **65** are controlled through a side penetrator **50** (not shown), which is electrically connected to the second electrical annulus **16** though electrical connection **18**.

[**0040**] As depicted in FIG. **6**, in one embodiment the lower end of hanger **10** has a cylindrical sleeve **30** that actuates valve **40** (not shown) and also has connection **52** where the side penetrator **50** (not shown) connects to the second annulus **14** (not shown). Further, the lower end of hanger **10** may include an alignment key **66**. The configuration of the alignment key **66** may correspond to the downhole connection ensuring proper alignment of the hanger **10** and corresponding downhole connections. For example, in the embodiment shown the downhole connection may include a structure adapted to slide into the two slots of alignment key **66**. In order to land the hanger **10**, the hanger **10** may be rotated about its longitudinal access until the alignment key **66** and the downhole connection are properly aligned. The alignment key **66** depicted in FIG. **6** is a simple configuration that would allow the proper alignment of the tubing hanger. However, the alignment key **66** and corresponding structure of the downhole connection could be modified as would be appreciated by one of ordinary skill in the art having the benefit of this disclosure.

[**0041**] In another embodiment of the invention depicted in FIG. **7**, the hanger **10** has an annulus **13** and an annulus **14** both, which contain fluid as the hanger is, ran into the casing **20**. Hanger **10** contains valve **100** that is in fluid communication with both annulus **13** and the downhole hydraulic controls. Valve **100** closes off the fluid path between annulus **13** and downhole hydraulic controls while the hanger **10** is lowered into casing **20**. Upon landing on shoulder **21**, push rod **101** compresses the fluid contained in annulus **14**. The compression of fluid in annulus **14** causes piston **102** to move, rotating pinion **103**, which actuates valve **100** opening the fluid flow path between annulus **13** and the downhole hydraulic controls. The valve **100** may be actuated by a pinion **103** as shown in FIG. **7** or any other suitable means as would be realized by one of ordinary skill in the art having the benefit of this disclosure. The hanger **10** may include a plurality of annuluses, such as **13** and **14**, located around the perimeter to connect to various downhole connections.

[**0042**] Alternatively, the embodiment depicted in FIG. **7** could be applied to an electrical switch block contained within a hanger. Upon landing on the shoulder **21**, push rod **101** compresses the fluid contained in annulus **14** causing piston **102** to move, rotating the pinion **103**. Pinion **103** could actuate an electrical switch block (not shown) electrically connecting electrical connections in the hanger to downhole electrical functions and controls. The electrical switch block may be actuated by a pinion **103**, as shown in FIG. **7**, or any other suitable means as would be realized by one of ordinary skill in the art having the benefit of this

disclosure. Further, the hanger **10** may include a plurality of electrical conduits to connect to various downhole electrical functions and controls.

[**0043**] One alternative embodiment of the disclosure is a tubing hanger comprising a production bore and a first annulus conduit that extends generally longitudinally through the tubing hanger, wherein the first annulus conduit is connectable at one end to a running tool connection and is connectable at the other end to a downhole well connection. The tubing hanger may include a second annulus conduit that intersects the first annulus conduit and extends generally laterally through the tubing hanger to a port for a side penetrator. Fiber optics may be inserted into the first annulus conduit and at the intersection of the first and second conduits a portion of the fiber optics may extend into the remainder of the first annulus conduit while the rest of the fiber optics extends into the second annulus conduit. As the tubing hanger is lowered into a casing the fiber optics in the first annulus conduit may be connected to downhole functions and may be used to control or monitor downhole functions. The fiber optics in the second annulus conduit may be connected to a side penetrator shortly before or after the hanger has landed within the casing. Once the side penetrator has been connected to the fiber optics the side penetrator can be used to monitor or control the downhole functions.

[**0044**] FIG. **8** illustrates one possible embodiment of an electrical switch block **120** that may be used in a hanger **10** (not pictured) to switch downhole electrical monitoring and/or control from a first annulus connected to the surface via a running tool to a second annulus connected to the surface via a side penetrator. The electrical switch box **120** is connected to downhole electrical functions **65** through connector **19** and downhole electrical wires **150** (although not shown connected to electrical switch box **120**). In the figure shown, three of the electrical wires **130** are fed through the first annulus conduit **15** (not shown) while the other three electrical wires **140** are fed through second annulus conduit **16** (not shown). All six of the up hole electrical wires **130**, **140** are connected to switch block **45** as are the three down hole electrical wires **150** (connection not shown). While the hanger **10** is being lowered into the casing, the three electrical wires **130**, connected to the surface via first annulus conduit **15**, are connected to the downhole electrical wires **150** through switch block **45**. As the hanger **10** (not pictured) descends into the casing, push rod **70** lands on the lower landing seat moving the push rod **70** up and actuating the switch block **45**. Upon actuation, switch block **45** connects the downhole wires **150** to electrical wires **140**, which connect to the side penetrator via the second annulus conduit **16**. As shown in FIG. **8**, the electrical switch box **120** may include a pressure ballast **160** to prevent drastic pressure changes within the electrical switch box **120**. The number of wires and elements contain in an electrical switch box may be varied as would be realized by one of ordinary skill in the art having the benefit of this disclosure.

[**0045**] While the invention has been described with reference to the preferred embodiments, obvious modifications and alterations are possible by those skilled in the related art. Therefore, it is intended that the invention include all such modifications and alterations to the full extent that they come within the scope of the following claims or the equivalents thereof.

What is claimed is:

1. A system for controlling downhole well functions while running and landing a hanger, the system comprising:

a housing having an upper landing seat and lower landing seat;

a hanger disposed within the housing wherein the hanger includes a landing shoulder, an axial bore, a first annulus bore in communication with the surface, and a second annulus bore;

wherein the hanger landing shoulder lands on the upper landing seat;

a sleeve connected to the hanger, the sleeve having a landing shoulder positioned to land on the lower landing seat of the housing and to move from a first position to a second position; and

a valve connected hydraulically to both the first annulus bore and second annulus bore wherein the movement of the sleeve from the first position to the second position actuates the valve from a first position to a second position to effect downhole well control.

2. The system of claim 1, wherein the housing is a tree body.

3. The system of claim 1, wherein the housing is a wellhead casing.

4. The system of claim 1, wherein the valve is a gate valve.

5. The system of claim 1, wherein the valve is a ball valve.

6. The system of claim 1, wherein the system further comprises a side penetrator in communication with the surface that connects to the second annulus in the hanger.

7. The system of claim 1, wherein downhole functions are connected to the first annulus bore.

8. The system of claim 7, wherein the first position of the valve connects the first annulus bore with the downhole controls and the second annulus bore is closed and the second position of the valve closes off the first annulus bore and connects the second annulus bore with the downhole controls.

9. The system of claim 1, wherein the sleeve may be moved to at least a third position.

10. The system of claim 1, wherein the sleeve is a circular sleeve external to the hanger.

11. The system of claim 10, wherein the sleeve is disposed at or near the bottom of the hanger.

12. The system of claim 11, wherein the size of the sleeve is adjustable.

13. The system of claim 11, wherein the sleeve contains a push rod that contacts the lower landing seat and moves the sleeve from the first position to the second position.

14. The system of claim 1, wherein the sleeve lands on the lower landing seat before the hanger landing shoulder lands on the upper landing seat.

15. An apparatus for use in a subsea well including a wellhead housing having a wellhead bore, at least one casing hanger supported within the wellhead for supporting a hanger, and a hydraulic control line wherein said apparatus comprises:

the hanger having a landing shoulder, a production bore, a first annulus bore and a second annulus bore;

a side penetrator connectable to the second annulus in the hanger;

a valve connectable to the hydraulic control line and both the first annulus bore and second annulus bore;

means for actuating the valve from a first position to a second position;

wherein the first position of the valve provides a flowpath between the first annulus bore and the hydraulic control line; and

wherein the second position of the valve provides a flowpath between the second annulus bore and the hydraulic control line.

16. The apparatus of claim 15, wherein the hanger is a tubing hanger.

17. The apparatus of claim 15, wherein the valve is a gate valve.

18. The apparatus of claim 15, wherein the valve is a ball valve.

19. The apparatus of claim 15, wherein the first annulus bore extends generally longitudinally through the hanger.

20. The apparatus of claim 15, wherein the means for actuating the valve further comprises means for actuating the valve before the hanger lands onto the casing hanger.

21. The apparatus of claim 15, wherein the valve is a one-way valve that in the first position also provides a flowpath between the second annulus bore and the hydraulic control line.

22. The apparatus of claim 21, wherein the valve in the second position closes the flowpath between the first annulus bore and the hydraulic control line.

23. The apparatus of claim 15, wherein the means for actuating the valve comprises a movable sleeve connected to the outside of the hanger.

24. The apparatus of claim 15, wherein the means for actuating the valve comprises a push rod.

25. The apparatus of claim 15, where the means for actuating the valve comprises a hydraulic piston.

26. The apparatus of claim 15, wherein the bottom of the tubing hanger comprises an alignment structure.

27. The method of monitoring downhole functions in a well which comprises:

running a tubing hanger into the well, the tubing hanger having a production bore, a first annulus bore fluidly connected to the downhole functions, and a second annulus bore;

monitoring downhole functions via the first annulus bore;

establishing a fluid connection to the second annulus bore;

actuating a valve to close the first annulus bore; and

monitoring downhole functions through the second annulus bore.

28. The method of claim 27, further comprising landing the tubing hanger into the wellhead casing.

29. The method of claim 27, further comprising soft landing the tubing hanger before actuating the valve.

30. The method of claim 27, further comprising removing the tubing hanger if a problem is detected downhole.

31. The method of moving fluid through a wellhead which comprises:

running a tubing hanger into the wellhead casing, wherein the tubing hanger contains a production bore, a first annulus bore hydraulically connected to one or more downhole devices, and a second annulus bore;

moving fluid downhole through the first annulus bore;

connecting a side penetrator to the second annulus bore;

actuating a valve to close the first annulus bore and hydraulically connect the second annulus bore to one or more downhole devices; and

moving fluid downhole through the side penetrator and through the second annulus bore.

32. The method of claim 31, further comprising landing the tubing hanger onto the wellhead casing.

33. A tubing hanger for use in a subsea well, wherein said tubing hanger comprises:

a production bore;

a first annulus conduit that extends generally longitudinally through the tubing hanger, wherein the first annulus conduit is connectable at one end to a running tool connection and is connectable at the other end to a downhole well connection;

a second annulus conduit that intersects the first annulus conduit and extends generally laterally through the tubing hanger to a port for a side penetrator;

fiber optics located in the first annulus conduit, wherein at the intersection of the first and second conduits a portion of the fiber optics extends into the remainder of the first annulus conduit and the rest of the fiber optics extends into the second annulus conduit.

34. An apparatus for use in a subsea well including a wellhead housing having a wellhead bore, at least one casing hanger supported within the wellhead for supporting a tubing hanger, and an downhole electrical line wherein said apparatus comprises:

the tubing hanger having a landing shoulder, a production bore, a first annulus conduit that extends generally longitudinally through the tubing hanger, and a second annulus conduit;

a side penetrator connected to the second annulus conduit in the tubing hanger;

a switch connected to the downhole electrical line and both the first annulus conduit and the second annulus conduit;

means for actuating the switch from a first position to a second position before the tubing hanger landing shoulder has landed onto the casing hanger;

wherein the first position of the switch provides an open electrical path between the first annulus conduit and the downhole electrical line; and

wherein the second position of the switch provides an open electrical path between the second annulus conduit and the downhole electrical line.

35. The method of connecting a hanger annulus to downhole functions in a well which comprises:

substantially preventing fluid leakage from the first annulus bore while running the hanger by having a valve close off the fluid path of the first annulus bore;

running a tubing hanger, the tubing hanger having a production bore, a first annulus bore containing hydraulic fluid and a second annulus bore with a closed fluid path containing hydraulic fluid;

compressing the fluid in the second annulus bore upon landing the hanger; and

using the compressed fluid in the second annulus bore to actuate a valve contained in the first annulus bore opening the fluid path between the first annulus bore and downhole hydraulic controls.

36. The method of claim 35, wherein the fluid in the second annulus is compressed by a spring loaded push rod landing on a casing shoulder.

37. The method of claim 35, wherein the compressed fluid moves a cylinder, which actuates the valve.

38. The method of claim 35, wherein the hanger contains multiple annuluses spread around its perimeter.

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