



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.10.2010 Bulletin 2010/43

(51) Int Cl.:
E21B 19/22 (2006.01)

(21) Application number: **10003895.9**

(22) Date of filing: **13.04.2010**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA ME RS

(30) Priority: **13.04.2009 US 212556 P**
12.04.2010 US 758427

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AT BE CH LI CY EE ES FI HR IS LU LV MC MK MT PT SE SI SK SM TR

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(54) **Spoiled device guide system**

(57) A technique facilitates coiled tubing operations in offshore environments. The technique employs a spoiled device, which is disposed on a reel located on an offshore facility. A guide system is mounted on the offshore facility to guide the spoiled device from the reel, along a desired path, and down through the floor of the offshore facility. The guide system enables the coiled tubing job to be conducted without requiring a line of sight along the coiled tubing as it is delivered down through the offshore facility.

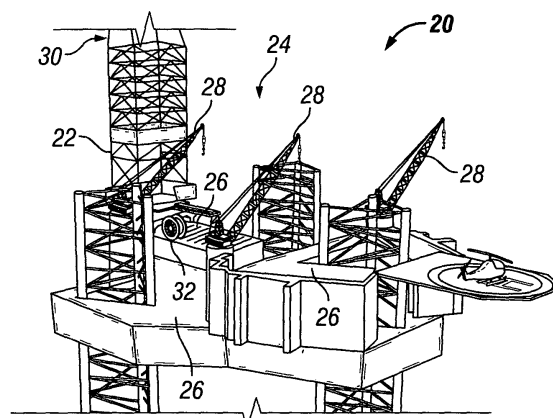


FIG. 1

Description

BACKGROUND

[0001] The statements in this section merely provide background information related to the present disclosure and may not constitute prior art. Oil producers use offshore platforms to support subsea oil wells. In many applications, coiled tubing jobs are performed on the offshore platform. The coiled tubing is unspooled from a reel and injected through a rig floor via a coiled tubing injector hanging in a derrick. However, the coiled tubing reel must be placed in position so that a line of sight is maintained along the coiled tubing as it moves through a door in the rig floor.

[0002] The line of sight requirement can create a variety of problems related to utilization of the offshore platform and completion of the coiled tubing job. For example, crane capability and lift radii restrictions often prevent placement of the heavy reel in an optimum position on the offshore platform. Additionally, placement of rig components, such as automated pipe handling systems and elevated catwalks, can be difficult without blocking the line of sight. Often, large deck areas of the offshore rig must be segregated with barriers during a coiled tubing job due to movement of the coiled tubing pipe overhead. As a result, rig operations and crane lifts are restricted. Because of the limitations on placement of the coiled tubing reel and other components, small radius goosenecks are sometimes necessary to direct the coiled tubing along a desired route. However, use of small radius goosenecks often detrimentally impacts the low cycle fatigue resistance of the coiled tubing.

SUMMARY

[0003] In general, the present disclosure provides a system and methodology for facilitating coiled tubing operations in offshore environments. The system and methodology employ a spooled device disposed on a reel which is located on an offshore facility. A guide system is mounted on the offshore facility to guide the spooled device from the reel, along a desired path, and down through a floor of the offshore facility. The guide system enables the coiled tubing job to be conducted without requiring a line of sight along the coiled tubing as it is delivered down through the offshore facility.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Certain embodiments of the invention will hereafter be described with reference to the accompanying drawings, wherein like reference numerals denote like elements, and:

Figure 1 illustrates an embodiment of an offshore facility incorporating a guide system;

Figure 2 is a view of an embodiment of an offshore

platform/rig in which a reel is deployed on a lower deck to deliver a spooled device through a guide system;

Figure 3 is a view of an embodiment of an offshore facility in which a guide system is used to guide coiled tubing from a coiled tubing reel;

Figure 4 is a view of an embodiment of an offshore facility having a guide system mounted along a derrick;

Figure 5 is a view of an embodiment of an offshore facility with a guide system having a swivel to enable alignment with a well center;

Figure 6 is a view of an embodiment of an alternate example of an offshore facility with the guide system mounted along a derrick;

Figure 7 is a view of an embodiment of one example of the offshore facility having a guide system in which one or more trumpet ends are employed along the guide system to limit potential stress acting on coiled tubing delivered through the guide system;

Figure 8 is a view of an embodiment of a derrick and a tubular guide system mounted to the derrick;

Figure 9 is an overhead view of an embodiment of an offshore facility with a derrick and cooperating guide system;

Figure 10 is a view of an embodiment of an alternate example of an offshore facility in which the guide system is utilized to access a blowout preventer impact deck;

Figure 11 is a view of an embodiment of a portion of the system illustrated in Figure 10;

Figure 12 is another view of an embodiment of a portion of the system illustrated in Figure 10; and

Figure 13 is another view of an embodiment of a portion of the system illustrated in Figure 10.

DETAILED DESCRIPTION

[0005] In the following description, numerous details are set forth to provide an understanding of the present invention. However, it will be understood by those of ordinary skill in the art that the present invention may be practiced without these details and that numerous variations or modifications from the described embodiments may be possible.

[0006] The present disclosure generally relates to a system and method for facilitating offshore well operations in which a spooled device is deployed from a surface facility. The technique enhances the efficient and safe use of a surface facility, e.g. an offshore platform/rig, a semi submersible rig, a monohull vessel, when deploying the spooled device to a subsea well or other location. The spooled device may comprise coiled tubing, wireline, slickline, or other spoolable device which is deployed from a reel. A guide system is mounted on the offshore facility to deliver the coiled tubing or other spooled device along a predetermined route in a manner which does not require "line of sight" control over the spooled device as

it is delivered down through the offshore facility to a sub-sea wellhead or other subsea installation.

[0007] Depending on the specific structure of the offshore facility, the guide system is designed according to the size, shape, and components of the offshore facility. In many applications, the guide system comprises a tubular guide, such as a pipe, e.g. steel pipe, through which the spooled device is routed. The tubular guide is designed with large radius curves to reduce or eliminate the fatigue otherwise experienced by certain spooled devices, such as coiled tubing. The guide system may be a continuous guide which fully encloses the route along which the coiled tubing is delivered from the coiled tubing reel to a location proximate a floor of the offshore facility. In other embodiments, however, the guide system may be intermittent such that the coiled tubing or other spooled device extends through open regions between tubular sections of the guide system.

[0008] In many applications, the guide system is permanently installed on the offshore facility. For example, the guide system may be mounted during construction of the offshore facility, thus enabling the guide system to be fully integrated and fitted into the derrick and/or other components of the offshore facility. In some applications, the guide system may incorporate additional components, such as mechanisms to grip and hold the coiled tubing (or other spooled device) at either end of the guide to increase rig up efficiency. The guide system also may incorporate swivels, extensions, flexible sections, lubricants, trumpet ends, roller guides, and other components designed to facilitate movement of the coiled tubing (or other spooled device) along the guide system during operation.

[0009] By incorporating the guide system into the offshore facility in a preplanned design which cooperates with the overall design of the offshore facility, the reel, e.g. coiled tubing reel, may be placed in a variety of convenient locations, such as a lower deck location of an offshore platform. Without the need for line of sight control, the guide system may be used to route the coiled tubing in a manner that does not interfere with pipe handling systems, elevated catwalks, and other components of the offshore facility. Additionally, the guide system can free up large deck areas of the offshore facility by removing the need to create barrier regions which can restrict rig operations and crane lifts.

[0010] Referring generally to Figure 1, an embodiment of an offshore system 20 is illustrated as having a guide system 22 incorporated into an offshore facility 24. The offshore facility 24 may comprise an offshore platform/rig, a semi submersible rig, a monohull vessel, or other offshore facility; however Figure 1 illustrates an example of an offshore platform/rig. In the example illustrated, the offshore facility 24 comprises a plurality of decks 26 located at different levels to enclose components or to provide surface area for a variety of components. In many subsea applications, the offshore facility 24 comprises a plurality of cranes 28 which are used to move compo-

nents onto, off, and around the offshore facility. Additionally, the offshore facility 24 comprises a derrick 30 which is used to deliver and retrieve components with respect to a subsea wellhead or other installation. In the specific example illustrated, at least a portion of the guide system 22 is mounted to the derrick 30.

[0011] Guide system 22 simplifies the rig up of a spooled device, e.g. coiled tubing, on offshore installations 24, such as jack up offshore installations. By utilizing guide system 22, a reel 32 may be positioned at a variety of convenient locations on the offshore facility 24. As illustrated in Figure 2, the reel 32 may be positioned at a convenient location 34 which is out of the way of many components used during various subsea well operations. In the particular example illustrated, reel 32 is located on a lower deck 36 of the plurality of decks 26. The lower deck 36 of this embodiment comprises a cantilevered pipedeck and is positioned beneath an upper deck/pedestal 38 on which derrick 30 is mounted. However, the reel 32 may be positioned in a variety of other convenient locations on the offshore facility 24.

[0012] Referring generally to Figure 3, the reel 32 may be positioned so that coiled tubing 40 (or other spooled device) is spooled off the lower side of reel 32 rather than over the top of the reel. The coiled tubing 40 is delivered from reel 32 into a tubular guide 42, e.g. a pipe section, of guide system 22. By way of example, guide system 22 may use tubular guide 42 in the form of one or more pipe sections which extend continuously or with interrupted segments from reel 32 through a bottom end of derrick 30 or to another desired exit location. The pipe sections of guide system 22 are constructed of suitably sized sections of pipe, e.g. steel pipe, with each section having a desired diameter and length. For some applications, the tubular guide 42 has an outside diameter of approximately 5 inches, which is suitable for many types of coiled tubing and other spooled devices 40. The one or more pipe sections 42 also may be connected via flanges, e.g. ANSI 150 pound flanges, or other suitable connectors. To cover a desired route, guide system 22 may employ a series of elongated pipe sections 42 arranged along a designated path through which the spooled device, e.g. coiled tubing 40, travels from the reel 32 to a coiled tubing injector head. If the spooled device is not coiled tubing, e.g. slickline cable or wireline cable, then the tubing injector head is not necessary.

[0013] Additionally, the guide system 22 is formed from suitable materials, e.g. stainless steel, which prevent corrosion and ensure a low coefficient of friction as the spooled device 40 passes through the guide system 22. Internal surfaces of the pipe sections 42 may be prepared with low coefficient of friction coatings, lubricants, rollers, or other mechanisms to facilitate movement of the spooled device. To further facilitate consistent, easy movement of the coiled tubing or other spooled device 40, the guide system 22 may be permanently installed on the offshore facility during, for example, the original build phase. The predesigned, permanent installation en-

ables guide system 22 to be fully integrated and fitted into the derrick 30 during construction.

[0014] As further illustrated in Figure 4, guide system 22 may employ pipe sections 42 with large radius curves 44 to reduce or eliminate fatigue experienced by the coiled tubing or other spooled device 40. Guide system 22 also may comprise a continuous, enclosed guide or an intermittent guide with straight, unconstrained runs between the intermittent pipe sections 42. In the specific example illustrated in Figure 4, pipe section 42 of guide system 22 extends from under the cantilever at a position beneath the upper deck or pedestal on which the derrick 30 is mounted. From this lower location of reel 32, the pipe section 42 curves upwardly and runs straight along a corner 46 of the derrick 30 until gently curving inwardly toward a central region of the derrick 30. The pipe section 42 then curves downwardly to a position which enables deployment of coiled tubing 40 through a floor opening of the offshore facility 24.

[0015] In some applications, the guide system 22 is lubricated. For example, lubricant may be placed along the interior of the one or more pipe sections 42 by injecting suitable fluid/chemical products into the guide system. The guide system 22 and tubular guide 42 also may be designed to provide secondary fluid containment in the event of a rupture, e.g. a pinhole or pipe separation.

[0016] The radii of the large radius curves 44 are selected according to the type and diameter of the spooled device 40. For example, if the spooled device comprises coiled tubing, the large radius curves 44 are designed to accommodate coiled tubing of a desired diameter and material. A minimum radius of curvature may be calculated or otherwise obtained. For example, in the publication SPE22820, K. R. Newman, D. A. Newburn, 1991, a table is provided and lists coiled tubing of several outside diameters with corresponding equivalent radii of zero plastic deformation. Examples of the coiled tubing outside diameters and corresponding radii include: 1 inch OD - 5.08 m radius; 1.25 inch OD - 6.35 m radius; 1.5 inch OD - 7.62 m radius; 1.75 inch OD - 8.89 m radius; 2 inch OD - 10.16 m radius; 2.388 inch OD - 12.13 m radius; and 2.875 inch OD - 14.61 m radius. Based on the desired radius parameters, large radius curves 44 may be designed to accommodate specific types or ranges of coiled tubing.

[0017] Any significant increase in the radius of curvature for the tubular guide 42 of guide system 22 over a normal 72 inch, 100 inch, or 120 inch gooseneck may reduce the plastic deformation and increase the fatigue life of the coiled tubing 40. The guide system 22 may incorporate spans larger than the minimum radius for all types of coiled tubing contemplated, e.g. larger than the minimum radius for 2.875 inch OD coiled tubing. The guide system 22 also may be designed to minimize the number of bends throughout the guide system. Various software models may be used to evaluate the effect of guide system bends in a given design relative to the anticipated fatigue life of the coiled tubing.

[0018] Referring generally to Figure 5, guide system 22 also may comprise a variety of components which facilitate routing and control over the spooled device 40. In one example, guide system 22 comprises one or more swivel connections 48 at one or more points along tubular guide 42. The swivel connections 48 may be used to orient various features, e.g. an upper gooseneck, to ensure a desired routing of the spooled device 40. Additionally, the swivel connections 48 may be used to move portions of guide system 22 temporarily out of the way and then back into position over a wellhead or well center located beneath an opening 50 in a floor 52 of the offshore facility 24. The swivel connections 48 also allow at least portions of the guide system 22 to be moved out of the way of rig operations when the guide system 22 is not being used.

[0019] Guide system 22 also may comprise other components, such as a vertical extension section 54, e.g. a telescopic extension section, which may be used to provide vertical adjustability along the vertical dimension of derrick 30. Vertical extension section 54 allows the guide system 22 to accommodate different well control stacks, e.g. blowout preventer stacks, in derrick 30. The guide system 22 may further incorporate a variety of mechanisms to grip and hold the coiled tubing or other spooled device 40 at either end of the tubular guide 42 to increase rig up efficiency.

[0020] In some applications, guide system 22 provides the ability to run a cable winch and connector, e.g. a pipe stabbing connector, through the tubular guide 42. The connector is run from an upper portion of the tubular guide 42 to initially stab the coiled tubing 40 (or other spooled device). Once connected to the coiled tubing 40, the coiled tubing can be returned to the reel 32 in a controlled manner after the operation has been completed.

[0021] Furthermore, the configuration and route of the guide system 22 may be rig specific to ensure the day-to-day operation of the rig is not obstructed. The entry point of the guide system 22 adjacent the reel 32 may be adjustable to accommodate various positioning of components on the offshore facility 24. For example, the entry point of the guide system may be selected to accommodate different positions of a cantilever structure because such a structure can skid from side to side and/or from forward to aft depending on the location of equipment on the offshore facility 24.

[0022] In Figure 6, an alternate position of guide system 22 is illustrated. In this embodiment, the tubular guide 42 is attached to the corner of the derrick 30 and enters the workspace at a fingerboard height. As further illustrated in Figure 7, the reel 32 may be positioned off the pipedeck, and the tubular guide 42 may incorporate trumpet ends 56 to avoid damaging the tubular guide pipe 42 during levelwind movement. The trumpet ends 56 enable an expanded angle of entry/exit of the coiled tubing or other spooled device 40 into and out of the tubular guide pipe 42. In Figure 8, an embodiment is illustrated in which trumpet ends 56 are employed to facilitate movement of

coiled tubing 40 from a gooseneck region within derrick 30 into a coiled tubing injector 58. In this embodiment, the tubular guide 42 is fitted in a manner similar to a standpipe along derrick 30. Figure 9 provides an overhead view of derrick 30 which further illustrates opening 50 and corresponding doors 60 which may be used to selectively provide open access over a wellhead or well center 62.

[0023] Referring generally to Figures 10-13, another embodiment of offshore system 20 is illustrated. In this embodiment, guide system 22 is constructed with an offshore facility 24 and is utilized to access a blowout preventer impact deck 64. As illustrated, guide system 22 employs tubular guide 42 to direct spooled device 40 from a position above a surface deck 66 to a position beneath the surface deck. Trumpet ends 56 may be used to facilitate routing of the spooled device to the injector head 58 located above the desired well center 62. In the specific example illustrated, a gooseneck 68 guides the spooled device 40 down through the injector head 58, as best illustrated in Figures 10 and 13.

[0024] In this and other embodiments, the tubular guide 42 may comprise a flexible guide section 70, as best illustrated in Figures 11 and 12. The flexible guide section or sections 70 may be employed to ensure component movement does not kink the tubular guide or the spooled device, e.g. coiled tubing. For example, the flexible guide section 70 may be used to compensate for the movement of a levelwind. By way of example, the flexible guide section 70 may be constructed from armored, braided high-pressure hose which is rubber lined and has a limited bend radius controlled by the size of the flexible segment. Additionally, various mechanisms may be used to reduce friction and wear on the spooled device 40 as it moves through flexible guide section 70 and/or other sections of tubular guide 42. As discussed above, a variety of fluids and lubricants may be employed in the tubular guide. However, roller guides 72 and/or other friction reducing mechanisms can be employed along the route established by guide system 22.

[0025] Guide system 22 may be incorporated into a variety of offshore facilities 24, including semi-submersible vessels, various platforms/rigs, and monohull vessels. The guide system 22 is useful in compensating for injector head movement when a heave compensation system is employed. In some embodiments, the guide system 22 is designed to facilitate coiled tubing intervention on jack up rigs without running through the rig floor. This type of embodiment may be utilized when a coiled tubing operation is being conducted simultaneously while drilling. In any of these applications, the guide system 22 enables routing of the spooled device from the location of reel 32 to the injector head 58 in a convenient manner which avoids the need for line of sight spooling.

[0026] By incorporating the guide system 22 into the offshore facility 24, the route of the tubular guide 42 may be predetermined and selected to avoid restrictions, thereby obviating the need for roller guides or other fea-

tures to bypass restrictions on the offshore rig/platform. The guide system 22 also may be used with wireline or slickline interventions on offshore installations and it may be used to eliminate the requirement for multiple sheaves during rig up preparation when performing at least one well service operation, such as, but not limited to, a coiled tubing operation, logging operation, slickline operation solid rod conveyance operation (for logging), stimulation operation, or similar well service operation, as will be appreciated by those skilled in the art.

[0027] It should further be noted that guide system 22 may be employed with a variety of offshore facilities having many types of components. The size, length and routing of the guide system may be adjusted according to the specific characteristics of a given offshore facility. Additionally, components such as those discussed above may be incorporated into the guide system to facilitate movement and long-term operation of the spooled device in a given subsea application.

[0028] Accordingly, although only a few embodiments of the present invention have been described in detail above, those of ordinary skill in the art will readily appreciate that many modifications are possible without materially departing from the teachings of this invention. Such modifications are intended to be included within the scope of this invention as defined in the claims.

Claims

1. A system for deploying coiled tubing, the system comprising:
 - an offshore rig having an upper deck, a lower deck, and a derrick extending upwardly from the upper deck;
 - a coiled tubing reel mounted on the lower deck; and
 - a coiled tubing guide positioned to route coiled tubing from the coiled tubing reel, past the upper deck, up along the derrick, and back down through a lower end of the derrick.
2. The system of claim 1, wherein the coiled tubing guide comprises a pipe.
3. The system of claim 1, wherein the coiled tubing guide is permanently installed on the offshore rig.
4. The system of claim 1, wherein the coiled tubing guide is continuous from the coiled tubing reel to the lower end of the derrick.
5. The system of claim 1, wherein the coiled tubing guide is intermittent from the coiled tubing reel to the lower end of the derrick.
6. The system of claim 1, wherein the coiled tubing

- guide is adjustable in length.
7. The system of claim 1, wherein the coiled tubing guide comprises a swivel.
 8. The system of claim 1, wherein the coiled tubing guide comprises a trumpet end to reduce stress on coiled tubing moving through the coiled tubing guide.
 9. The system of claim 1, wherein the coiled tubing guide is lubricated with a fluid.
 10. A system for guiding, comprising:
 - a spooled device disposed on a reel located on an offshore facility;
 - a wellhead for receiving the spooled device; and
 - a tubular guide system positioned between the reel and the wellhead to enable use of the spooled device without requiring a line of sight control of the spooled device as it is delivered through the offshore facility to the wellhead.
 11. The system of claim 10, wherein the offshore facility comprises an offshore rig platform installation.
 12. The system of claim 10, wherein the offshore facility comprises a semi-submersible rig.
 13. The system of claim 10, wherein the offshore facility comprises a monohull vessel.
 14. The system of claim 10, wherein the spooled device comprises coiled tubing.
 15. The system of claim 10, wherein the tubular guide system comprises a steel pipe through which the spooled device moves.
 16. The system of claim 10, wherein the tubular guide system comprises a continuous pipe from the reel to the wellhead.
 17. The system of claim 10, wherein the tubular guide system is routed to a blowout preventer impact deck.
 18. A method, comprising:
 - locating a reel with a spooled device on an offshore facility;
 - mounting a guide system on the offshore facility to guide the spooled device;
 - and
 - orienting the guide system to deliver the spooled device through an opening in a floor of the offshore facility without requiring a line of sight along the spooled device when it is moved through the opening in the floor.
 19. The method of claim 18, further comprising unspooling the spooled device from the reel and guiding the spooled device via the guide system.
 20. The method of claim 18, wherein locating comprises locating the reel on a lower deck of an offshore platform.
 21. The method of claim 18, wherein mounting comprises permanently mounting an enclosed guide system onto an offshore platform.
 22. The method of claim 18, wherein locating comprises locating a coiled tubing reel.
 23. The method of claim 18, wherein mounting comprises mounting a tubing up along a side of a derrick and down through a central, lower end of the derrick.
 24. The method of claim 18, wherein orienting comprises pivoting a portion of the guide system to a desired position.

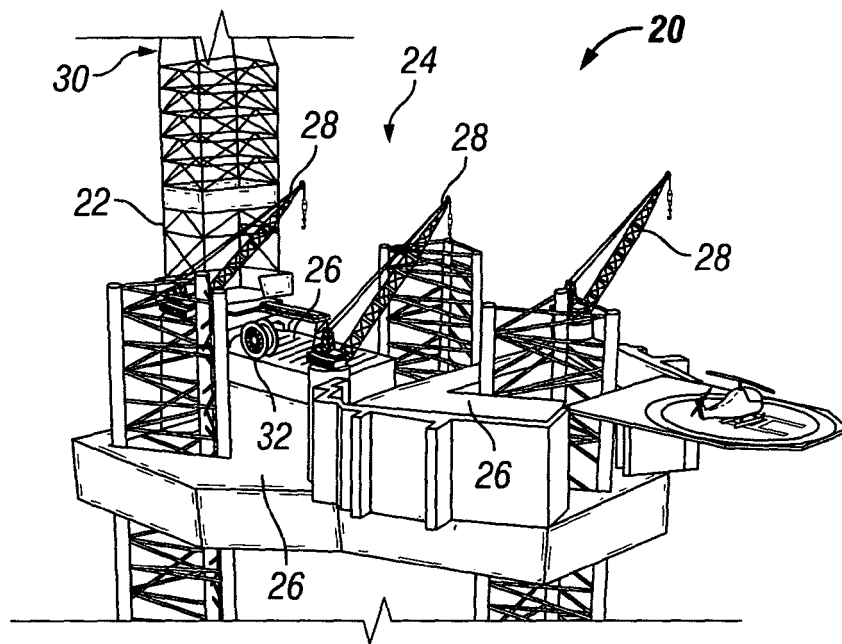


FIG. 1

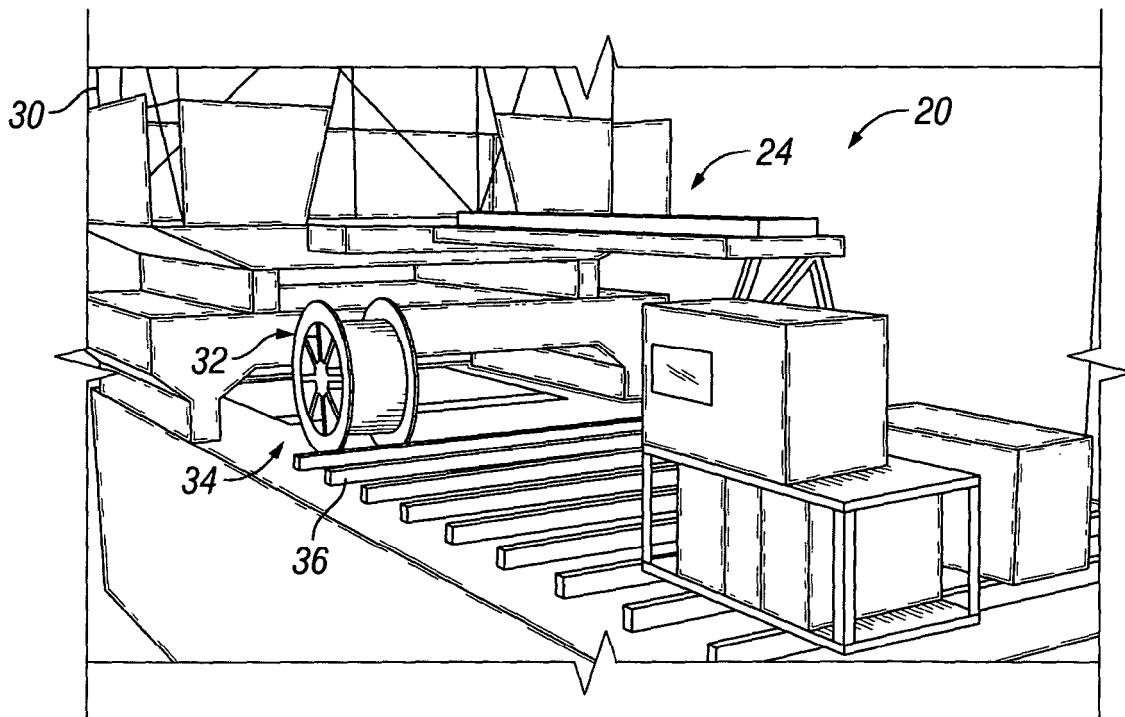


FIG. 2

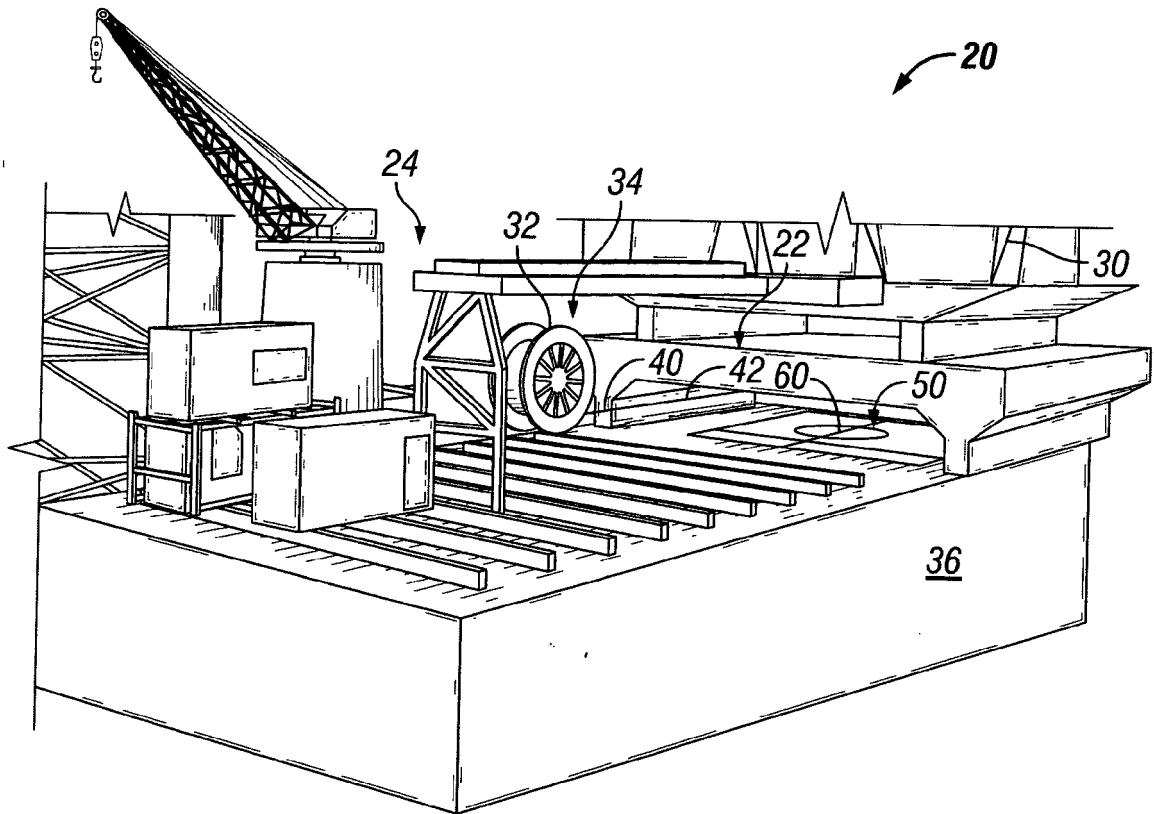


FIG. 3

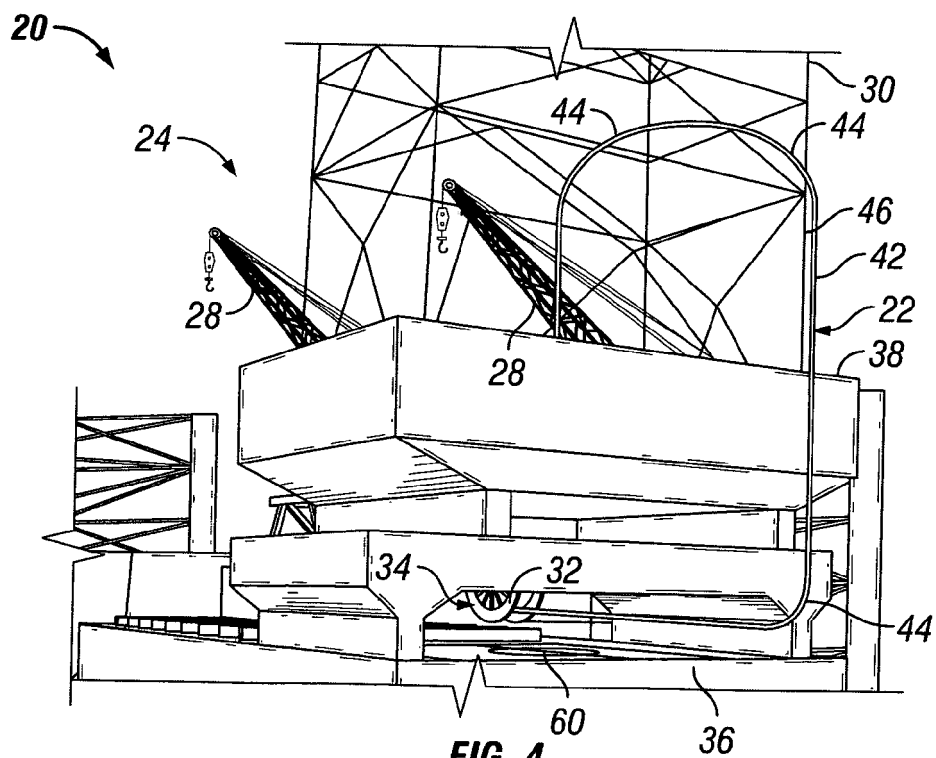


FIG. 4

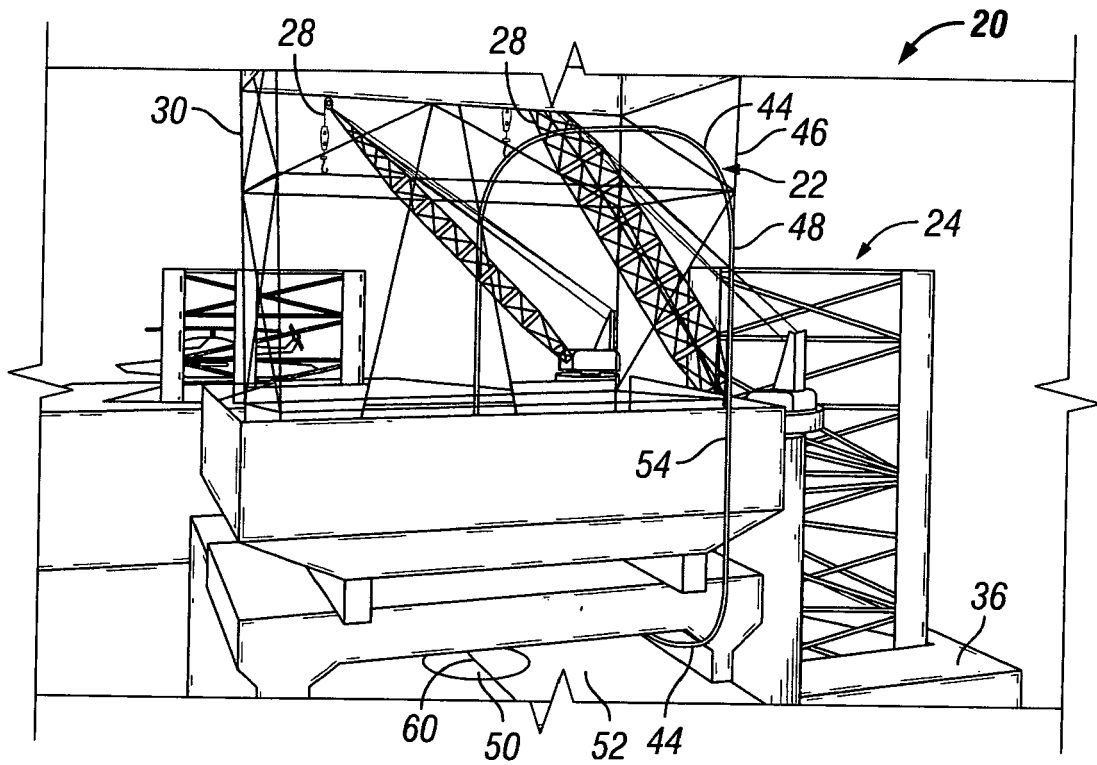


FIG. 5

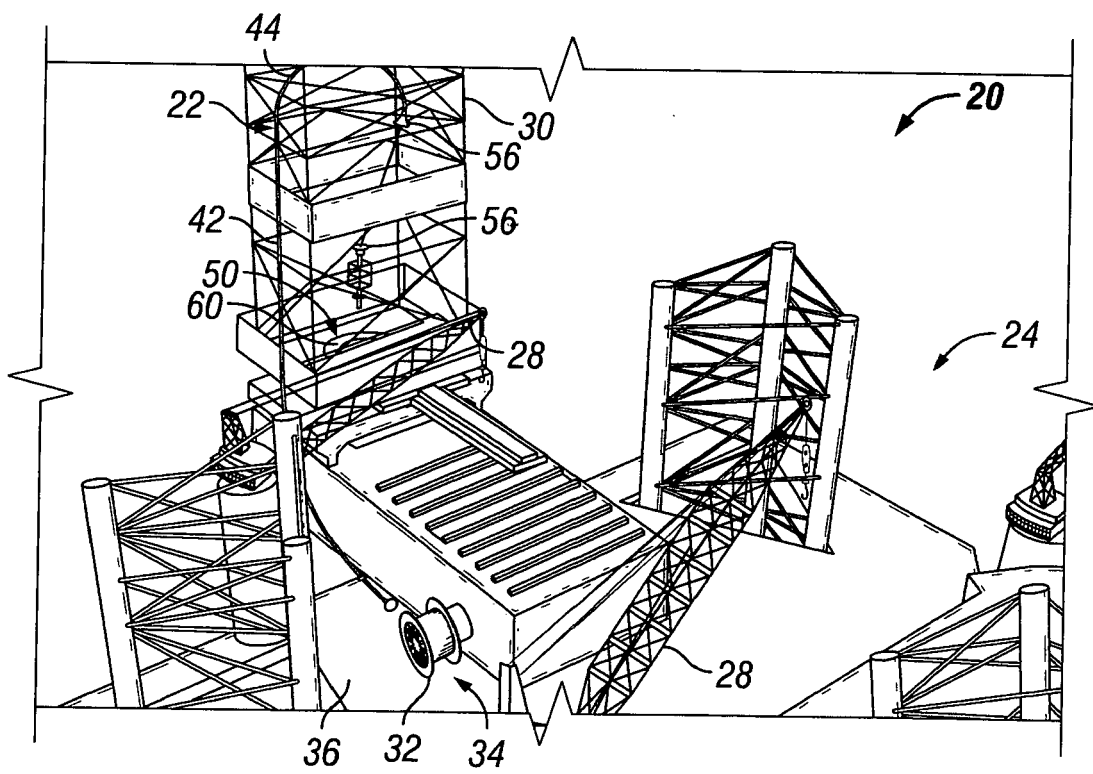


FIG. 6

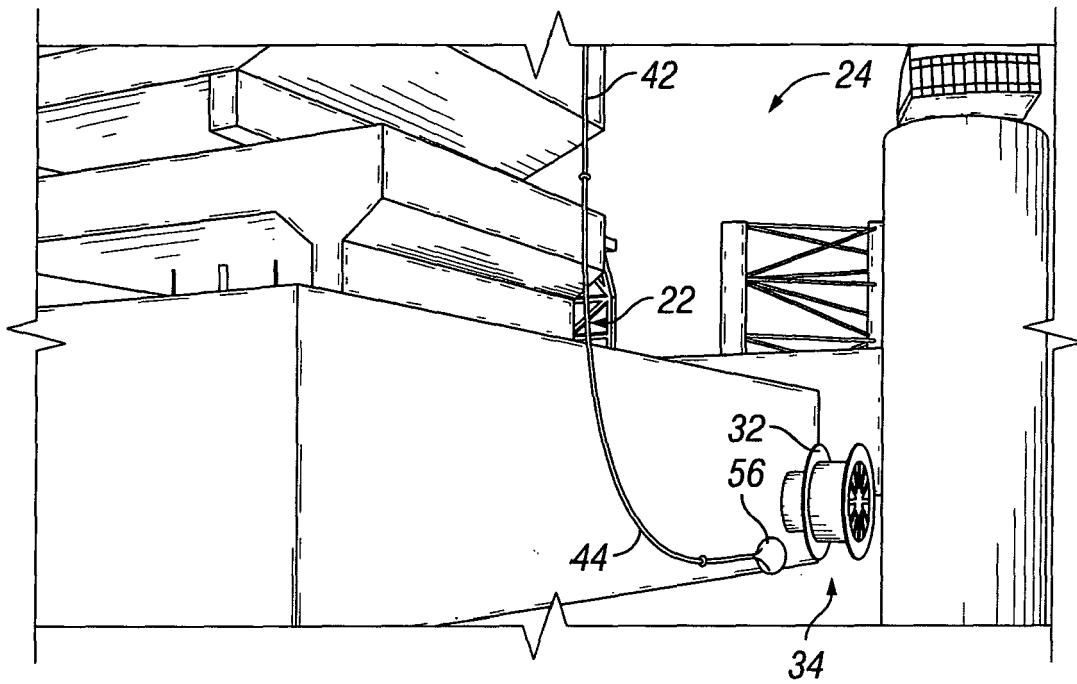


FIG. 7

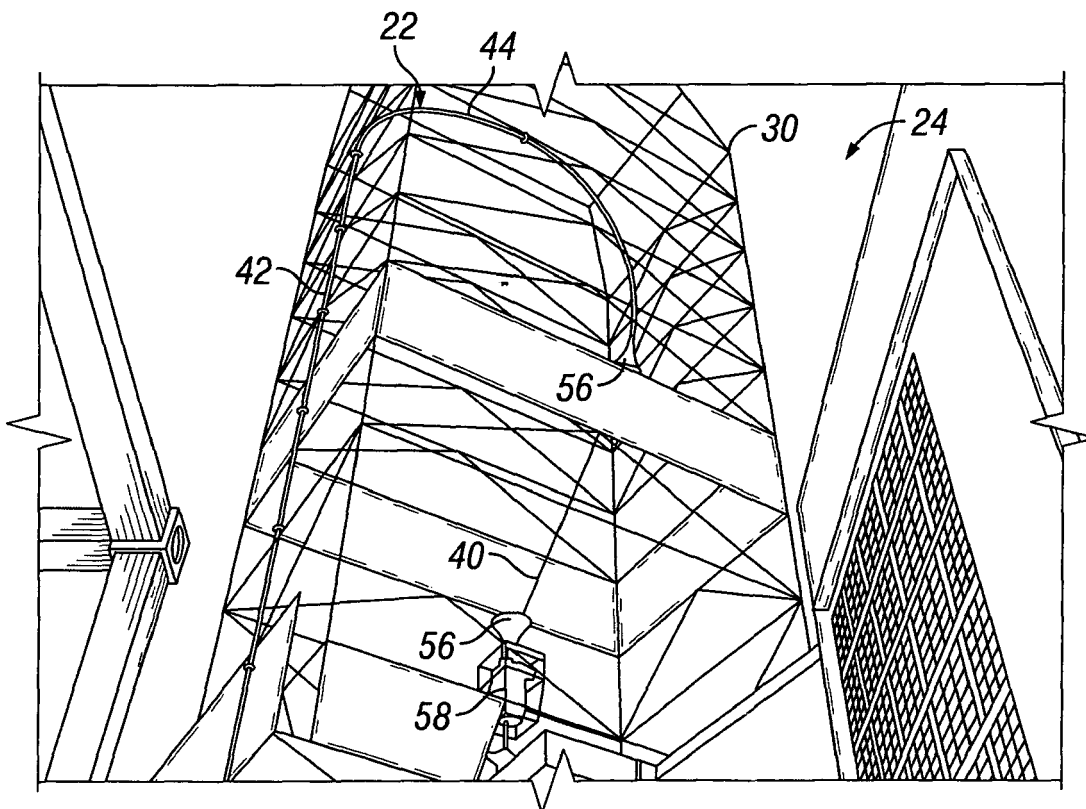


FIG. 8

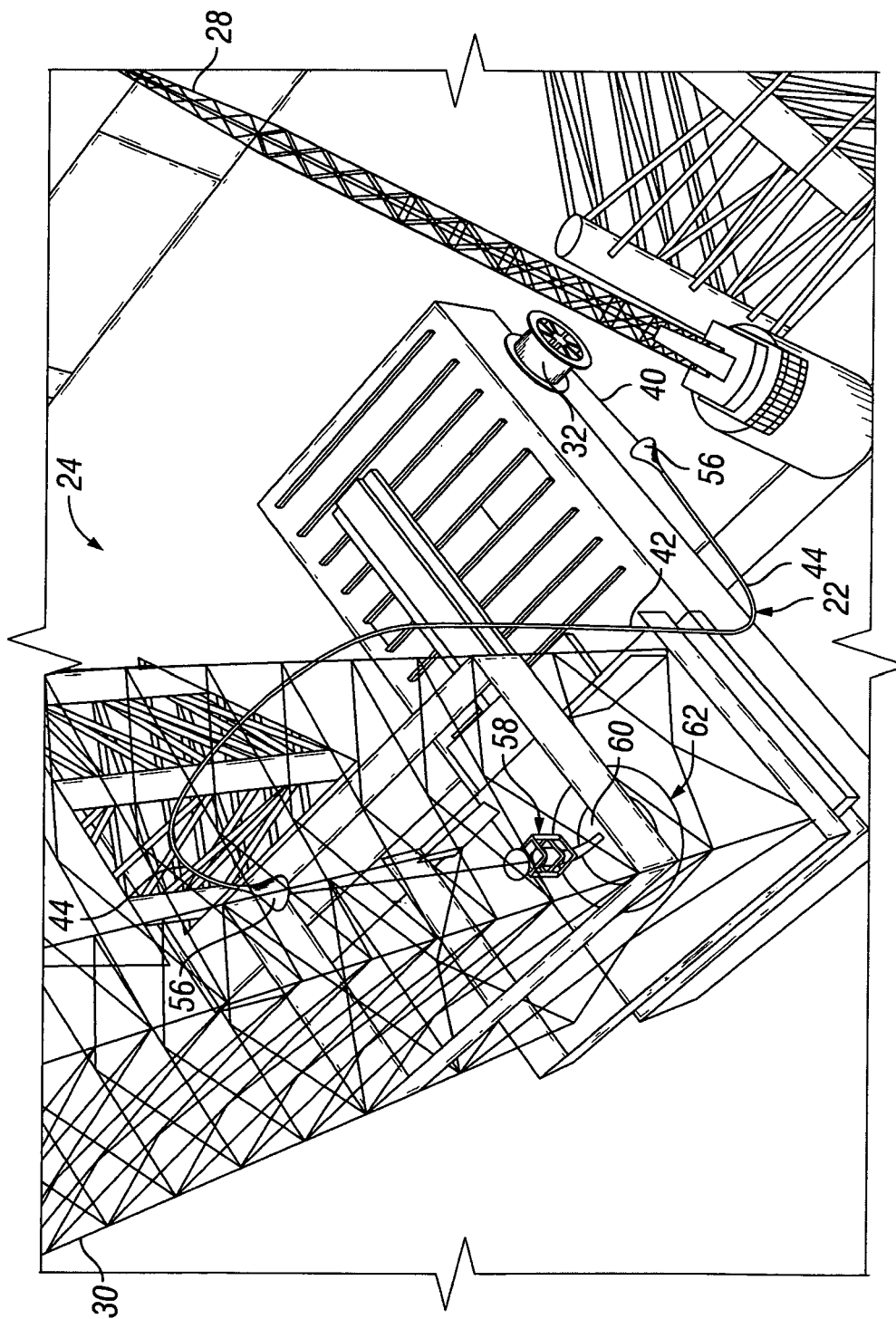


FIG. 9

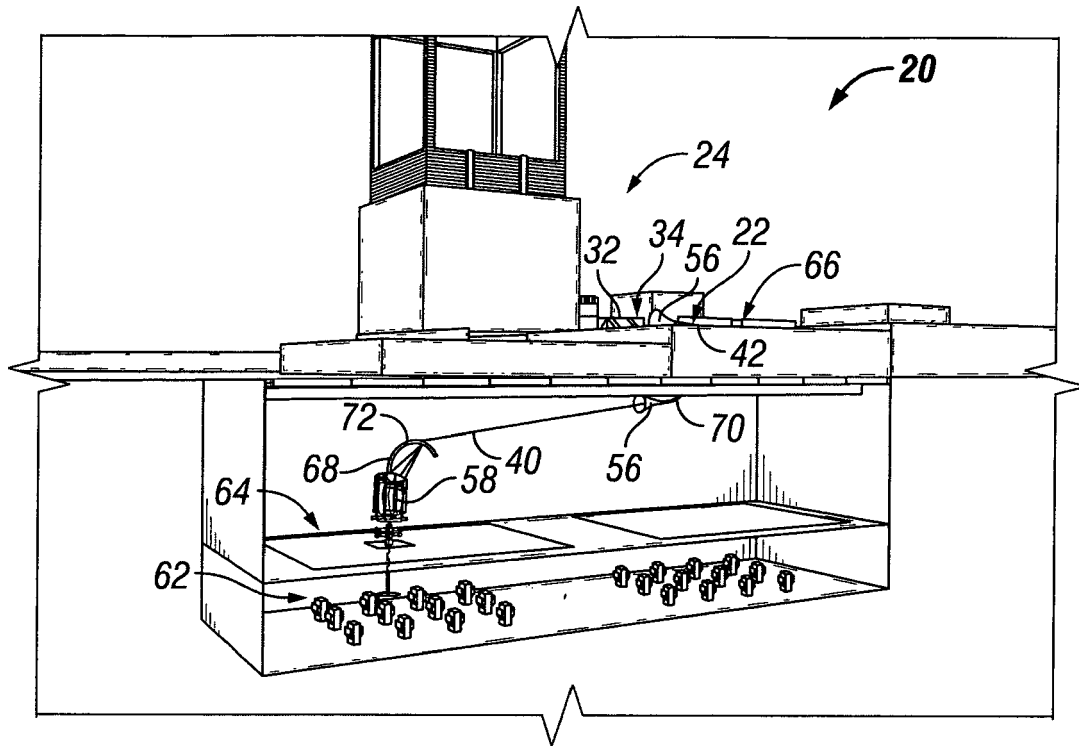


FIG. 10

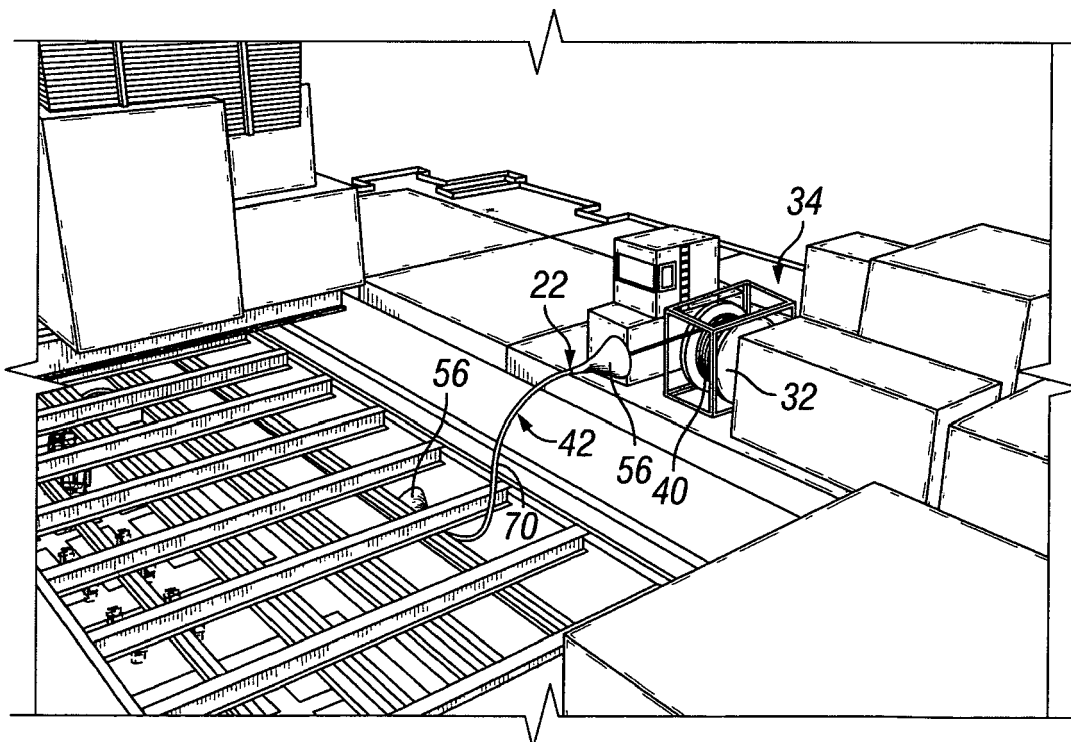


FIG. 11

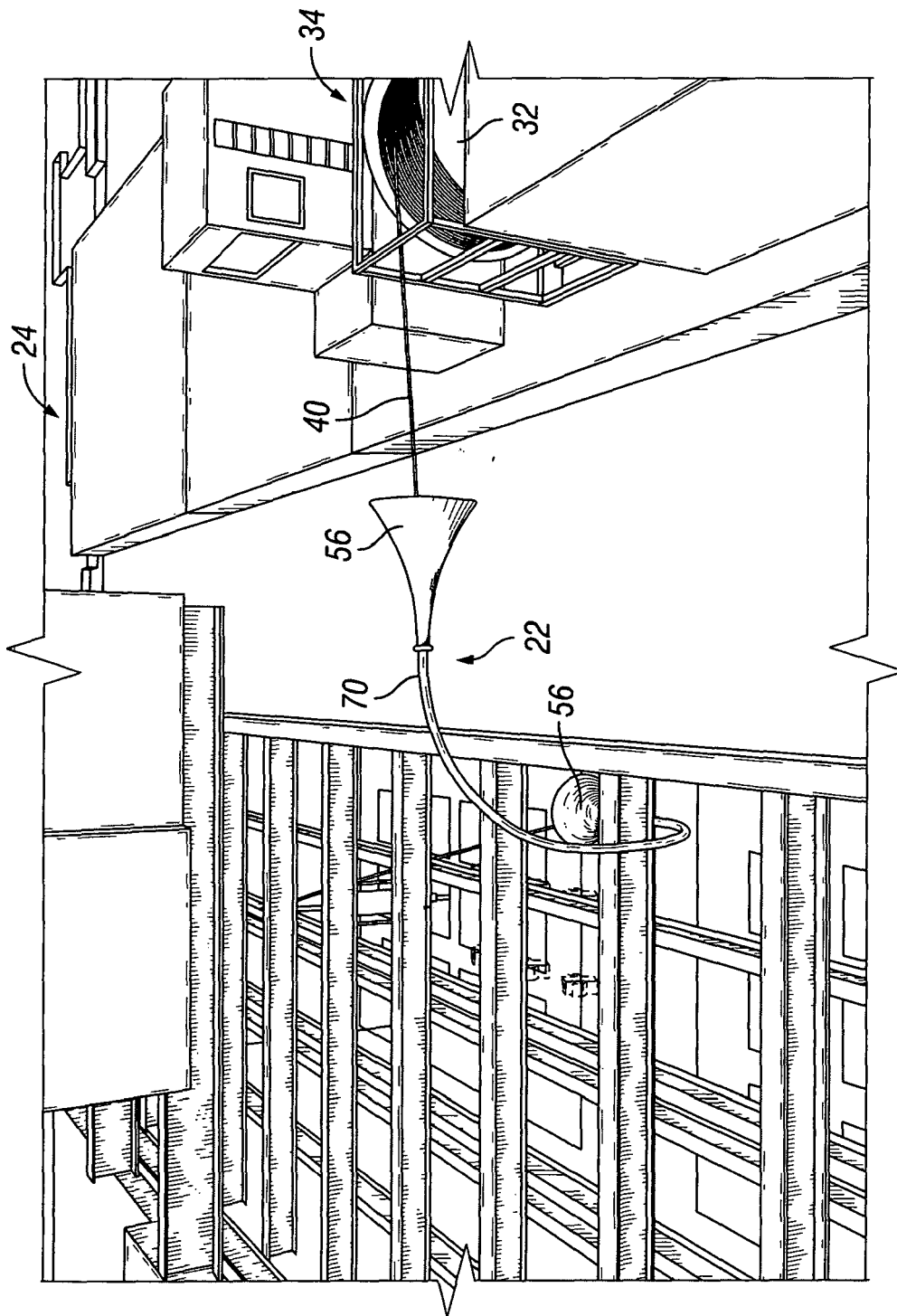


FIG. 12

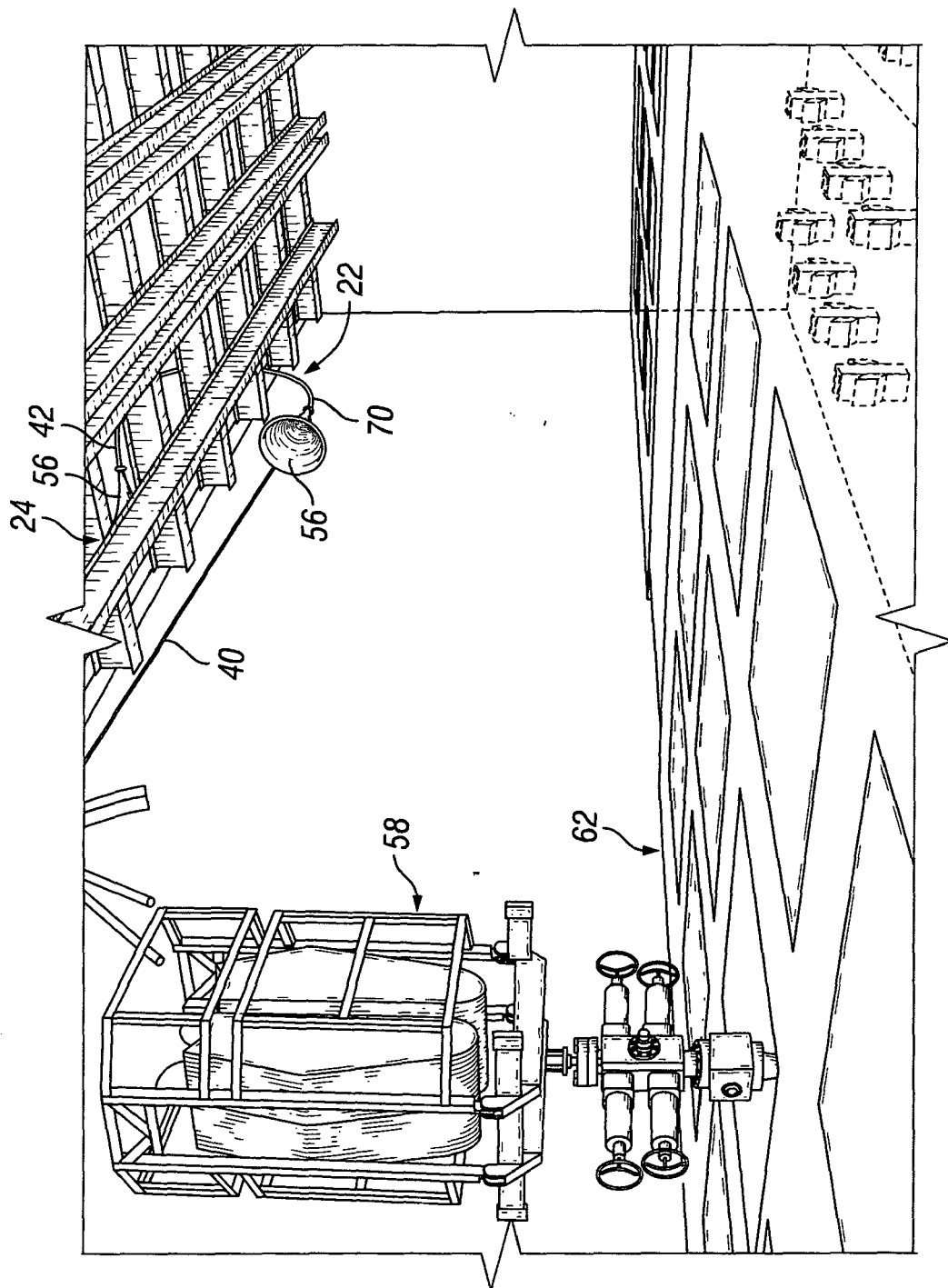


FIG. 13