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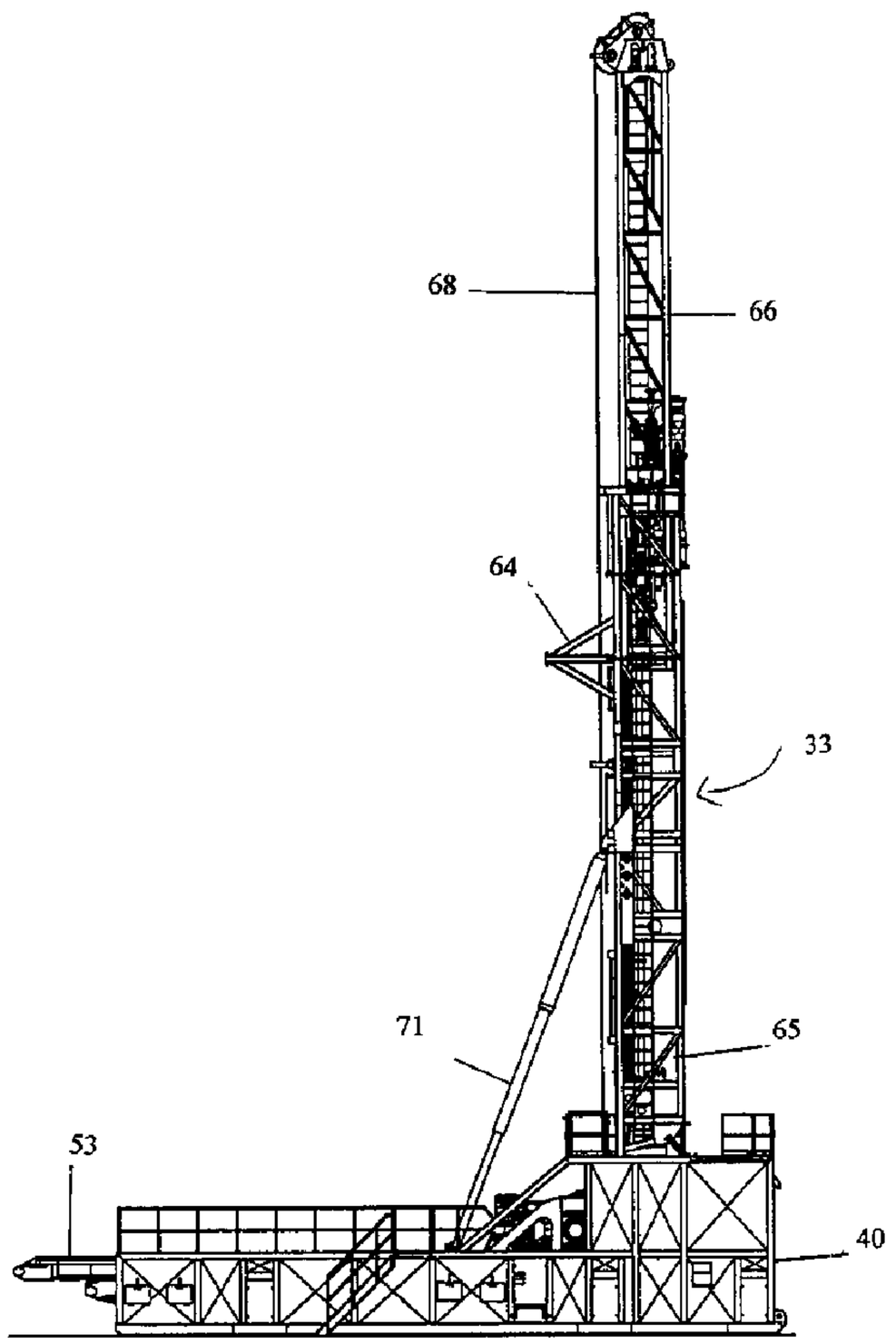

(57) Abrégé/Abstract:
A drilling rig for use in both coiled tubing injection and rigid threaded pipe operations, and consisting of a number of separably transportable modules which are assembled on site for carrying out the operations. Included in the modules are a substructure

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(57) Abrégé(suite)/Abstract(continued):
component, a mast component and an injector component. In setting up for operation, the mast component is combined on site with the substructure component which supports the assembled rig over the borehole. The mast component in location provides a loading area to support the injector component in a position for ready loading of an injector included in the injector component into the mast when required for a coiled tubing operation.

ABSTRACT

A drilling rig for use in both coiled tubing injection and rigid threaded pipe operations, and consisting of a number of separably transportable modules which are assembled on site for carrying out the operations. Included in the modules are a substructure component, a mast component and an injector component. In setting up for operation, the mast component is combined on site with the substructure component which supports the assembled rig over the borehole. The mast component in location provides a loading area to support the injector component in a position for ready loading of an injector included in the injector component into the mast when required for a coiled tubing operation.

MODULAR COILED TUBING AND SECTIONAL PIPE DRILLING RIG

Field Of The Invention

This invention relates to a drilling rig of the type used in drilling and servicing boreholes, and more particularly, to one formed of separate units or modules, capable of being readily transported and then assembled for use with coiled tubing or threaded pipe sections.

Background Of The Invention

The use of the coiled tubing technique in forming and servicing well boreholes has gained wide spread acceptance in the last decade due to the convenience and speed of using a continuous length of tubing from a reel as opposed to the amount of labour and time required in using the conventional method of joining and disassembling of sections of lengths of threaded pipe. Initially, it was a common practice to mount a reel of the coiled tubing on a transport deck also carrying a mast or boom supporting an injector which is supported over the well head, although prior art exists wherein the injector was supported separate from the reel carrier. In any event, the coiled tubing process has limitations under certain drilling conditions, and as a result various equipment and techniques have developed for being able to switch back and forth between the two different processes in the drilling and servicing of a single well. Various techniques have developed for combining into a single well operation the necessary components to allow quick and effective changes between the two processes, and this together with the increased tubular size has resulted in the need to transport extremely heavy equipment to and from the drilling site. Even with the provision of the necessary equipment for

providing both types of operations at the site at the same time, much of the equipment design which followed utilized a single transport unit. Not only does the weight and size result in complicated moving from one drill site to another in the oil field, but the weight regulations on public roadways set strict restrictions in size and weight as to what can be taken to or removed from the oil field. It had become known, that there is added convenience in providing at least the reel of coiled tubing on a separate transport, as shown in applicant's Canadian Patent Application No. 2,529,921, filed, December 13, 2005, Allan J. Pleskie. Nevertheless, again in view of the added size and weight of the overall drilling rig, there has existed a need for providing a more flexible and convenient method of transport and set-up at the drilling site.

Summary Of The Invention

It is an object of the present invention to provide an overall drill rig formed of readily separable units or modules each of which is of a weight and dimension which can be more conveniently moved from site to site each with more reasonable weight and within set requirements, and yet also be readily assembled and disassembled on site.

According to the present invention there is provided a drilling rig of the type for forming and servicing boreholes, and includes at least three separably transportable modules, including a substructure component, a mast component and an injection component. A first transportable module forming the substructure component includes a framework base structure having a ground engaging lower portion for supporting the rig. The framework base includes a well head area with a vertical axis therein adjacent one end of the framework base for alignment with the borehole, and a bed area extending to an opposite end of the framework base. The mast component of the rig includes a base portion and a mast framework having a

longitudinal central axis and being pivotally attached to the base portion for movement between a lowered position and a raised operative position. The base portion of the second module is shaped for reception in the bed of the substructure component of the first module so as to position the second modular component for alignment of the mast framework in the raised position with the axis of the well area of the first substructure component. The base portion of the mast component defines an upper support area. The injector component includes an injector carrier and a tubing injector having attachment means for connection to the mast framework, the injector carrier being adapted to be positioned on the upper supporting area of the base portion of the mast component and supporting the injector in a location for connection of the tubing injector to the mast framework when the mast framework is in a loading lowered position so as to allow loading of the tubing injector in relation to the mast.

There maybe further provided a fourth module which includes a transport component for carrying a coiled tube holding reel for placement juxtapose the substructure component and mast component when assembled for supplying to and receiving from the injector component the coiled tubing.

Yet an independent transportable module may be provided which forms a power pack component for positioning juxtapose the second and fourth module for supplying power services thereto.

Brief Description Of The Drawings

In the accompanying drawings, which show one preferred embodiment of the invention, by way of example:

Figure 1 shows a side view of a first module of the invention which is a separate component in the form of a substructure;

Figure 2 is a top view of the substructure of Figure 1;

Figure 3 is an end view of the substructure of Figures 1 and 2, as seen from the right hand end;

Figure 4 is a side view of another component unit which is a portable power pack for providing power to the rig of the present invention in operation;

Figure 5 is a side view of another component of the invention which is formed by drawworks/mast structure, hereafter referred to as the mast component, carried on its own framework and in a transport mode;

Figure 6 is a top view of the structure shown in Figure 5;

Figure 7 is a side view of the mast component of Figure 5 and 6 as combined with and mounted within the substructure component of Figures 1 - 3;

Figure 8 is a top view of the combined structure of Figure 7;

Figure 9 is an end view of the combined structure as seen from the right hand end of Figures 7 and 8;

Figure 10 is a side view of the combined structure as seen in Figure 6, with the mast in a raised and extended condition wherein the top drive may be used in manipulating threaded pipe sections during certain operations in forming the borehole;

Figure 11 is a end view of the structure in the mode of Figure 10 as seen from the right hand end of Figure 10;

Figure 12 is a perspective view of an injection unit, hereinafter referred to as the injector, as utilized in the coiled tubing processing work within the borehole;

Figure 13 is a side view of another module or component of the present invention which includes the injector unit of Figure 12 carried on its loading/unloading mechanism within its own transport framework;

Figure 14 is a top view of the separate component as seen in Figure 13, of the invention.

Figure 15 is an end view of the component of Figures 12 and 13 as seen from the right hand end of Figures 13 and 14;

Figure 16 is a side view of the drilling rig of the present invention with the mast in a raised working mode and wherein the injector component of Figures 13 to 15 is mounted on the frame structure of the mast component.

Figure 17 is a side view of the structure as in Figure 16, and wherein the mast has been lowered to a position for the mounting of the injector unit of Figure 12 as carried within the injector component of Figures 13 and 14.

Figure 18 is a perspective view of the overall structure of the components of the present invention, less the reel storage component and power package, showing the relative positioning of the mast and injection component.

Figure 19 is a side view like Figure 17, but with the loading/unloading unit extended to an injector loading position

Figure 20 is a side view of the components of Figure 18, but in a position after the mast has been raised to its operation position with the injector loaded into the mast;

Figure 21 is an end view of the overall structure of Figure 18 as seen from the right hand end; and

Figure 22 is a side view of a complete final set up of the apparatus, including the reel storage component and showing the relative position of the injector unit and the mast after the final operation of moving the injection unit into its final operating mode.

Figure 23 is an end view of the apparatus of Figure 22, as seen from the right hand side showing the apparatus of the present invention in a coil tubing working mode.

Figure 24 is an enlarged, perspective view of a portion of the mast containing the injector, and showing a locking and positioning mechanism within the mast.

Detailed Description

Referring first briefly to Figure 22, there is shown a complete set up at a drilling site of rig 30 of the present invention in an operating mode and incorporating the present invention. The rig 30 includes an overall substructure or base component 31 on which there is mounted a drawwork/mast module, hereinafter referred to as a mast component 52. On the mast component 52 there is mounted an injector carrier 32. The mast component 52 includes an upright mast 33 which is provided with a top drive apparatus 34 and supports an injector component 75 during a coiled tubing operation. A separate module or transport component 36 carries a reel 37 which furthers supplies coiled tubing 38 during a drilling operation, or receives the coiled tubing during its withdrawal from a well.

In an operatively assembled form in Figure 1, there is shown the first module or base component 31 which is in the form of a completely separable substructure 40. This component is movable to and from a drill site by a carrier such as a highway transport. Examples of its overall dimensions may be about 50 feet long, 14 feet wide and 14 feet high at its area of maximum height. As can be noted from Figure 2, the base component 31 in plan view has an overall outside rectangular shape and is constructed basically of a steel framework. One end 41, as seen at the left hand end in Figure 1, has a greater height in relation to an opposite lower end portion 42, the latter of which is adapted to receive the drawwork/mast module shown in Figure 5 and 6, and hereinafter referred to as the mast component 52. Located in the raised end portion of the substructure 40 is a well area 43, which in operation is located over the borehole centre. The outermost longitudinal upright sides 44,44 of the framework are supported at lower ends on longitudinally extending runners 45,45 which effectively provide a skid for the base of the overall base component 31. A platform 46 area is provided between the sides 44,44 at the raised portion about the

well area 43. Formed longitudinally between side walkways 47,47 which extend the length of the lower end portion 42 is a lower channel area 48 forming an elongated bed. The channel area or bed 48 is shaped to receive the mast component 52 when the mast component and base component 31 are assembled on site. The bed area 42 is open at the outer end of lower end portion 42, and longitudinally extending support rails 49,49 are provided at the bottom of the channel area 48 to carry a base 53 (Figure 5) of the mast component 52. An elongated roller 50 is provided between rails 49,49 at their outer end to assist in initial entry of the mast component 52 during assembly of the mast component 52 into the substructure 40. As will become more apparent below, during operation of the rig 30, the mast component 52 has its lower portion nested with the lower channel area 48 as the rig is assembled for operation on site. Along outside edges of the lower end portion of the substructure 40, hand rails 51,51 are provided as well as stair structures 54 which are properly moved into position when the mast component is installed. Hand rails 58 are also provided at the edges of the raised end portion 41 as well but are adapted to fold down to a flat, horizontal position for shipping.

Figure 4 illustrates another separate module, which may be termed a power pack 55, and includes a platform 56 mounted on skids 57, and on which are carried a prime mover, for driving one or more components, such as an electrical generator, an air compressor and associated tank, a hydraulic pump and associated reservoir, and the like. While the base component 31 or mast component 52 may be provided on or within their substructures an area to contain the power pack 55, it may be delivered to the site separately and possibly located at a distance from the overall rig 30 setup.

Referring now to Figures 5 and 6 for a more complete understanding of the completely separate module forming the mast component 52, it may be noted its base 53 has an integral raised framework section 61 at one end thereof and by way of a pivot connection 60, there is connection to this raised framework 61 a lower end 62

of a mast framework 63. As is apparent in Figure 5, the free end of the base 53 does not extend horizontally to the same extent as the collapsed mast framework 63. In its shipping state, as illustrated in Figures 5 and 6, the overall length of the mast component may be in the order of 56 feet. When assembled in the channel area 48 of the base component 31, as shown for example in Figure 7, the free end of the base 53 projects outwardly of the end of the base component 31. The structure forming the base 53 of the mast component 52 is also designed so as to provide a skid structure for the mast component 52. It is to be noted that toward the outer end of lower frame structure 65 of the mast framework 63 there is attached thereto a pair of perpendicular projecting legs 64 which are of a length to rest on the base 53 of the mast component 52 when the mast framework is in its completely lowered horizontal position so as to transfer the weight of the mast 33 at this point directly to the base during transport.

The mast framework 63 has a telescoping form so that in an extended condition, which is more apparent in Figures 10 and 11, it has a significantly greater height than its length when in the lowered form of Figures 6 and 7, the total mast structure including telescopically joined lower framework 65 and an upper framework 66. When in an operating condition the upper framework 66 is elevated relative to the lower framework 65 by drawworks with lifting cables (not shown) to provide the higher mast particularly for use when the rig is being used for drilling with threaded pipe sections. Contained within the mast is a top drive apparatus 70 for use with the threaded pipe sections. The top drive apparatus 70 can be run substantially the full height of the mast framework in a continuous aligned track system within the two sections of the extended mast framework 63 by way of cables 68 which pass over the sheaves 67 at the top of the upper frame structure 66. Housed in the raised framework 61 of the base 53 are motor driven winches 69 for controlling the winding in and paying out of cables 68.

Expandible piston and cylinder type motors 71 are pivotally connected at lower ends to the base 31 of the mast component 52 and at upper ends to the lower frame structure 65 of the mast framework 63. Accordingly, on expansion of the motors 71, the mast framework can be raised by pivoting about pivot connection 60 from a horizontal position to its upright position. After this operation, the upper structure 66 of the mast framework is raised to its elevated position where it remains regardless of whether the top drive apparatus 70 is being used or alternatively the injector 35 has been inserted into its elevated operation position within the mast 33 as further described below.

As shown in the Figures 5 and 6, the base 53 of the mast component 52 provides an upper surface 59 which is readily accessible within the combined structure provided by the substructure component 40 and the mast component 52 when the mast is in a raised condition. As will become more obvious below this surface 59 is below the open area 74 of the mast framework 63 when the mast is lowered while in its extended condition. This upper surface 59 thus provides an upper support area for injector carrier 32, for reasons which will be hereinafter described.

In Figures 7, 8 and 9, the drilling rig is shown at the stage of the mast component 52 being fully assembled into the base component 31, and with other auxiliary parts, such as the stairs 54, hand rails 58, etc. being moved into their working positions. As is apparent from Figures 7 and 8, when the mast component 52 is fully nestled within its channel area 48 of the base component 31, the end of the pivotal connection 60 is located partially within the higher end portion 41 of the base component 31, and is positioned so that as the mast is raised by motors 71, the central longitudinal work axis of the mast is moved to a position aligned with the well centre area 43 in the base component, which is located vertically above the borehole, as can be seen in Figures 10 and 11.

In the vertical position of the mast 33, as shown in Figures 10 and 11, without the injector 35 having been attached in the open area indicated at 74 within the mast framework 63, the rig is capable of operating with threaded pipe sections by using the top drive apparatus 34. As previously indicated, the top drive apparatus 34 is capable of travelling in aligned tracks within the lower and upper mast structure of sections 65,66. Thus, the rig is then totally functional in the usual manner as a rigid pipe drilling apparatus area with the top drive apparatus 34 being aligned with the well centre area of the base component 31. As previously indicated, the vertical positioning of the top drive apparatus 34 is determined by the operation of the motor driven winch means 69, (Figure 5) by way of cables 68.

There is shown in Figure 12, the injector 35 which is optionally loaded into the open area 74 at the mast, once the top drive has been raised to a position above the open area 74, as shown, for example, in Figure 11. The position of the top drive shown in Figure 11 represents one which is used when it is desirable to commence the use of coiled tubing in the drilling or servicing operations in the borehole. As can be seen in Figure 12, the injector 35 per se is provided with a base member 76 and a head member 77 which are shaped for reception in the open area 74 within the mast framework 63. Located between the base member 76 and the head member 77 is the injector body 78 which includes two sets of driven gripper chains (not shown) which engage the coiled tubing and, depending on the direction of drive of the chains, the chains either push the tubing down into the well or pulls it upwardly out of the well when using the coiled tubing process. As may be seen in Figure 15, the base member has a central opening 80 through which the tubing is pulled or pushed, depending on the operation in process. In operation, the opening 80 is in alignment with the well centre area 43 of the base component. In addition to the securement of the injector 78 between the base member 76 and head member 77, a framework 79 is provided outside of the injector body 78 and is joined at lower and upper ends to the base

member 76 and head members 77, respectively.

As is apparent in Figure 12, the base member 76 of the injector 35 is provided with a pair of rigid locating lugs 84,84 at opposite sides thereof which function as stops to locate the injector 35 as it is being raised into loading position within the open area 74 within the mast framework 63. The base member 76 also includes an internal hydraulic mechanism for extending and retracting cylindrically shaped lock members 72, 72 which secure the base member 76 within the mast 33 when extended. The head member also has a pair of rectangular shaped lock members 73,73 which are hydraulically extendable and retractable from opposite sides thereof. The action of the lock members is further described below.

Secured to the head member 77 of the injector 35 is a gooseneck 81, which is of the type formed by two sections, a base portion 82 which is affixed relative to the head member 77 of the injector 35, and an outer end portion 83 which is hinged to an outer end of the base portion 82 so as to fold under when it is not in use and thereby occupy less space. When in use, the gooseneck 81 provides a track of a smoothly formed curvature in which the coiled tubing passes when travelling from its storage reel 37 to the injector 35, or in the opposite direction when the tubing is being withdrawn from the well and returned to the reel.

Turning now to Figures 13 to 15, there is shown a separately transportable module, in the form of what is termed hereinafter the injector component 75 consisting of the above described injector 35 mounted on the injector carrier 32. As indicated above also, this injector component is adapted to be accurately located on upper surface 59 provided on top of the base 53 of the mast component 52, once the mast 33 has been raised to an upright position. As will be described further below, when the mast 33 is then subsequently lowered, the open area 74 of the mast partly encompasses the injector 35 as it rests on the support mechanism 86 of the injector carrier 32 of the injector component 75.

The injector carrier 32 includes a base 85, again in the form of a platform , which provides a skid for this transport component so as to enhance its movement on the ground on its transporter or in placement on the platform or upper surface 59 on the base of the mast component 52. The support mechanism 86 is affixed to the top of the base 85 and has an upper injector engagement member 87 which carries the injector 35 in a completely horizontal position. There is provided, however, between the member 87 and the base 85, a lift means 88 shown in the form of a scissor mechanism, which may be actuated by a screw mechanism, hydraulic cylinder, or the like, to raise the injector 35. The lift means 88 is shown in Figure 19 in a lift position. Mounted on either side of the base 85 are mast support posts 90,90 which extend upward and laterally outward and provide upper end surfaces 91,91 which engage the framework of the mast 33 as it is lowered to its slightly inclined, injector load position for pick-up or delivery of the injector 35. Thus, these posts 90,90 take the weight of the mast 33 when it reaches its inclined pick-up position, and supports the weight of the mast and accurately ensures its position as the injector 35 is loaded into or removed from its nested position in the open area 74 in the mast.

Turning now to Figure 16, which shows the rig ready to be prepared for commencing a coiled tubing loading operation, the mast 33 being in its vertical operative position with the top drive apparatus 34 stored in a raised position in the upper frame structure 66 of the mast 33, well above the open area 74 of the lower frame structure 65 of the mast. The injector component 75 is mounted on the upper surface 59 of the base 53 of the mast component 52.

Prior to the injector 35 being lifted, the additional module in the form of the transport component 36 carrying the coiled tubing holding reel 37 is positioned in line with the assembled injector component 75 as mounted on platform 56 and shown in Figure 22. This Figure includes the transport unit 36 on which the coiled tubing reel 37 is mounted. It may be noted that a crane 96 having an extendable boom 92 is

mounted rearwardly of the reel 37 on the transport unit 36, this boom being utilized in the stabbing of the tubing into the injector prior to the injector being raised into its operative position. Normally a short length of tubing (not shown) is left in the injector 35 during transport. A tubing snake (not shown) is then attached to the top end of that length of tubing. The crane 96 which holds the free end of the tubing on the reel is then extended to pull that free end from the reel to the gooseneck where it is attached to the snake. Then by activating the injector momentarily while the free end is released by the crane, the coil from the reel 37 is pulled by the snake into the injector, so as to allow the removal of the snake and short piece of tubing which have been pushed through opening 80 in the bottom end of the injector 35. A reverse procedure is utilized after terminating of the coiled tubing drilling process to ready the equipment for transport so that the short piece of tubing is returned to the injector and the continuous length of tubing is returned entirely to the transport unit 36.

However, returning to the preparation for switching from a threaded tubular operation to a coiled tubing operation, once the outer or free end 93 of the tubing on the reel 37 is in place within the injector 35 which is still positioned on the lift means 88 of the support mechanism 85, the cylinders 71 (Figure 16) are then retracted to lower the still extended mast 33 to the lowered, inclined or angled position wherein the mast 33 engages the tops 91,91 of the support posts 90,91. With such engagement there is established the correct position of the opening area 74 in relation to the partially encompassed injector 35. The lift means 88 of the support mechanism 86 in the injector component is then activated to move the injector 33 from the position shown in Figure 17 to that shown in Figure 18 or Figure 19. When positioned initially in the open area 74 of the mast, the axis of the injector 35 is still horizontally disposed, and thus at an angle relative to the central axis of the slightly inclined mast. When positioned in this manner the hydraulics within the base member 76 and head member 77 of the injector 33 are activated to cause lock

members 72 and 73 to move to an active position in which they project from opposite sides of the base member 76 and head member 77, respectively.

The lock members 72,72 in the base member 76, which are of circular cross section, are positioned when supported by the support mechanism 86 so as to project into circular openings in a frame member 95 at opposite sides of the mast as best indicated in Figures 18 and 19. The lock members 73,73 when projected from the head member with the injector in its horizontal position relative to an angle of section of the mast extend in front of locking pads 97,97, one of which is shown in Figure 24. Each lock pad is integral with a piston rod of a hydraulic piston and cylinder type motor 98, the outer end of each such cylinder of being supported by the framework 63 of the mast.

As the motors 98 remains in a retracted condition as the piston and cylinder motors 71 are activated to commence raising of the mast 33 from its inclined injector loading position, the axis of the injector 35 remains at an angle relative to the central axis of the mast. In order to prevent damaging of the coiled tubing held in the injector, the mast is continued to be elevated towards its vertical working position, with the injector remaining at the above described angle, usually until the mast at least approaches its entirely upright (Figures 20 and 21). In order to place the injector 35 in its working position relative to the mast, i.e., with the axis of the injector and that of the mast coinciding, the motors 98 are activated to extend their length whereby the pads 97 push the extended lock members 73,73 and thus the injector 35 to its working position (Figure 22 and 23) where it is locked by the engagement of the pads 97 with the lock member 73,73. The injector is free to pivot in this manner because the lower lock members 72,72, being of circular cross section, can rotate in the circular openings on the frame member 95 of the mast.

When in the position of the injector 35 as illustrated on Figure 22 and 23, the coiled tubing drilling work in relation to the borehole is commenced and continued

until the borehole is completed, or it becomes necessary to return to operations using threaded pipe sections. In the case of the latter, the reverse of operations are carried out, namely the motors 98 are retracted to allow the injector 35 to tilt to its unloading condition so that as the mast is lowered to its loading/unloading inclined position and the injector 35 is in a horizontal position upon its support 86. The lock members 72 and 73 are then hydraulically retracted so that the weight of the injector is transferred to its own injector carrier 32 and the mast 33 remains supported on the mast support posts 90 of the injector carrier 32. The mast can then be returned to its vertical operation position by activation of cylinders 71. The top drive apparatus 70 is then reactivated into its normal operation.

In the event the operation on the borehole is complete, the mast is raised again after the removal of the injector and the top drive apparatus 34 is lowered into the lower frame structure 65 prior to the upper frame structure 66 being also lowered into its lowered frame structure 65. The coiled tubing is disconnected and returned to its reel from the parked injector 35 in the manner described above at which time the transport component of the coiled tubing reel can be removed from the site. The injector carrier component including the base 85 with the injector 35 supported thereon is removed from the upper surface 59 of the base 53 of the mast component 52, and may be separably transported away from the site. The mast 33 can then be lowered and the appropriate disconnections made for removing the entire mast component 52 from the base component 31 before both are separately removed from the site.

Various modifications to the disclosed embodiment of the invention will be obvious to those skilled in the art without departing from the spirit of the invention as defined in the appending claims.

CLAIMS

1. A drilling rig for forming and servicing a borehole comprising;

a first transportable module forming a substructure component including a framework base structure having a ground engaging lower portion for supporting said rig,

said framework base including a well head area with a vertical axis therein adjacent one end of said framework base for alignment with said borehole, and a bed area extending to an opposite end of said framework base;

a second separably transportable module forming a mast component of said rig,

said mast component including a base portion and

a mast framework having a longitudinal central axis and being pivotally attached to said base portion for movement between a lowered position and a raised operative position,

said base portion of said mast component being shaped for reception in said bed of said substructure component of said first module and positioning said second module component for alignment of said mast framework in the raised position with said axis of said well area of said first substructure component, and

said base portion of said mast component defining an upper support area; and

a third separably transportable module forming an injector component and including;

a tubing injector having attachment means for connection to said mast framework, and,

an injector carrier for positioning on said upper supporting area of said base portion of said mast component and supporting said injector in a location for connection of said tubing injector to said mast framework when said mast framework is in a lowered loading position to thereby allow the loading of said tubing injector

into a working relation in said mast.

2. A drilling rig as defined in claim 1, and further comprising a fourth module including a transport component carrying a coiled tube holding reel for placement juxtaposed said substructure component and mast component when assembled for supplying to and receiving from said tubing injector component the coiled tubing.

3. A drilling rig as defined in claim 2, wherein said transport component includes a crane located rearwardly of said reel, said crane having an extendible boom for moving a free end of coiled tubing on said reel to said injector located on said injector carrier.

4. A drilling rig as defined in claim 1, and further comprising a fifth independent transportable module comprising;

a power pack component for positioning juxtaposed said second and fourth module for supplying power services thereto.

5. A drilling rig as defined in claim 1, wherein said mast framework contains a top drive apparatus for vertical travel within a major length of said mast framework during pipe section drilling.

6. A drilling rig as defined in claim 5, wherein said mast framework is formed of upper and lower sections wherein one of said sections is contained within the other, and further including drive means for raising said upper section to an extended operative position in a telescopic manner.

7. A drilling rig as defined in claim 6, wherein said lower section of said framework is pivotally connected at its lower end to said base portion of said mast

component, and

said mast framework is provided with an open area for reception of said tubing injector, when said top drive apparatus is parked above said open area.

8. A drilling rig as defined in claim 7 wherein said tubing injector in a locking situation is horizontally disposed and located at least partially within said open area when said mast framework is in said lowered loading position.

9. A drilling rig as defined in claim 8 wherein said mast framework is extended when in said lowered loading position, whereby a working axis of said injector is angularly disposed relative to said centre axis of the mast framework in said lowered loading position.

10. A drilling rig as defined in claim 9, wherein said injector has laterally lock members relatively extendable for engagement with said mast framework for raising said injector in place for raising of said injector with said framework.

11. A drilling rig as defined in claim 10, wherein said lock members hold said injector in an angular disposed position relative to said centre axis of said mast framework at least during initially raising of said mast framework to the raised working position.

12. A drilling rig as defined in claim 11 and further comprising motor means for tilting said injector to a working condition within the open area wherein said working axis of said injector is aligned with said axis of said mast framework in its raised working position, said motor means being actuable to the return of said injector to said tilting position during return of said mast framework to its locking position.

Application number / numéro de demande: 2595666

Figures: 6 to 8, 16 to 21 & 23

Pages:

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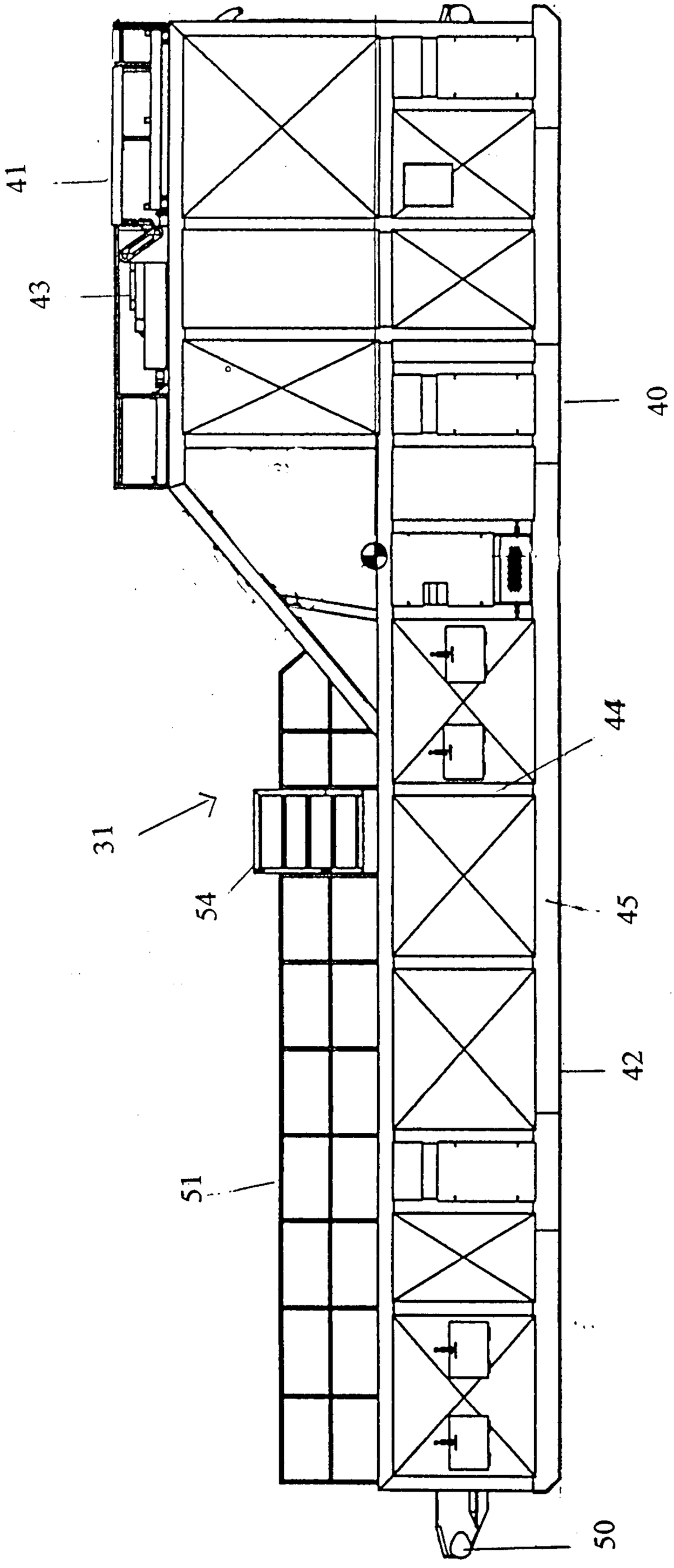


FIGURE 1

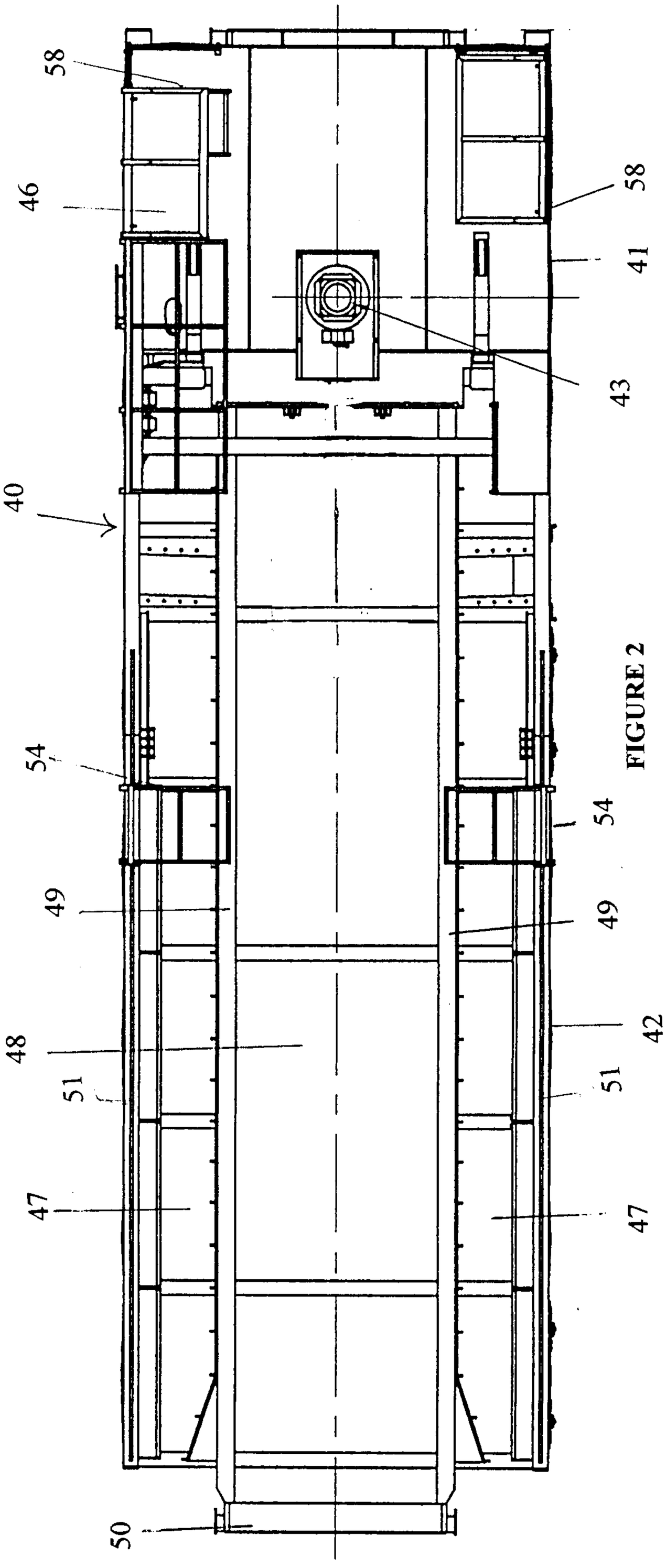


FIGURE 2

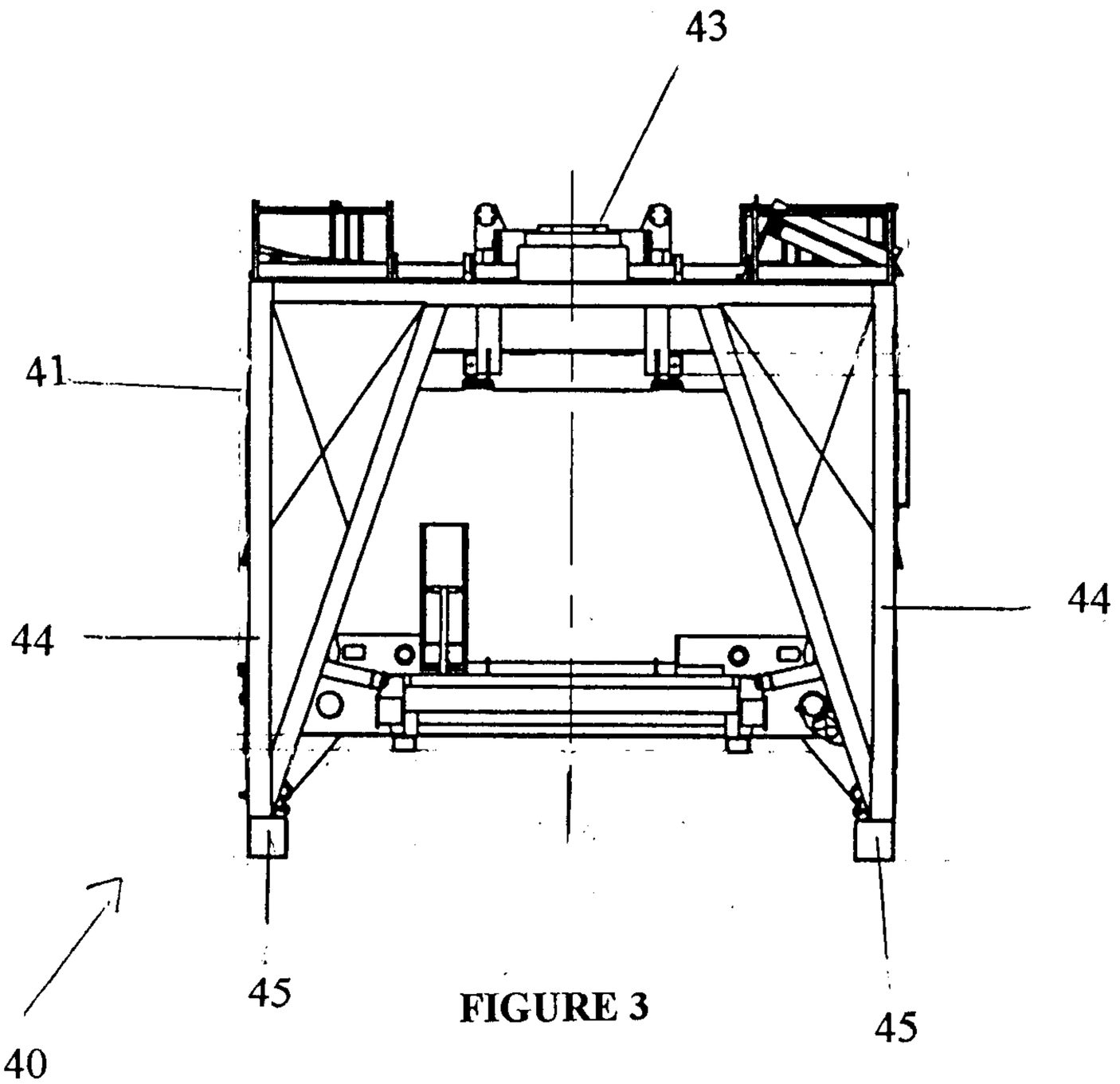


FIGURE 3

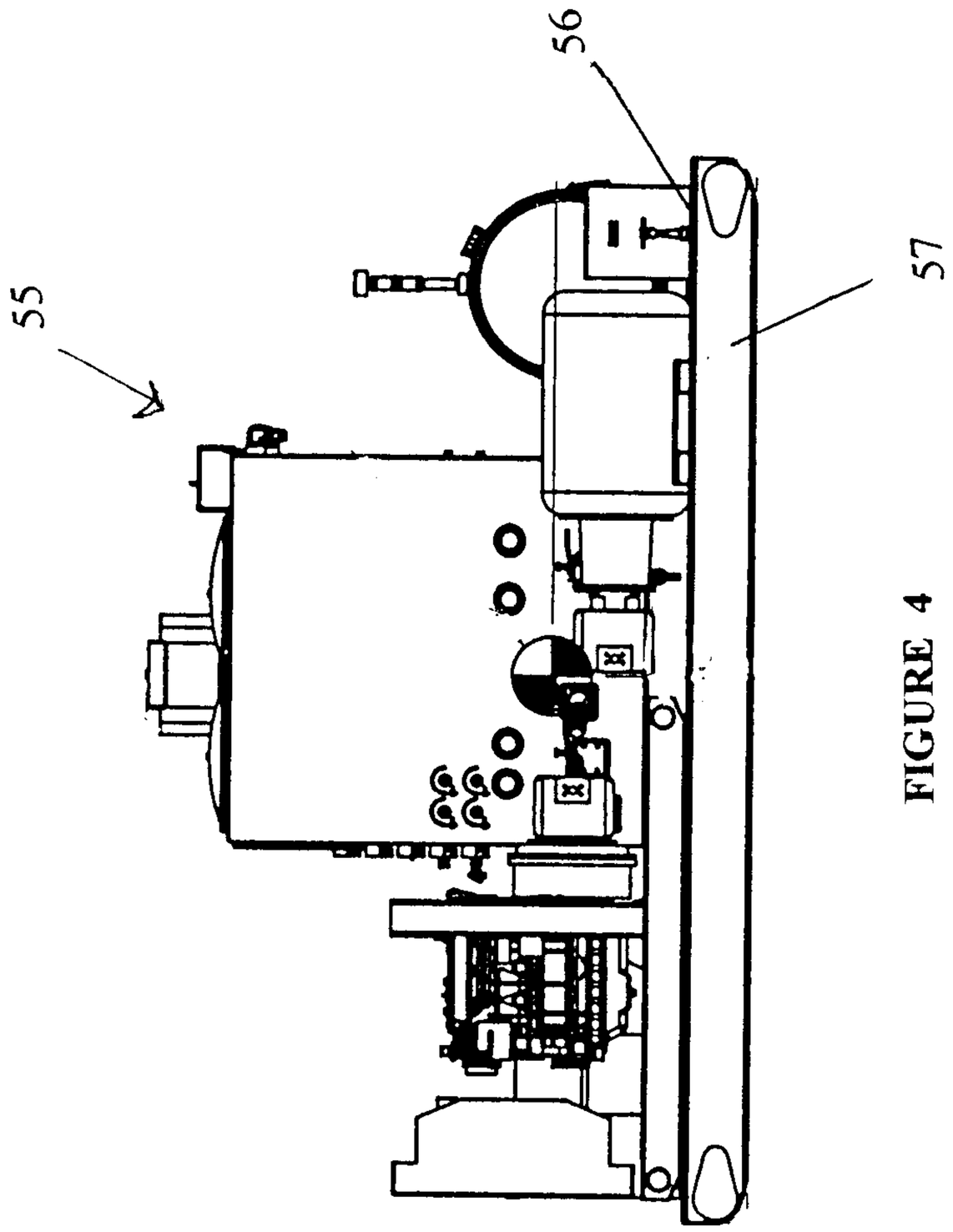


FIGURE 4

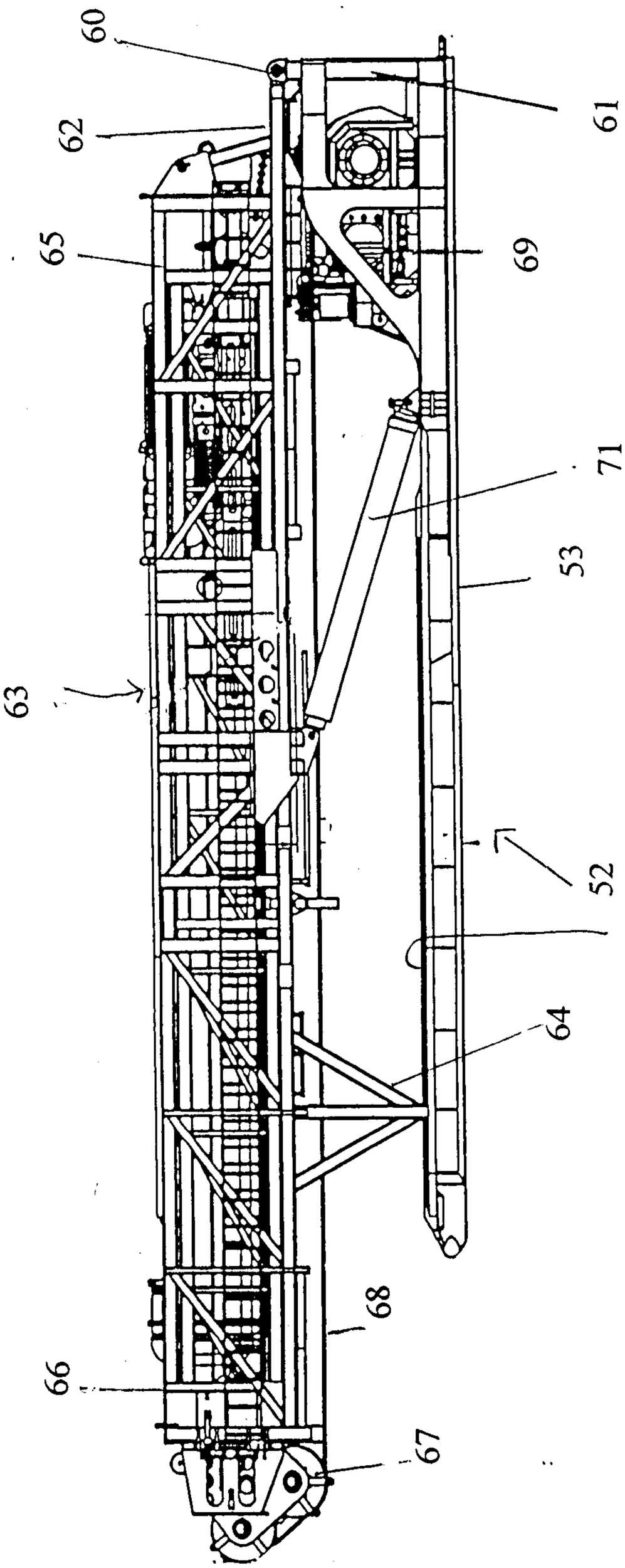


FIGURE 5

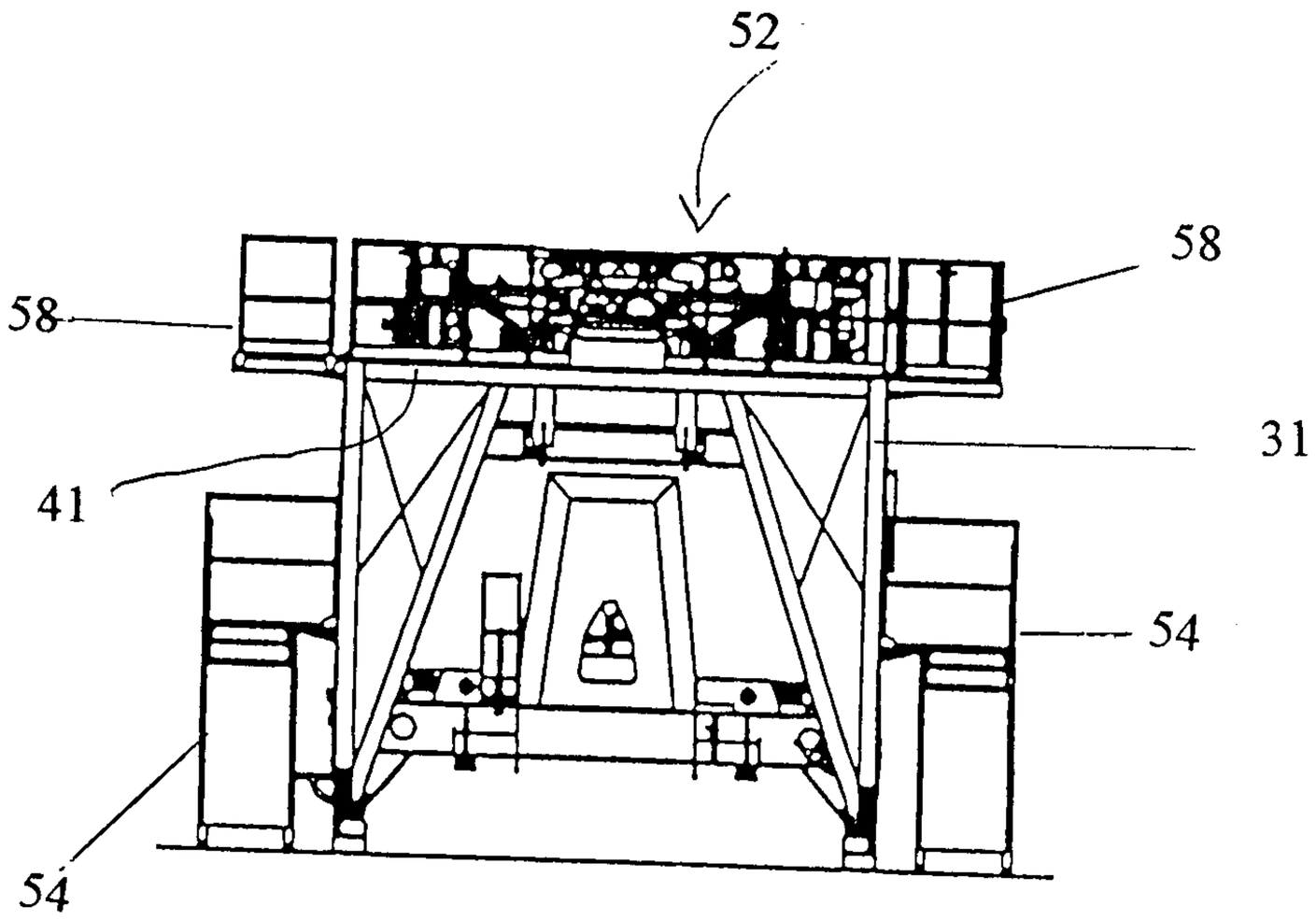


FIGURE 9

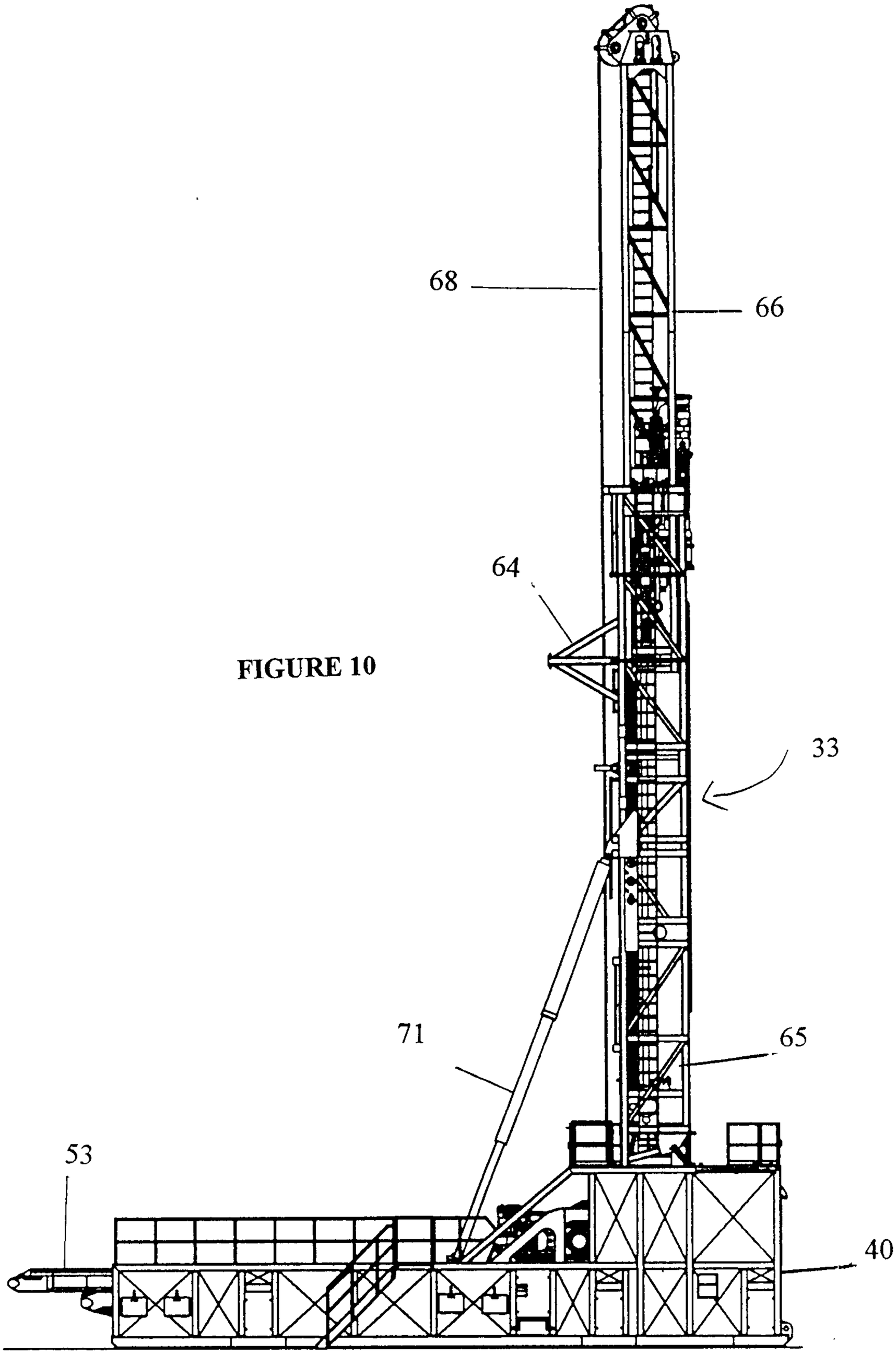


FIGURE 10

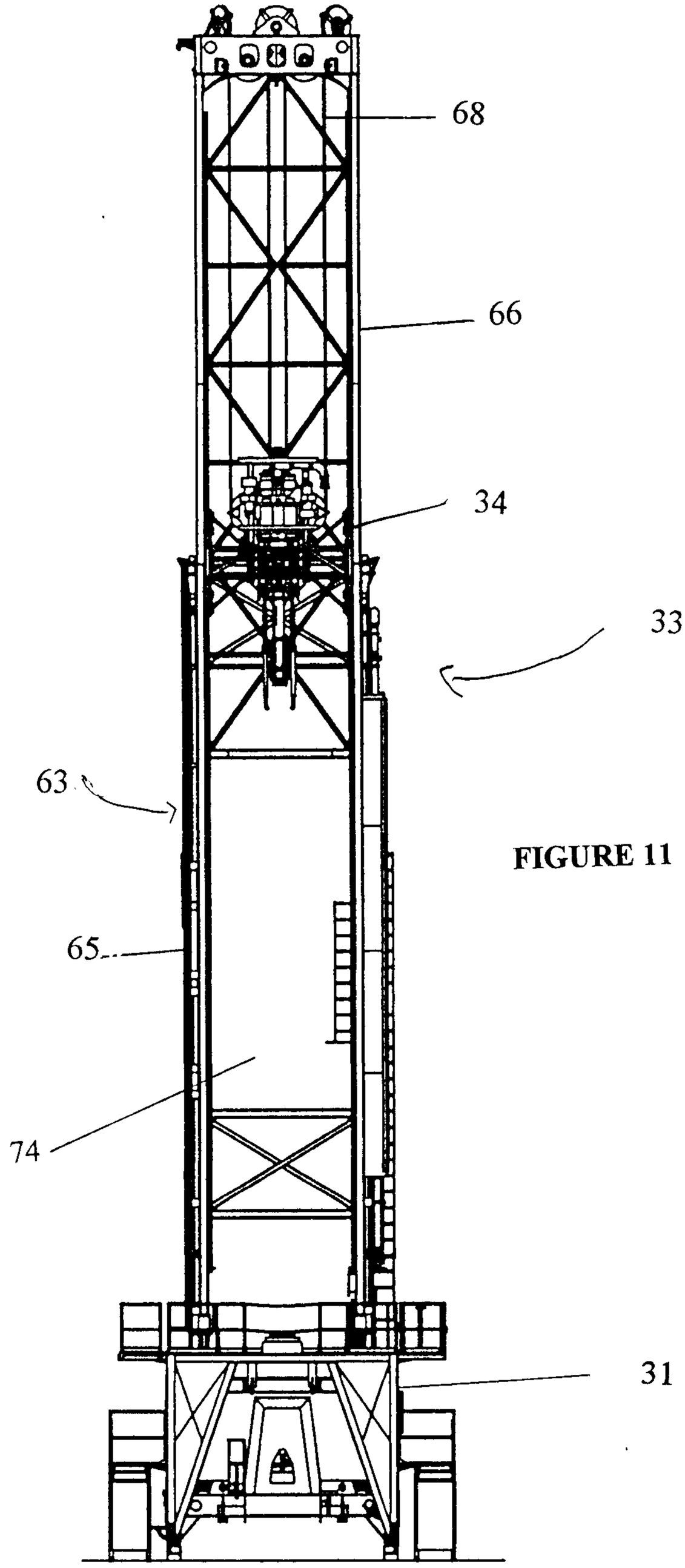


FIGURE 11

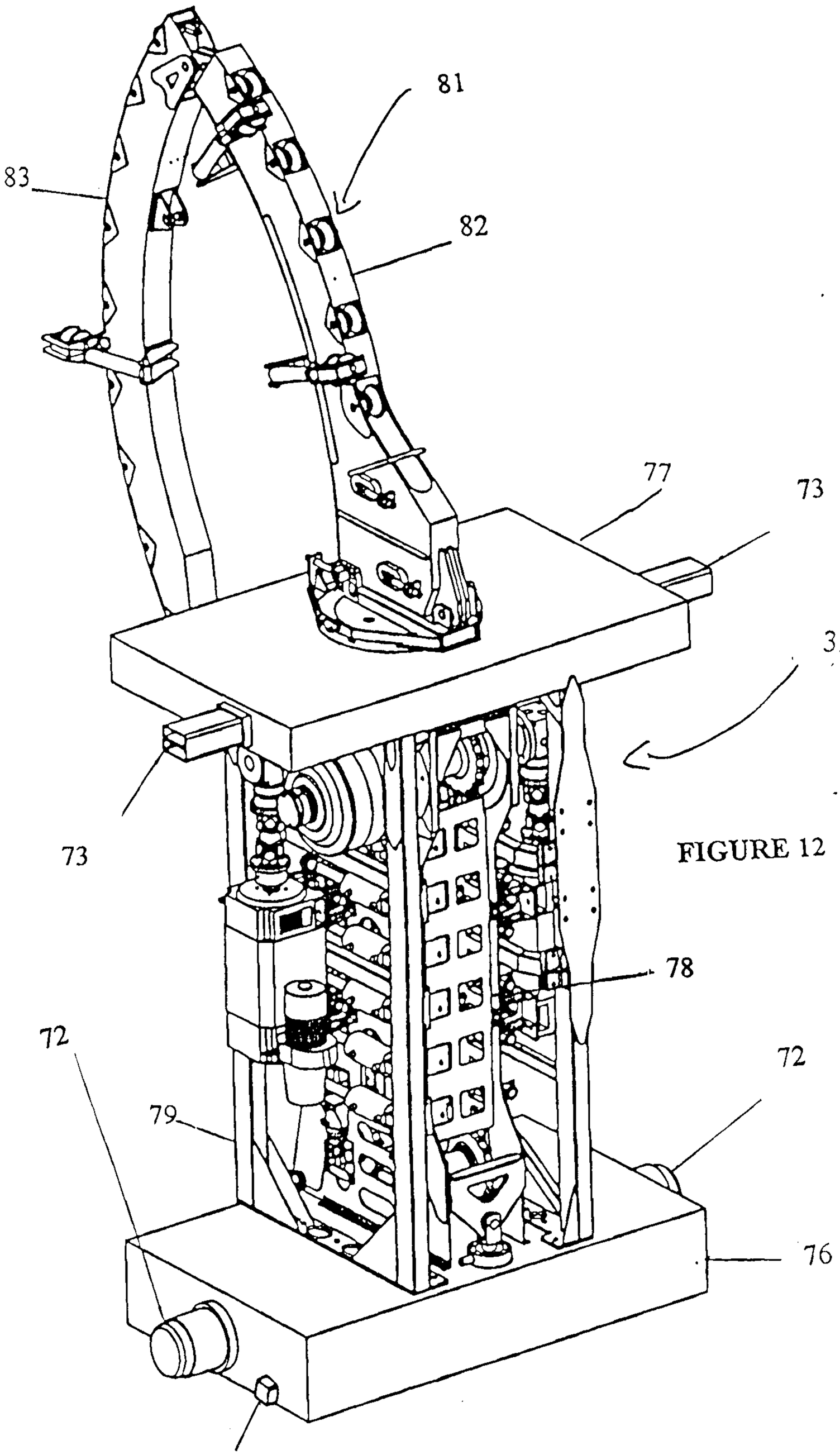


FIGURE 12

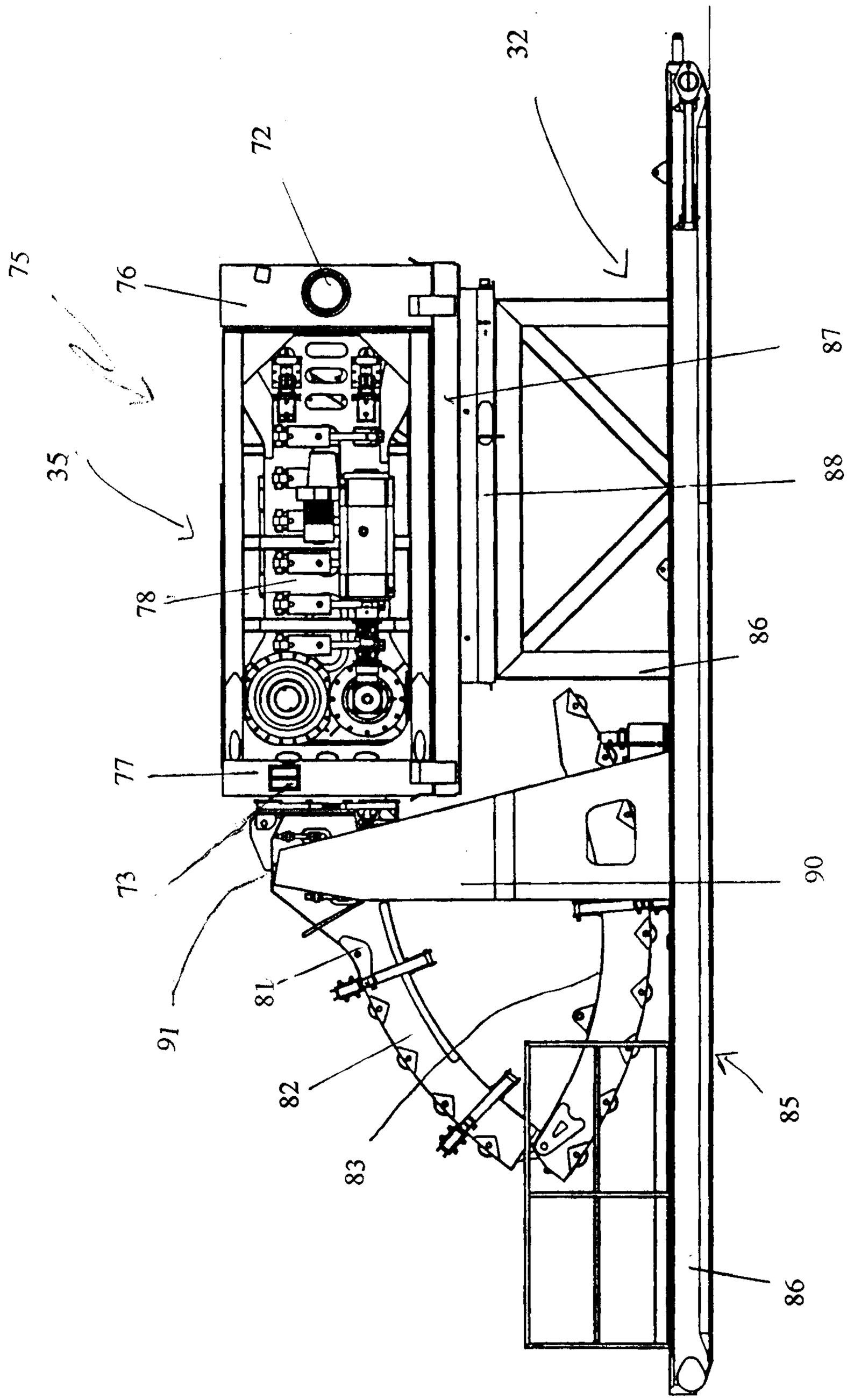


FIGURE 13

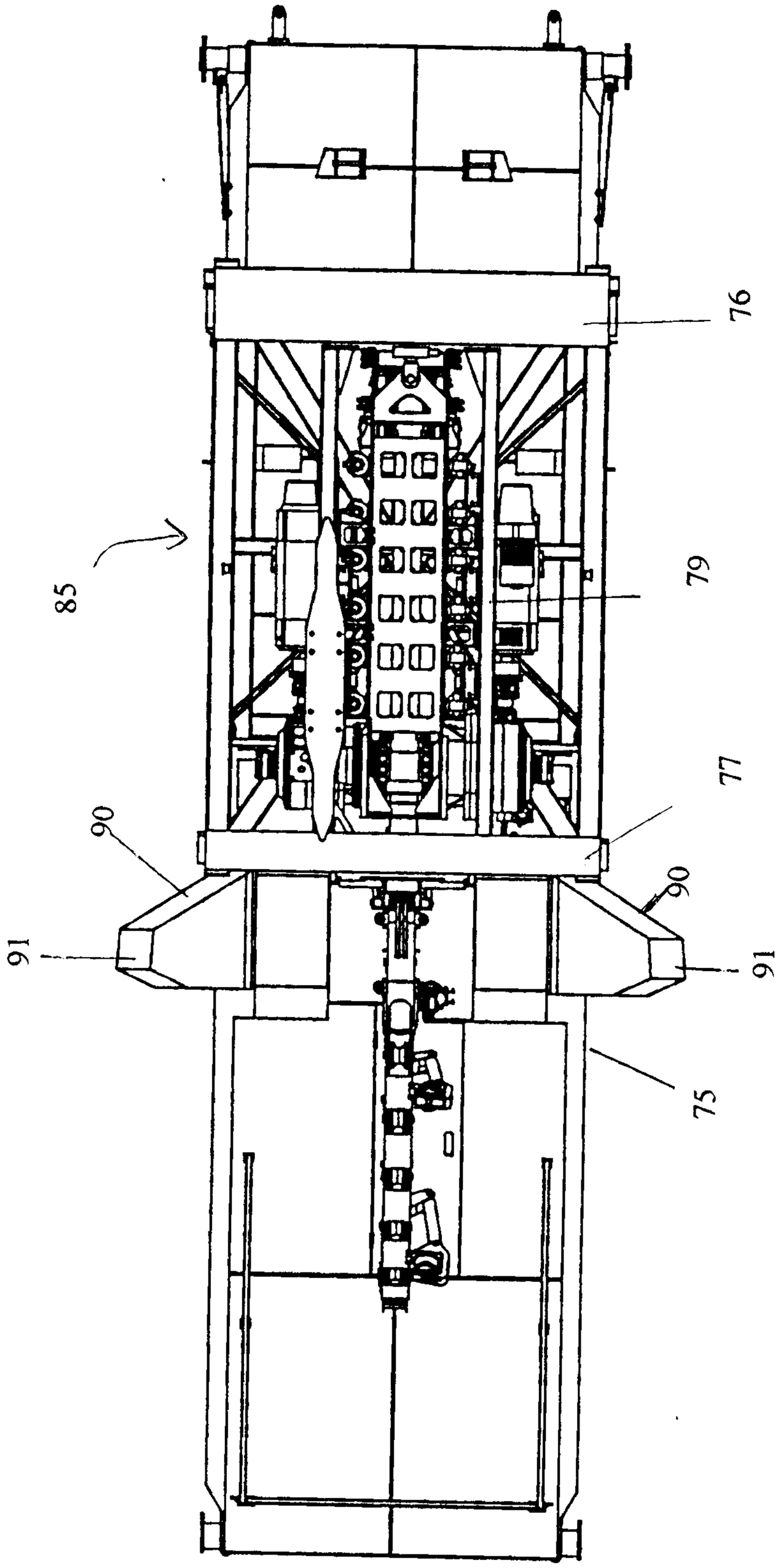


FIGURE 14

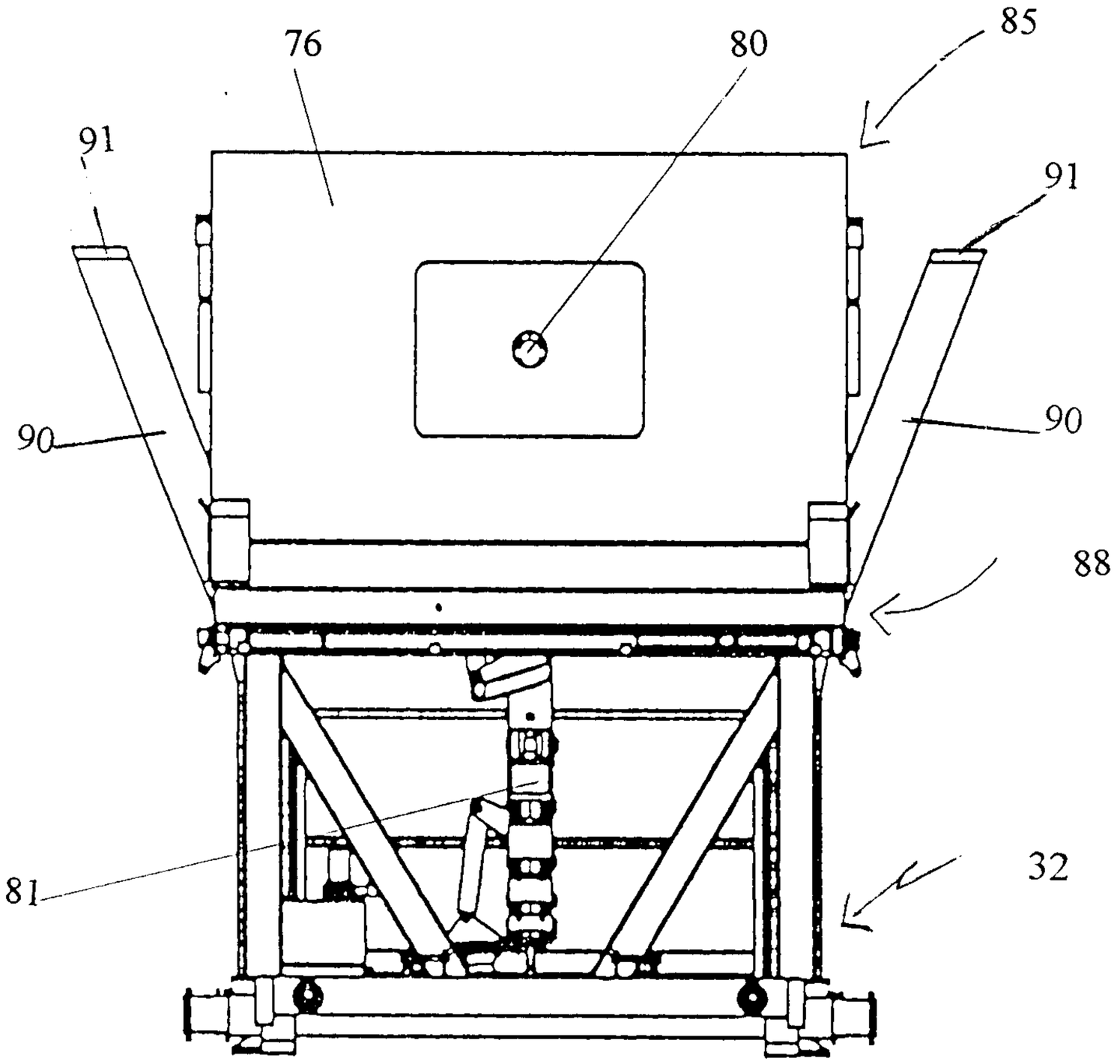


FIGURE 15

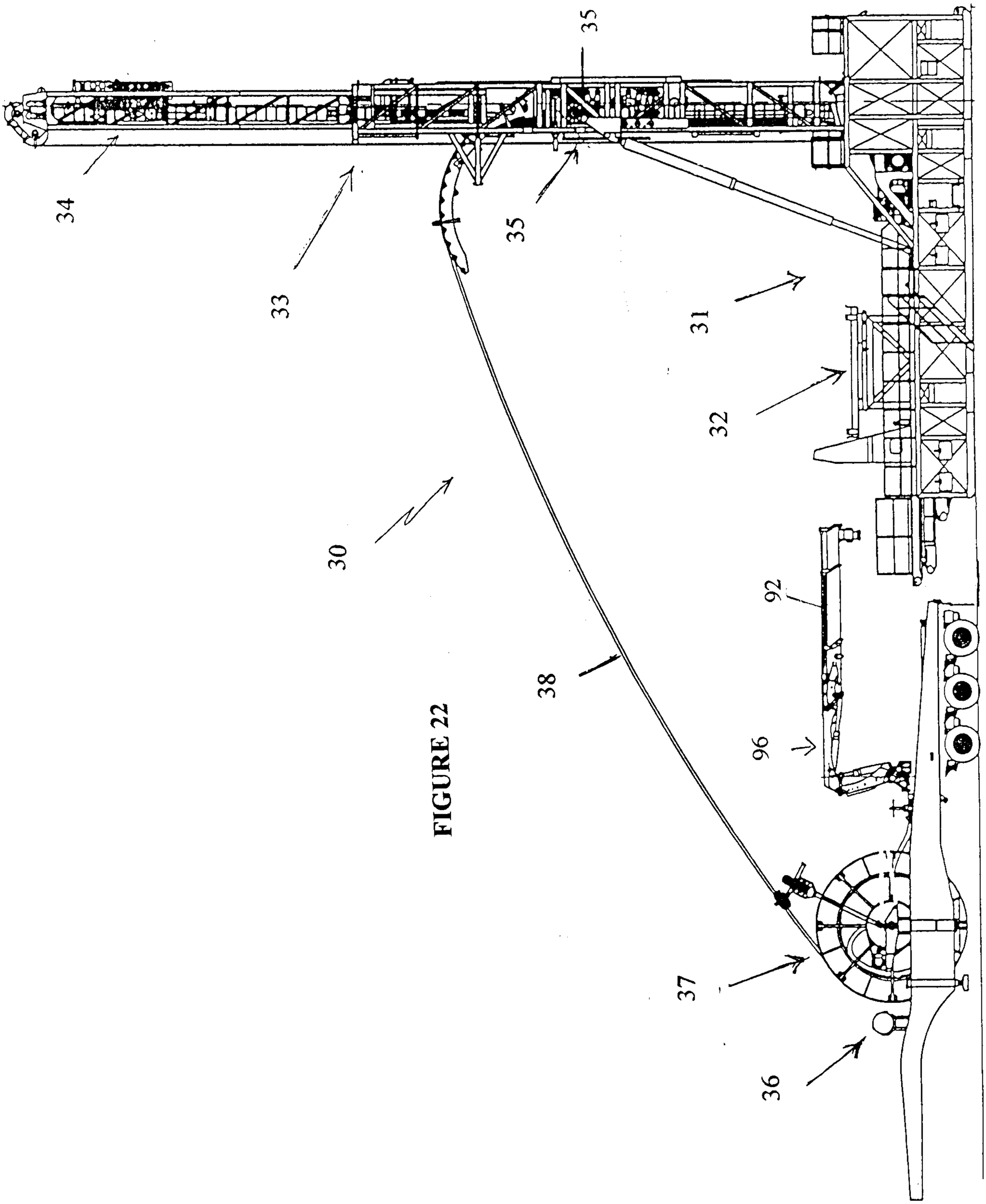
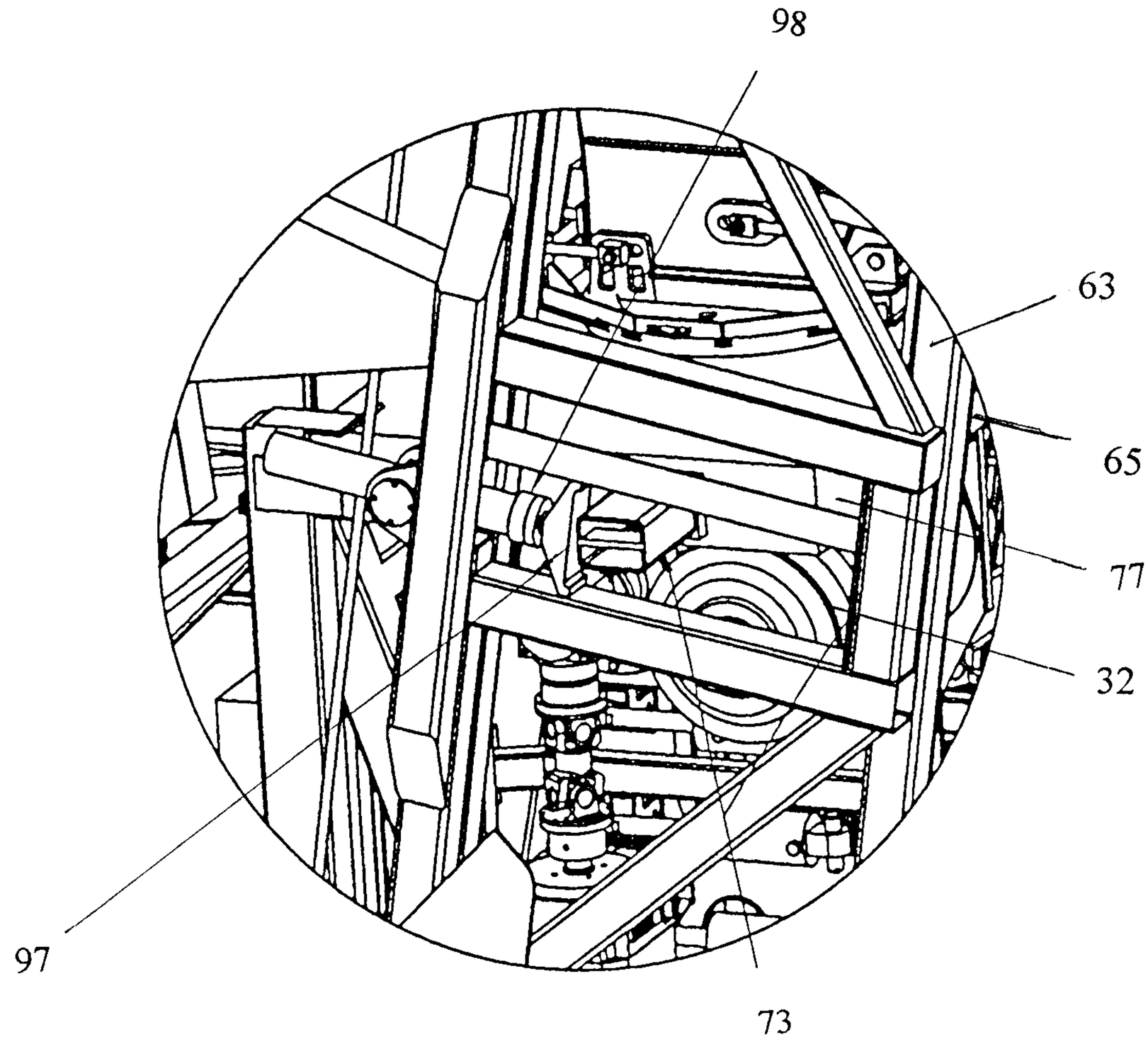


FIGURE 22



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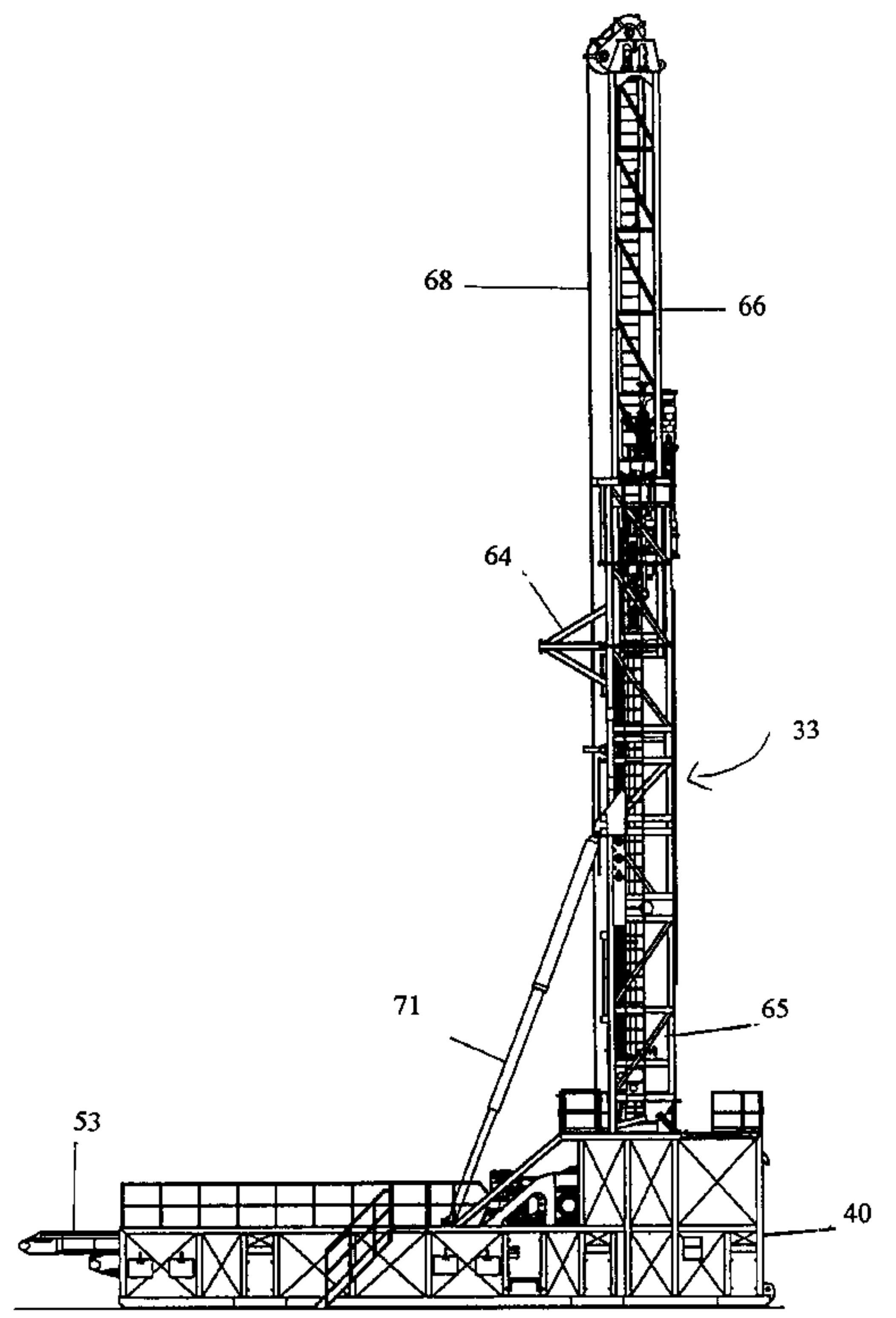
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