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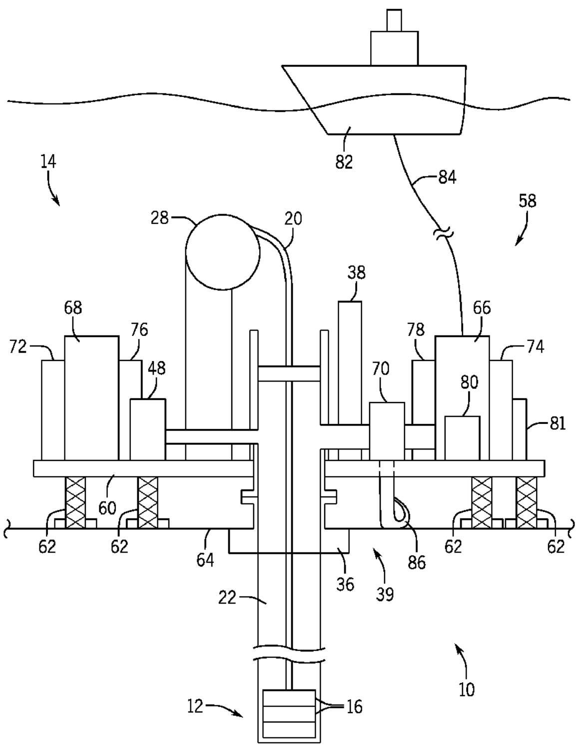

FIG. 2

(57) Abstract: A system including a hydrocarbon extraction system (10), including a well boring apparatus (12) configured to drill through a subterranean formation without rotating a drill string, and a seabed support system (14) configured to support drilling operations of the well boring apparatus.

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SUBSEA HYDROCARBON EXTRACTION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/216,872, filed September 10, 2015, entitled “SUBSEA HYDROCARBON EXTRACTION SYSTEM,” which is incorporated by reference herein in its entirety for all purposes.

FIELD OF THE INVENTION

[0002] The present invention generally relates to hydrocarbon extraction systems.

BACKGROUND

[0003] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present invention, which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present invention. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

[0004] Drilling offshore wells traditionally uses surface equipment for the exploitation of subsea petroleum and natural gas deposits. In deep water applications, surface equipment can include floating platforms or vessels (e.g., drill ships).

[0005] The surface equipment typically supports risers that extend from one or more wellheads or structures on the seabed to the equipment at the sea surface. The risers connect the subsea well with the surface equipment to protect the fluid integrity of the well and to provide a fluid conduit to and from the wellbore. The risers connecting the surface systems to the subsea wellhead can be thousands of feet long and extremely heavy.

[0006] Drilling operations including surface equipment are generally associated with substantial operating costs. In addition, the offshore environment can be difficult for personnel working on the surface equipment or below the surface. Weather often impacts operations and requires that work stop until conditions improve, resulting in time delays and additional costs. The time required to recover defective equipment from the well to the rig and then returned to the well can amount to days. In view of these issues, an alternative approach to deepwater subsea drilling would be beneficial.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Various features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying figures in which like characters represent like parts throughout the figures, wherein:

[0008] FIG. 1 is a schematic view of an embodiment of a subsea hydrocarbon extraction system;

[0009] FIG. 2 is a schematic view of an embodiment of a subsea hydrocarbon extraction system;

[0010] FIG. 3 is a schematic view of an embodiment of a subsea hydrocarbon extraction system; and

[0011] FIG. 4 is a schematic view of an embodiment of a subsea hydrocarbon extraction system.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0012] One or more specific embodiments of the present invention will be described below. These described embodiments are only exemplary of the present invention. Additionally, in an effort to provide a concise description of these exemplary embodiments, all features of an actual implementation may not be described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0013] The disclosed embodiments include a subsea hydrocarbon extraction system with a well boring apparatus and a seabed support system. As will be explained in detail below, the seabed support system supports drilling operations, hydrocarbon production, and well shutdown operations from the sea floor. For example, the seabed support system may include multiple modular systems, such as a coiled tubing spool system, blowout preventers (BOP), power generation systems, managed pressure drilling systems, continuous casing systems, water treatment systems, separation systems, drone/robot garages, material storage systems, pump systems, control systems, communication systems, laser system, etc. These modular systems may be supported on one or more platforms or skids on the sea floor. In some embodiments, the seabed support system may include multiple platforms that support one or more wells. These platforms may couple together with tracks and/or other infrastructure (e.g., pipes) enabling materials and equipment to be shared during hydrocarbon extraction operations on multiple wells. In other words, the seabed support system with its variety of modular systems may form a kind of unmanned subsea village capable of supporting all drilling, production, and shutdown operations associated with one or more wells.

[0014] FIG. 1 is a schematic view of an embodiment of a subsea hydrocarbon extraction system 10 that may support unconventional well boring and production operations. For example, the subsea hydrocarbon extraction system 10 may support all operations associated with hydrocarbon extraction from a hydrocarbon reservoir (e.g., drilling, production, shutdown, etc.). In order to drill the well, the subsea hydrocarbon extraction system 10 includes a well boring apparatus 12 capable of drilling a well without a drill string and drill riser(s). In this way, the well boring apparatus 12 eliminates the time involved in assembling a drill string to drill deeper or disassembling a drill string to retrieve or change a drill bit. Moreover, in deep water drilling only 5% to 10% of surface energy may reach the drill bit. Accordingly, a large portion of the power of conventional rig top drives is wasted in overcoming large frictional losses along the drill string. Accordingly, the well boring apparatus 12 may therefore use less power to drill the same well due to the absence of frictional losses. Furthermore, the well boring apparatus 12 may enable drilling of a constant diameter well, thus avoiding traditional drilling of an initial large borehole, which is then incrementally decreased to an ever-smaller borehole as depth increases.

[0015] The well boring apparatus 12 may be self-propelled, steerable, and launchable from a topside vessel or directly from a seabed support system 14. In some embodiments, the well boring apparatus 12 may be capable of drilling multiple tracks (e.g., wells) from a central borehole. The well boring apparatus 12 may be modular such that it can be configured and then reconfigured for different tasks (e.g., support specific down hole activities). For example, the well boring apparatus 12 may include one or more modules 16 (e.g., 1, 2, 3, 4, 5, or more) such as a cutting/boring module (e.g., a cutter or a grinder), a motor/power module (e.g., a motor and/or a power source), a thrust module (e.g., movable arms configured to engage the wellbore and/or to propel the well boring apparatus), a pump module (e.g., a pump), a cutting processing module (e.g., a container configured to receive cuttings and/or a grinder configured to grind the cuttings), a chemical module (e.g., a container configured to receive and/or to store chemicals, supply chemicals, and/or process chemicals), a casing production module (e.g., pre-cast casing, a frame configured to support precast casing, a container configured to receive and/or to facilitate mixing of cuttings and/or chemicals to form a casing, and/or a frame configured to facilitate deposition of the casing within the wellbore and/or to support formation of casing between the frame and a wall of the wellbore), a laser module (e.g., a laser), a microwave module (e.g., a microwave), a sensor module (e.g., a temperature, pressure, torque, force, depth, angle, speed (rotational and travel), inclination, accelerometer, location, flow rate, gamma ray, nuclear, acoustic, and/or electromagnetic sensor, among others), a plug module (e.g., a plug), a gas handling module (e.g., a container or lines to receive and direct gas), etc.

[0016] The cutting/boring module16 may include a cutting wheel, one or more drill bits 18, and/or a hammer/vibrator capable of cutting and breaking through rock formations. In some embodiments, the subsea hydrocarbon extraction system 10 may include multiple cutting/boring modules 16 each specialized in cutting through different kinds of rock and sediment layers. Accordingly, during drilling operations, the well boring apparatus 12 may be periodically withdrawn in order to exchange one cutting/boring module 16 for another. For example, a cutting/boring module 16 with a drill bit and/or cutting wheel may be substituted for a laser module 16 capable of cutting through rock formations.

[0017] In order to drive the boring module 16, the well boring apparatus 12 includes a motor or power module 16 that provides power to drive the boring module 16. The motor or power module may include solid oxide and solid acid fuel cells; energetic materials (e.g., Hydrazine, propellant); aqua batteries (e.g., Lithium-seawater); direct electrical supply from the seabed support system 14 (e.g., through coiled tubing 20 or another connection); direct electrical supply from a rig and/or a ship; indirect electrical supply from a rig, a ship, and/or remotely operated vehicle; and/or hydraulic fluid.

[0018] As the cutting/boring module 16 cuts through the rock formation, one or more thrust modules 16 may propel the well boring apparatus 12 further into the well 22. For example, the thrust module 16 may include gripper arms/shoes, tracks, etc. that engage the wall 24 of the well 22 and propel the boring apparatus in axial direction 26. In some embodiments, the well boring apparatus 12 may be propelled by the coiled tubing 20, as the coiled tubing system 28 rotates in circumferential direction 30. In another embodiment, the well boring apparatus 12 may be propelled through a combination of force from the coiled tubing 20 and from the thrust module 16. The coiled tubing 20 may also be used to retrieve the well boring apparatus 12 from the hole as the coiled tubing system 28 rotates in circumferential direction 32. As illustrated, the coiled tubing system 28 may be part of a seabed support system 14, but may also be located at a surface location. The well boring apparatus 12 may also be recovered using a winch and a recovery line on the seabed support system 14 or a surface location (e.g., ship, rig). In some embodiments, the coiled tubing system 28 may assist in providing chemicals used to provide a temporary seal in fluid loss zones as the cutting/boring module 16 cuts through the rock formation. The coiled tubing system 28 may include coiled tubing 20 that is either monochambered for the deployment of fluid to the cutting surface or could be multi-chambered for the deployment of chemicals that upon mixing could be used as a temporary sealant in fluid loss zones.

[0019] As the cutting/boring module 16 drills the well 22, a pump module 16 may pump seawater and/or mud to removing the cuttings. The pump module 16 may receive seawater and/or mud through the coiled tubing 20 and/or a separate tubing attachment. In some embodiments, the well boring apparatus 12 may include a grinding module 16 that grinds the cuttings to facilitate transport to the seabed support system 14 and/or for production of a casing surrounding the well 22. For example, the well boring apparatus 12 may include a casing production module 16 that produces a casing/lining using the ground cutting paste produced by the grinding module 16, and chemicals (e.g., pre-polymers and photo initiators such as acrylate and methacrylate monomers) stored in a storage container of a chemical module 16. The casing may then be cured with a curing module (e.g., microwave component, ultraviolet light component, etc.). However, in some embodiments, the casing/lining production module may grind the cuttings, combine the cuttings with chemicals into a casing/lining, and then cure the casing/lining; instead of using separate modules. In some embodiments, the casing production module(s) 16 may include a material ready to produce the casing (e.g., cement) and/or receive it from an external source (e.g., from the seabed support system 14 through the tubing spool 20). In some embodiments, the casing production module 16 may include preformed casing/lining sections that are installed as the well boring apparatus 12 progresses towards the hydrocarbon reservoir.

[0020] Once the well boring apparatus 12 reaches the hydrocarbon reservoir, the well boring apparatus 12 may enable oil and/or natural gas production by cutting through the casing with a laser module 16. In another embodiment, the well boring apparatus 12 may include a water jet-cutting module 16 that is likewise able to cut through the casing/lining to begin production. The laser module 16 and/or water jet module may also prepare the casing (e.g., cut the casing) for hydraulic fracturing. For example, in a hydraulic fracturing situation, the well boring apparatus 12 may cut through the casing with either a laser module 16 or a water jet-cutting module 16 (e.g., a waterjet cutter). Once cut, the well boring apparatus 12 may use a plug module 16 to plug the well 22 before frac fluid is pumped into the well 22 during hydraulic fracturing operations.

[0021] As discussed above, the well boring apparatus 12 may include one or more chemical modules 16 that store chemicals to form the casing. In some embodiments, the chemical module(s) 16 may store additional chemicals to facilitate drilling and production operations. For example, the chemical modules 16 may store chemicals that inhibit hydrate formation and chemicals that enable hydrocarbon production by dissolving methane hydrates (e.g., release the gas in methane hydrates by the use of exothermic reactions) as the well boring apparatus 12 drills. The modules 16 may also store chemicals such as acids, hydrate inhibitors, scale inhibitors, biocides, thermite, eutectic materials (e.g., bismuth alloys that can be used as temporary or permanent sealants), among others. These chemicals may also be pumped from the subsea support system 14 through coiled tubing 20 to replenish module(s) 16 on the well boring apparatus 12 and/or directly into the well 22 through the well boring apparatus 12.

[0022] The well boring apparatus 12 may also include other module(s) 16 to assist in drilling and production operations (e.g., melt methane hydrates, inhibit hydrate formation). For example, the well boring apparatus 12 may include a heating module (e.g., a heat source) that inhibits hydrate formation and releases gas from methane hydrates. In some embodiments, the well boring apparatus 12 may include an acoustic energy module (e.g., an acoustic energy source) that breaks up methane hydrates for production as well as inhibits formation of hydrates. Moreover, the well boring apparatus 12 may include a microwave module that releases gas from methane hydrates and inhibits hydrate formation in the well 22.

[0023] In order to steer and measure properties in the well 22, the well boring apparatus 12 may include a sensor and/or control module 16 with one or more sensors. For example, the sensor module 16 may include a temperature, pressure, torque, force, depth, angle, speed (rotational and travel), inclination, accelerometer, location, flow rate, gamma ray, nuclear, acoustic, and electromagnetic sensors among others. The sensor and/or control module 16 may also include navigation tools such as an inertial navigation system that guides the well boring apparatus 12. The sensors also may enable the well boring apparatus 12 to analyze properties of the surrounding environment such as temperature, pressure, acidity, and for the presence of particular chemicals, as well as steer the well boring apparatus 12. Accordingly, the direction of the well bore may be changed at any time during the drilling process. In some embodiments, the steering control signals may be provided from a surface location, the seabed support system 14, and/or a preloaded mission package. In some embodiments, the direction of drilling can be manipulated by changing characteristics of the cutting wheel or bits 18 that contact the formation (e.g., changing the location, number, or type of teeth, the angle of the cutting wheel relative the formation, the portions of the cutting wheel in contact with the formation, etc.). In some embodiments, the thrust module 16 may be used to control the direction of travel, or a combination of the thrust module 16 and the cutting wheel or bit(s) 18.

[0024] In order to launch, recover, and selectively change the modules 16, the subsea hydrocarbon extraction system 10 may include a launch and recovery frame 34 that aligns the well boring apparatus 12 for insertion into the well 22 through the wellhead 36. In some embodiments, the frame 34 may couple to the well boring apparatus 12 to enable a drone or robot 38 to change the configuration of the well boring apparatus 12 (e.g., selectively coupling and uncoupling modules 16 from the well boring apparatus 12). As illustrated, the wellhead 36 may couple to a multi-port wellhead connection 39 that includes multiple conduits 40 that enable insertion of the well boring apparatus 12, insertion of additional tools into the well 22, as well as fluid processing of fluid (e.g., drilling mud, water, hydrocarbons, etc.) coming out of the well 22. For example, the wellhead 36 may include a main conduit 42 that enables insertion of the well boring apparatus 12 into the wellhead 36. Coupled to the main conduit 42 are second and third conduits 44 and 46. The second and third conduits 44, 46 may enable insertion of additional tools following insertion of the well boring apparatus 12, as well as fluid processing. For example, the secondary conduit 44 may direct fluid to a production tree as it flows out of the well 22, while the third conduit 46 may enable tool insertion and/or chemical injection. To control fluid flow out of the multi-port wellhead connection 39, the multi-port wellhead connection 39 may couple to various blowout preventers 48 that control access to the well 22.

[0025] FIG. 2 is a schematic view of an embodiment of a subsea hydrocarbon extraction system 10 with a seabed support system 14 that supports operation of the well boring apparatus 12. In some embodiments, the seabed support system 14 may include modular equipment and/or systems 58 supported by one or more platforms or skids 60. As illustrated, the platforms 60 may include a leveling system 62 legs or jacks that lift the platform 60 off a sea floor 64. For example, the legs or jacks may be raised or lowered in order to level the platforms or skids 60 on an uneven sea floor 64. The subsea modular systems 58 may include the coiled tubing system 28, blowout preventers (BOP) 48, power generation system(s) 66, water treatment system(s) 68, separator system(s) 70, drone/robot garage(s) 72, material storage system(s) 74, pump system(s) 76, mixing system(s) 78, control system(s) 80, communication system(s) 81, high power laser (power source, generator, fiber and lasing head), fishing and remedial equipment etc. In other words, the seabed support system 14 may include all of the equipment and systems to support the well boring apparatus 12 and the production of hydrocarbons from a hydrocarbon reservoir. Moreover, because the systems 58 may be modular, the modular systems 58 facilitate installation, retrieval, and exchange. In other words, the systems 58 may be seamlessly swapped out.

[0026] The modular systems 58 may be installed and retrieved directly by lowering and retrieving the platform 60 and/or with the use of a remotely operated vehicle or an autonomous underwater vehicle. Moreover, the seabed support system 14 may be deployed from a construction vessel rather than a conventional drilling unit. For example, the platform 60 and/or modular systems 58 may be secured using ball and taper units that allow for quick-release disconnection by remotely operated vehicle as well as retrieval for maintenance and/or replacement.

[0027] In order to power the seabed support system 14 and/or the well boring apparatus 12, the power generation system 66 may generate and/or store power. The power generation system 66 may produce power in various ways including subsea turbines (e.g., water/hydro turbines), nuclear, fuel cells, energetic materials (such as hydrazine, propellants), and/or thermal conversion. The power generation system 66 may also store power produced on the surface (e.g., wind power system, wave power system, rig, ship, etc.) using batteries and/or provide a connection for external power to flow to the subsea hydrocarbon extraction system 10. For example, the power generation system 66 may electrically couple to a ship 82 that produces power (e.g., power generation ship). The ship 82 then transfers power to the subsea hydrocarbon extraction system 10 through power line(s) 84 (e.g., umbilical lines). In some embodiments, the power generation system 66 may couple to subsea cables that carry power from a shore facility. As the power generation system 66 receives power, it distributes the power throughout the subsea support system 14 and/or stores the power in batteries for later use (e.g., during a storm).

[0028] As the well boring apparatus 12 drills the well 22, pump systems 72 may pump water, chemicals, and/or drilling mud into the well 22 to remove cuttings (e.g., rock, sand, etc.), to hydraulically fracture the well, or otherwise facilitate drilling operations. Moreover, as the well boring apparatus 12 drills, the water, drilling mud, chemicals, etc. may mix with natural gas and/or oil. However, instead of processing the cuttings, water, chemicals, drilling mud, etc. at the surface, the subsea hydrocarbon extraction system 10 may process these materials at the seabed with the seabed support system 14, thereby removing the need for a drilling riser. In order to process the fluids exiting the well 22, the seabed support system 14 may include a separator system 70 that separates oil and/or natural gas from the water, chemicals, and/or mud exiting the well 22. The oil and/or natural gas may then be pumped through pipelines 86 to the surface or along the sea floor to the shore for further processing and refining. After separating the water, gas, and oil in the separator system 70, the seabed support system 14 may also treat the water in a water treatment system 68 for reuse in the well 22 or for release into the surrounding environment (e.g., desalination, disinfection, etc.).

[0029] Similarly, instead of pumping drilling mud, frac fluid, etc., from the surface the seabed system 14 may include material storage systems 74 with storage tanks, racks, etc. These storage systems 74 may store a variety of materials such as water, chemicals, proppant, cement, fishing heads (e.g., for retrieving stuck pipes or equipment), pipes, thermite (e.g., to form temporary or permanent zonal seals in the well 22 as well as wellhead isolation), bismuth alloy, etc. for use by the hydrocarbon extraction system 10. The tanks may in turn couple to mixer systems 78 that combine water, chemicals, proppant, cement, etc. that is then pumped into the well 22 using pumps 76 (e.g., drilling mud pumps, frac pumps, etc.). The mixer systems 78 may also combine chemicals, water, etc. for use in the modules 16 of the well boring apparatus 12.

[0030] As explained above, the well boring apparatus 12 may include one or more modules 16 that facilitate drilling of the well 22. These modules 16 enable the well boring apparatus 12 to be reconfigured to perform different activities. In order to exchange and/or change out the modules 16, the seabed support system 14 may include drones/robots 38 that move modules 16 around the platform 60 as well as change the configuration of the well boring apparatus 12. The drones/robots may also manipulate other equipment and systems 58. For example, the drones/robots 38 may perform repairs on the seabed support system 14, replace equipment or systems 58, lay pipes, lift pre-formed casing into the well 22, etc. When the drones/robots 38 are not in use or when the robots/drones 38 need maintenance (e.g., battery charging, refueling) the drones/robots 38 may be relocated to a drone/robot garage(s) 72 that recharges batteries, downloads data, uploads missions, etc.

[0031] The seabed support system 14 may also include control and communication system modules 80, 81 that control operation of the seabed support systems 58, well boring apparatus 12, and drones/robots 38. For example, the control system modules 80 (e.g., a control system having an electronic controller, processor, and memory) may be in signal communication (fluid, optical, electrical, wireless, acoustic, radio, inductive, and/or magnetic) with one or more modular systems 58 (e.g., sensors and/or controllers coupled to the modular systems 58), well boring apparatus 12, and one or more drones/robots

38. In some embodiments, the control system module 80 may also receive feedback from video cameras (e.g., visual, infrared, thermal) positioned around the subsea support system 14. In this way, the control system module 80 enables monitoring and control of hydrocarbon extraction operations (e.g., drilling, production, and well abandonment operations). For example, the control system module 80 may control permanent or zonal sealing of the well 22 during drilling as well as wellhead isolation once production is complete. The control system module 80 may use the well boring apparatus 12 and modules 16 (e.g., chemical modules 16 with thermite, and/or bismuth alloys) to form the seals. In some embodiments, the control system module 80 may control other equipment (e.g., cranes) on the subsea support system 14 to deploy thermite, explosives, bismuth alloys, etc. to form temporary or permanent seals (e.g., zonal seals) in the well 22. Moreover, the control system module 80 may communicate with remote operators (e.g., shore, rig, ship, etc.) by providing video feed, sensor data, etc. Thereby, enabling operators to monitor and control operation of the subsea hydrocarbon extraction system 10 remotely.

[0032] FIG. 3 is a schematic view of an embodiment of a subsea hydrocarbon extraction system 10 with a well boring apparatus 12 and a seabed support system 14. As illustrated, the seabed support system 14 may include multiple platforms or skids 60 (e.g., 1, 2, 3, 4, 5, or more) that support one or more modular systems 58. These platforms 60 may couple together with tracks 110 (e.g., rails). The tracks 110 may support pipes and other infrastructure as well as enable drones 38 to travel back and forth between platforms 60 carrying supplies, repairing equipment, replacing equipment, carrying modules 16 or 58, etc. As the drilling operations progress, some of the modular systems 58 may no longer be needed. Accordingly, the modularity of the seabed support system 14 may enable some of the platforms 60 and/or modular systems 58 to be removed from the hydrocarbon extraction system 10 for use at a different location. As illustrated, the subsea hydrocarbon extraction system 10 may also include hydrophones and/or geophones 112 or other sensing equipment used in analyzing the hydrocarbon formation, rock/sediment layers, etc. (e.g., produce

4D imaging). In some embodiments, the seabed support system 14 may additionally or alternatively include a conveying system (e.g., roller ball conveying system) to facilitate movement of the modules 16 about the platform 60. For example, roller balls may protrude from a transport surface (e.g., a surface of tracks 110 or other structure that contacts modules 16 or other equipment for use in the seabed support system 14), and controlled rotation of the roller balls may drive or cause movement of the modules 16 along the platforms 60, along tracks 110 or other pathways of the seabed support system 14, or the like.

[0033] FIG. 4 is a schematic view of an embodiment of a subsea hydrocarbon extraction system 10 with a well boring apparatus 12 and a seabed support system 14. As illustrated, the seabed support system 14 may include multiple platforms or skids 60 (e.g., 1, 5, 10, or more) and tracks 110 in a hub and spoke layout that surrounds a central well 22. It should be understood that the platforms 60 may have any number of geometries suitable for drilling operations and that accommodate the sea floor terrain. As explained above, each of these platforms 60 may support a variety of modular systems 58 of the seabed support system 14. Coupling the platforms 60 are tracks 110 that support drone/robot movement as well as infrastructure (e.g., pipes). Moreover, and as illustrated, the seabed support system 14 may support multiple wells 22 with the tracks 110 connecting each of these wells 22 together. Accordingly, one seabed support system 14 may support multiple wells 22 with some or all of the same modular systems 58.

[0034] While the invention may be susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and have been described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the following appended claims.

CLAIMS

1. A system, comprising:

a hydrocarbon extraction system, comprising:

a well boring apparatus configured to drill through a subterranean formation without rotation of a drill string; and

a seabed support system configured to support drilling operations of the well boring apparatus.

2. The system of claim 1, wherein the well boring apparatus comprises one or more interchangeable modules that facilitate drilling a well.

3. The system of claim 1, wherein the seabed support system comprises one or more modular systems.

4. The system of claim 1, wherein the seabed support system comprises one or more drones or robots.

5. The system of claim 3, wherein the one or more modular systems comprises a coiled tubing system configured to couple to the well boring apparatus.

6. The system of claim 3, wherein the one or more modular systems comprises a blowout preventer.

7. The system of claim 3, wherein the one or more modular systems comprises a power generation system.

8. The system of claim 3, wherein the one or more modular systems comprises a separator system.

9. The system of claim 3, wherein the one or more modular systems comprises a material storage system.

10. The system of claim 3, wherein the one or more modular systems comprises a control system configured to control the one or more modular systems.

11. The system of claim 3, wherein the one or more modular systems comprises a drone garage.

12. The system of claim 3, wherein the one or more modular systems are supported on one or more subsea platforms.

13. The system of claim 12, wherein the subsea support system comprises a plurality of platforms mechanically coupled together.

14. A system, comprising:

a hydrocarbon extraction system, comprising:

a seabed support system, comprising:

one or more modular systems configured to support drilling operations of a well boring apparatus.

15. The system of claim 14, wherein the seabed support system comprises one or more platforms configured to support the one or more modular systems.

16. The system of claim 14, wherein the seabed support system comprises a plurality of platforms configured to support the one or more module systems.

17. The system of claim 16, wherein the plurality of platforms are mechanically coupled together.

18. A system, comprising:

a hydrocarbon extraction system, comprising:

a well boring apparatus configured to drill through a subterranean formation without rotation of a drill string; and

a seabed support system, comprising:

one or more modular systems configured to support drilling operations of the well boring apparatus; and

one or more platforms configured to support the one or more modular systems.

19. The system of claim 18, wherein the one or more modular systems comprise at least one of a coiled tubing system, a blowout preventer, a power generation system, a water treatment system, a separator system, a drone/robot garage, a material storage system, a pump system, a mixing system, a control system, or a communication system.

20. The system of claim 19, wherein the well boring apparatus comprises one or more interchangeable modules that facilitate drilling a well.

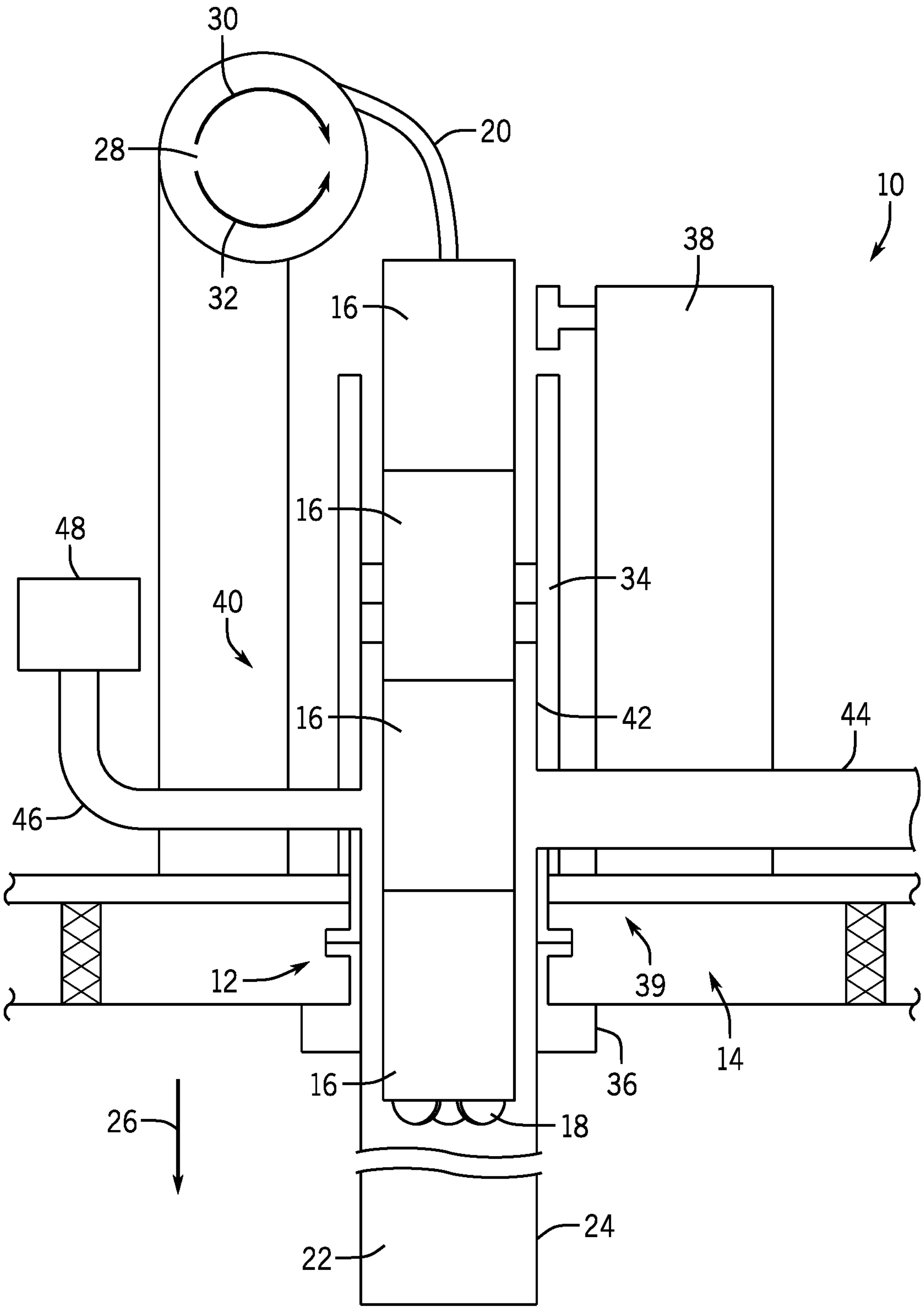

FIG. 1

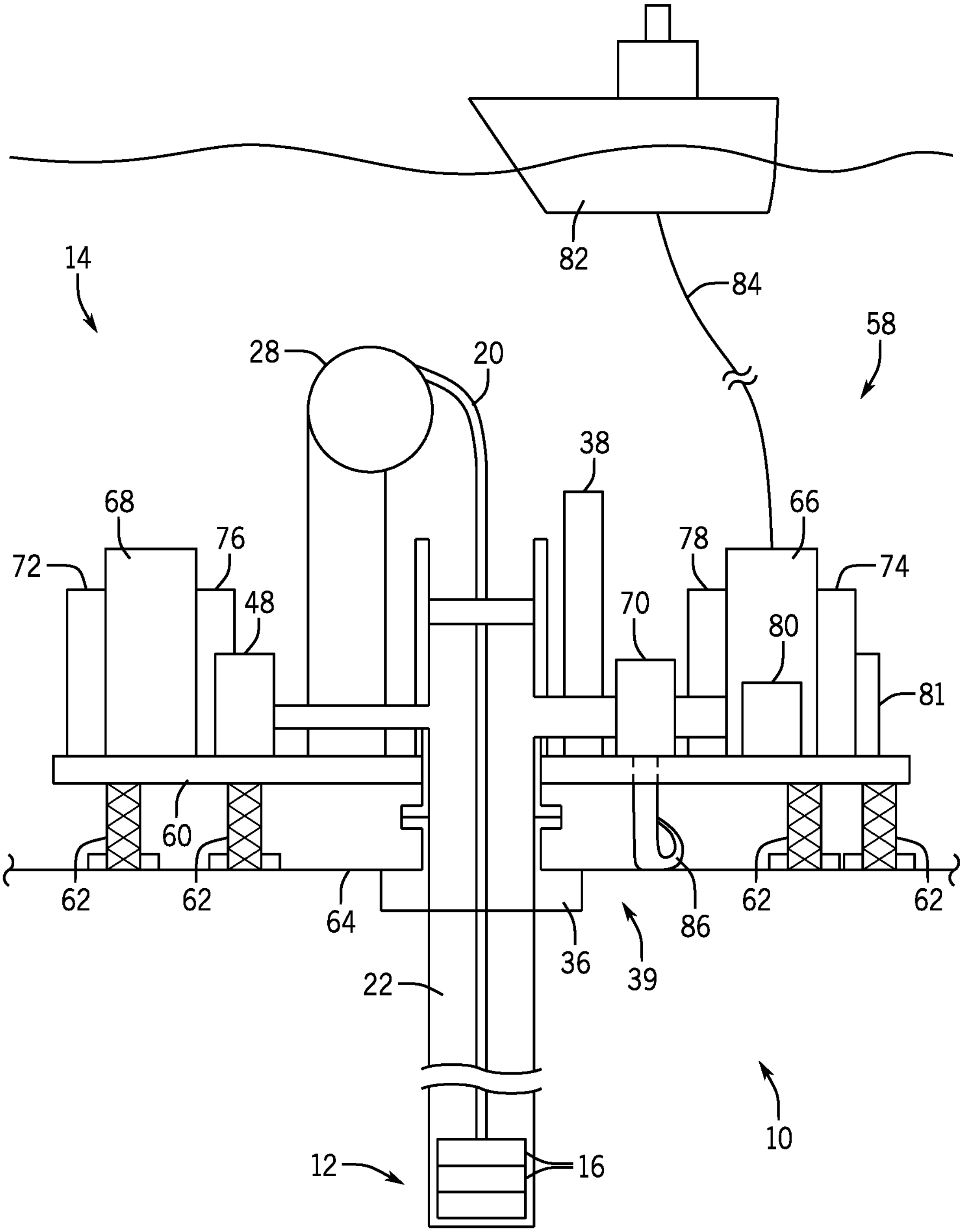
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FIG. 2

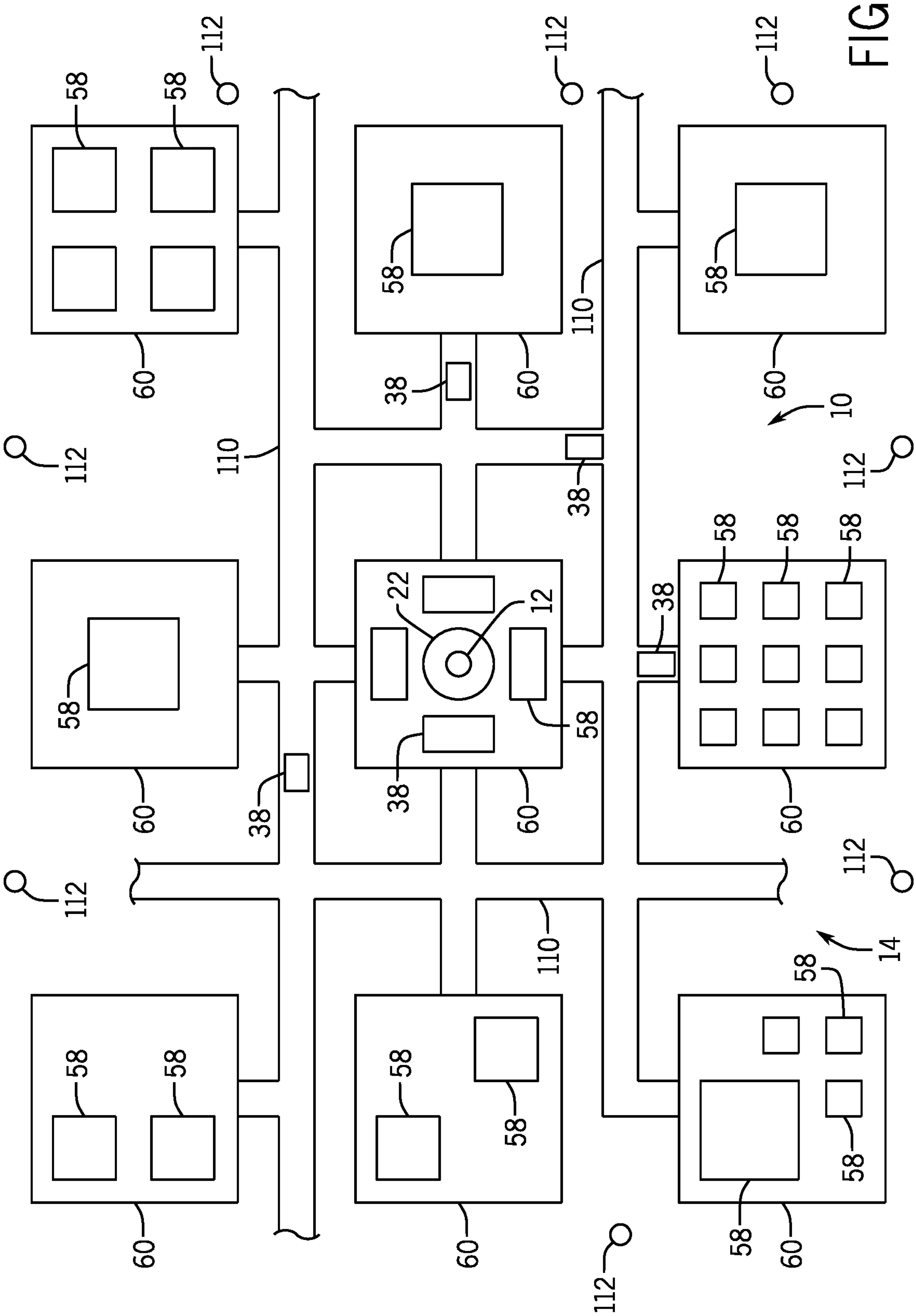

FIG. 3

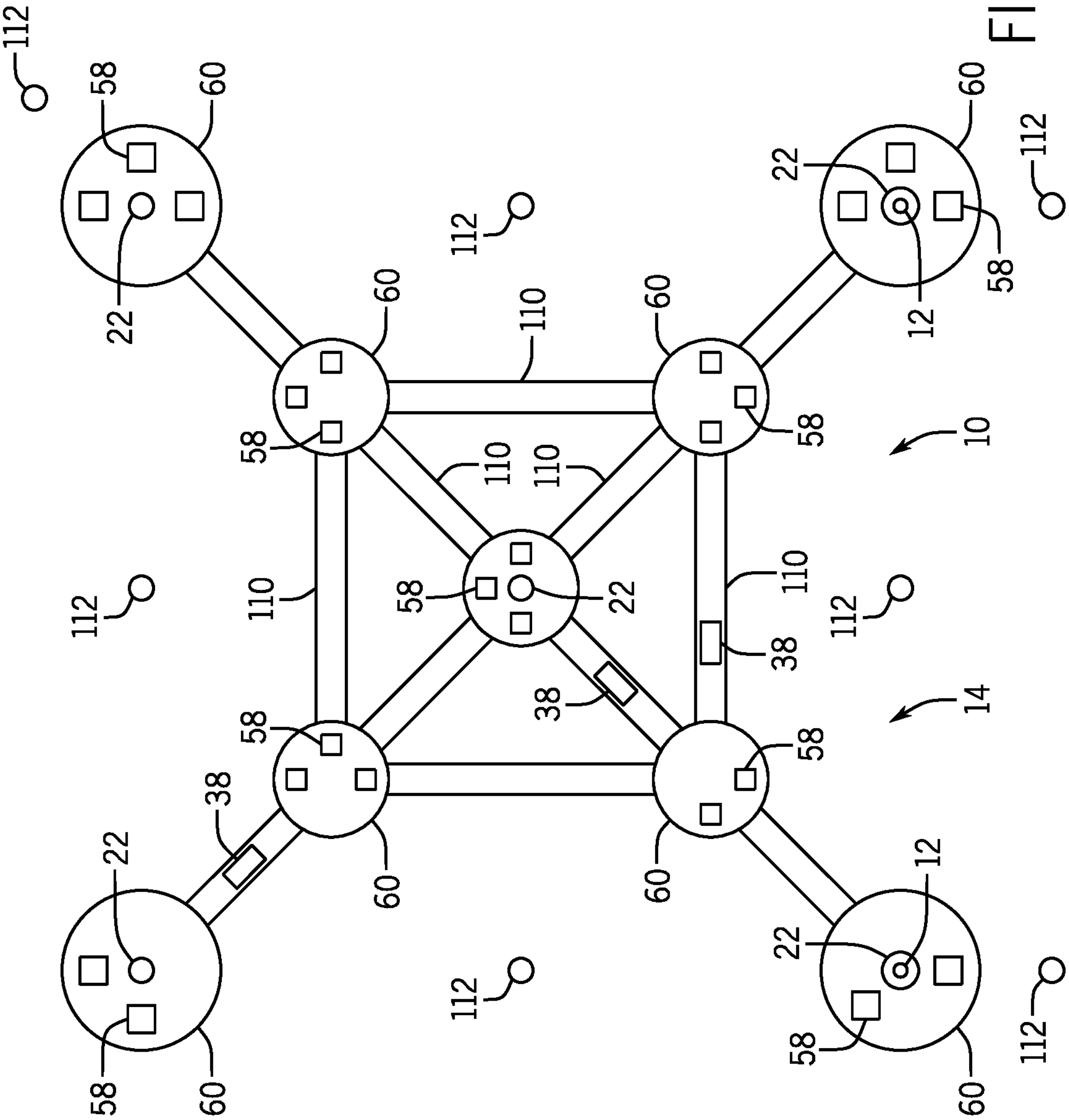

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/051111

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B43/01 E21B7/124 E21B15/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E21B B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2008/130242 A1 (SEABED RIG AS [NO]; HAUGHOM PER OLAV [NO]) 30 October 2008 (2008-10-30) abstract figures 1-4 page 5, line 12 - page 6, line 21 -----	1-4,6, 11-20 7-9
X	WO 2007/129899 A1 (SEABED RIG AS [NO]; HAUGHOM PER OLAV [NO]) 15 November 2007 (2007-11-15) abstract figures 1-4 page 1, line 1 - line 7 page 5, line 6 - page 6, line 23 -----	1-20

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 January 2017	24/01/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Hustedt, Bernhard

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2016/051111

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