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Orgeron

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(54) **TELESCOPING JACK FOR A GRIPPER ASSEMBLY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(22) Filed: **Oct. 27, 2008**

(65) **Prior Publication Data**

US 2010/0034620 A1 Feb. 11, 2010

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/923,451, filed on Oct. 24, 2007, now Pat. No. 7,918,636.

(51) **Int. Cl.**
E21B 19/00 (2006.01)

(52) **U.S. Cl.** **414/22.55**; 166/77.52; 254/30

(58) **Field of Classification Search** 166/77.52, 166/77.53; 175/85; 254/30; 294/81.61; 414/22.55, 22.62, 23, 546, 680, 729, 738, 414/740, 742, 746.8, 783; 52/119, 120; 74/103, 74/110; 901/15, 21, 22

See application file for complete search history.

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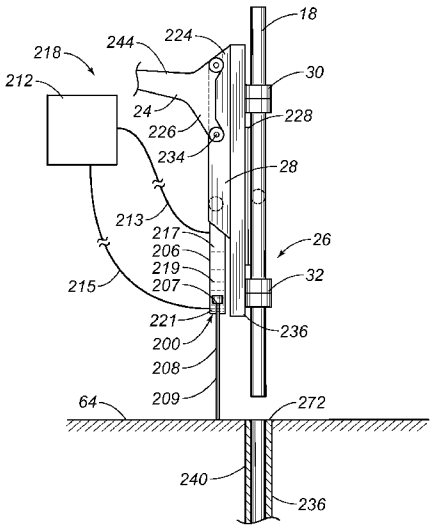
(57) **ABSTRACT**

A pipe handling apparatus has a base, a main rotating structural member pivotally connected to the base, a pipe handler connected to the main rotating structural member for moving a pipe from a generally horizontal orientation to a vertical orientation, and a jack connected to the pipe handler. The jack exerts a downward force in generally parallel relation to the pipe when the pipe is in the vertical orientation. The pipe handler has a gripping structure for gripping an outer surface of the pipe. The gripping structure has a stab frame. The jack is affixed to the stab frame. The jack has a piston-and-cylinder assembly positioned relative to the stab frame, and a hydraulic actuator connected to the piston-and-cylinder assembly. The hydraulic actuator is suitable for passing hydraulic fluid to the piston-and-cylinder assembly so as to move the piston-and-cylinder assembly from a retracted position to an extended position.

9 Claims, 6 Drawing Sheets



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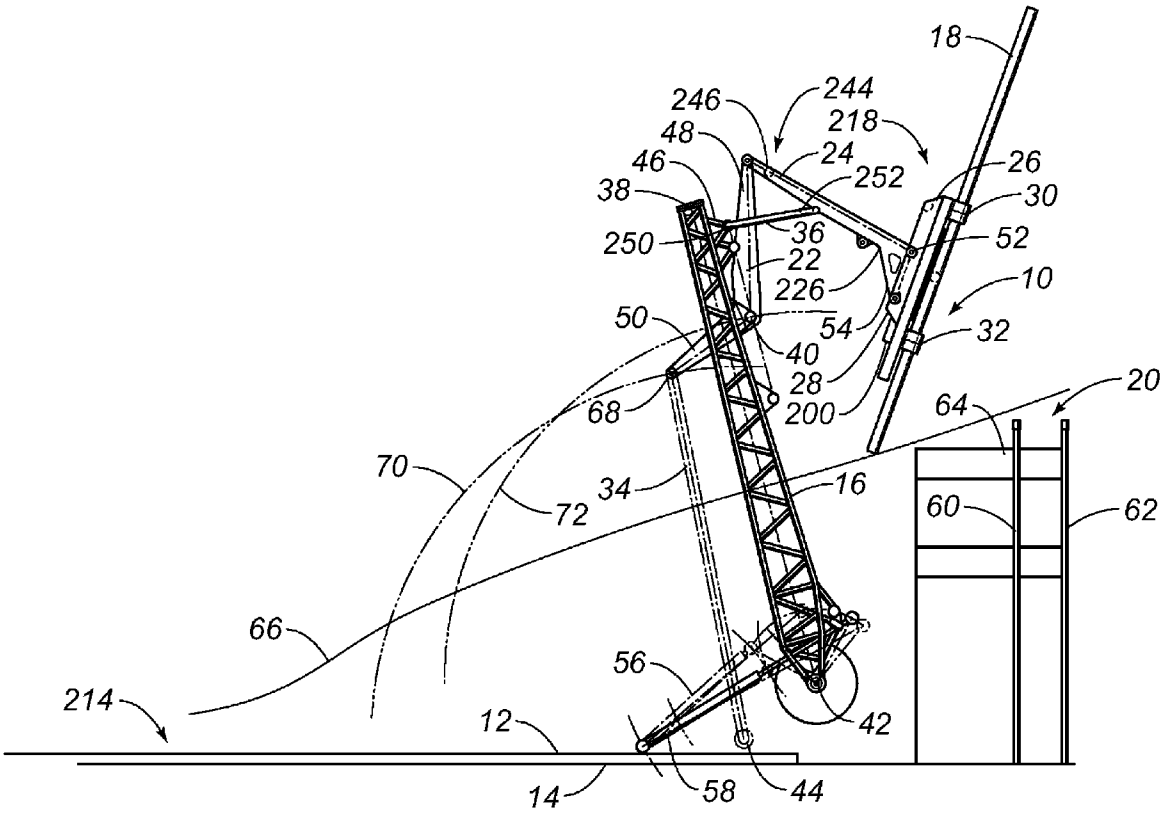
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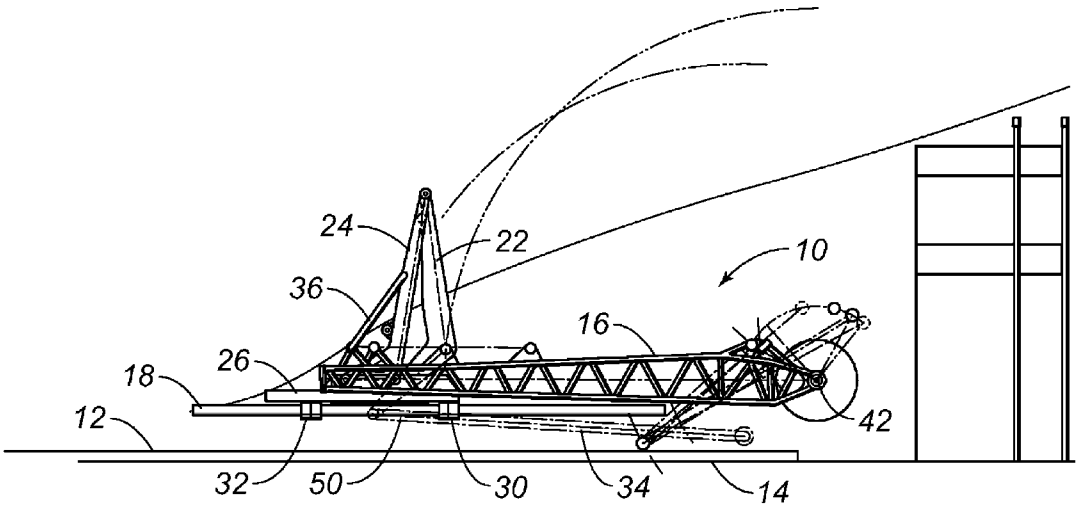
FIG. 1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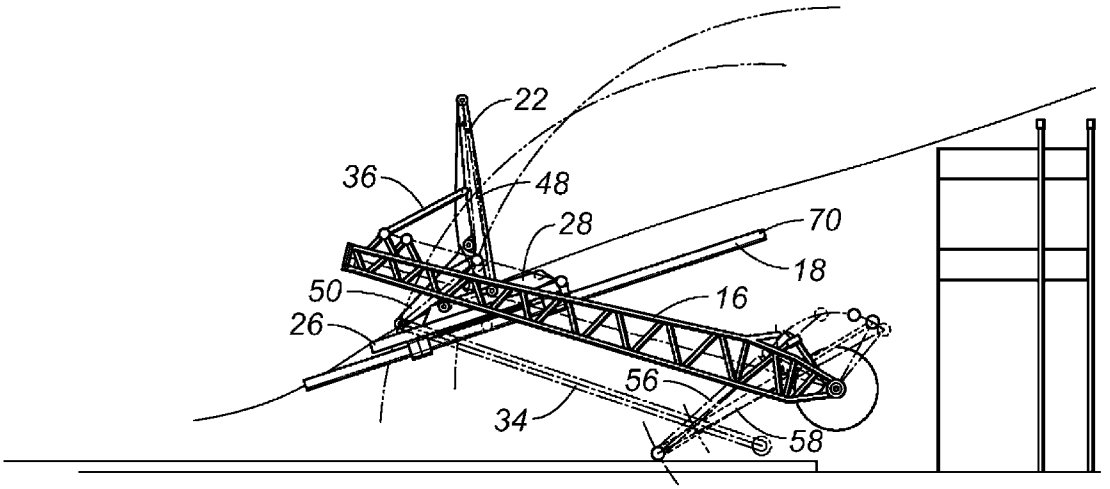
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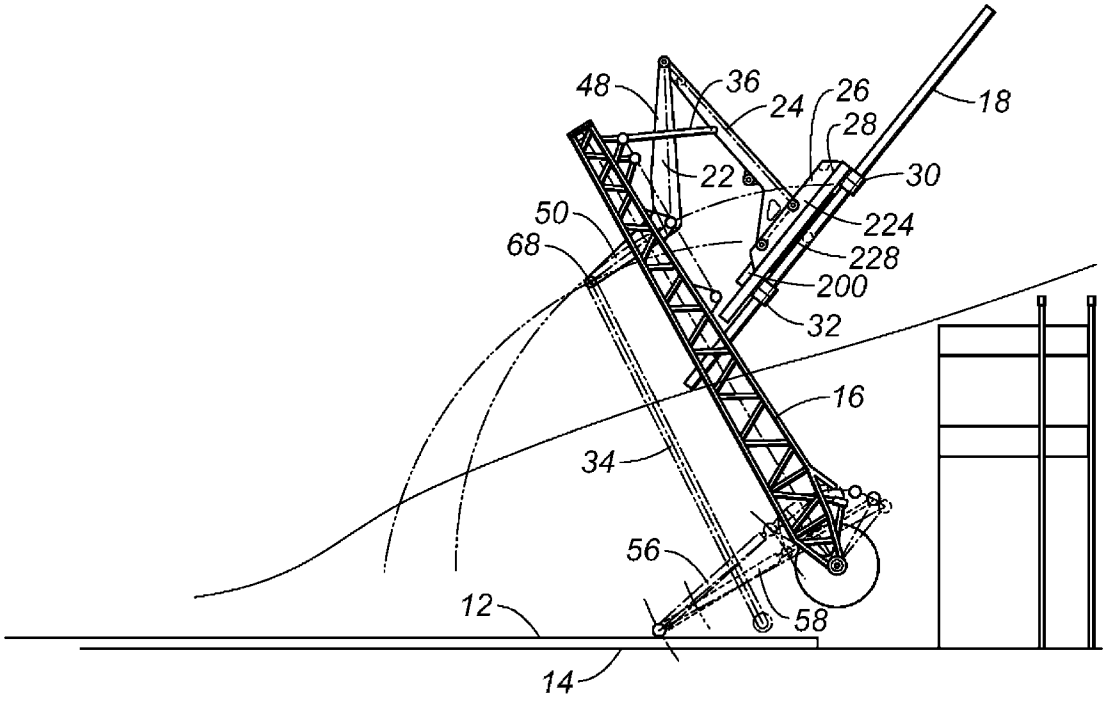
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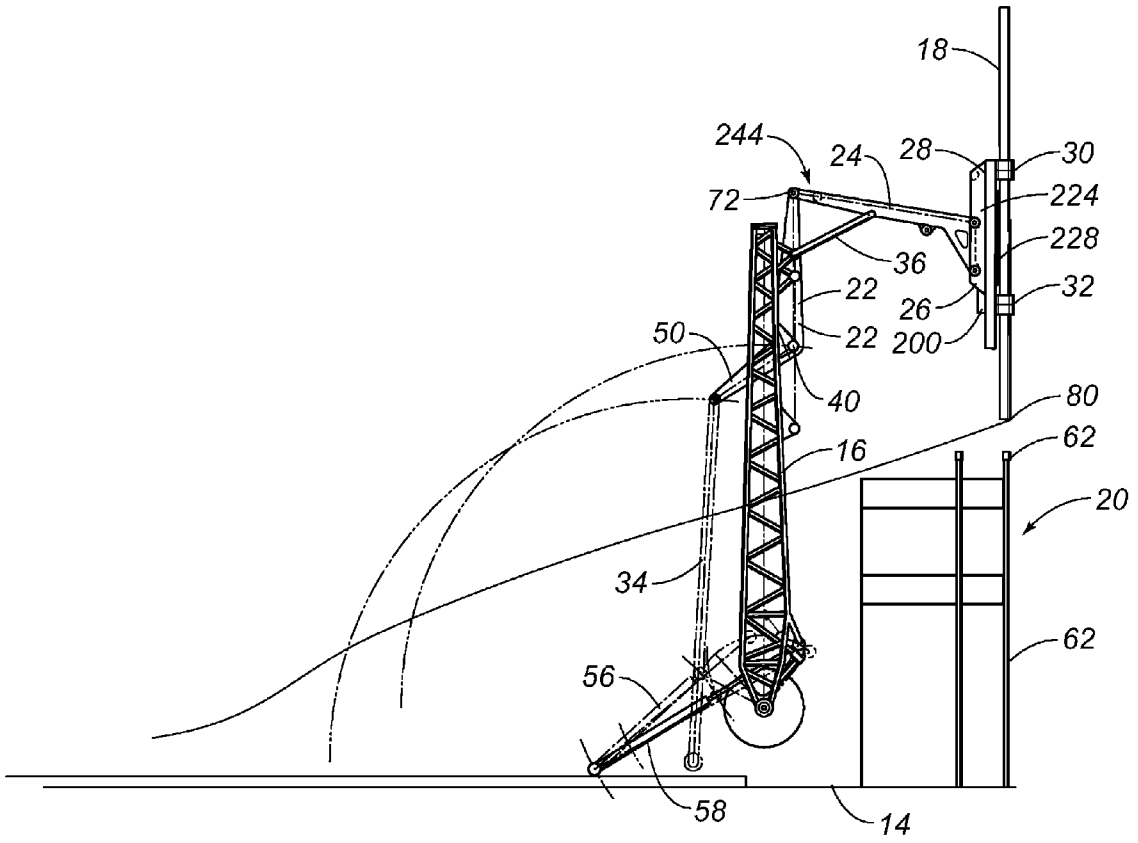
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FIG. 5

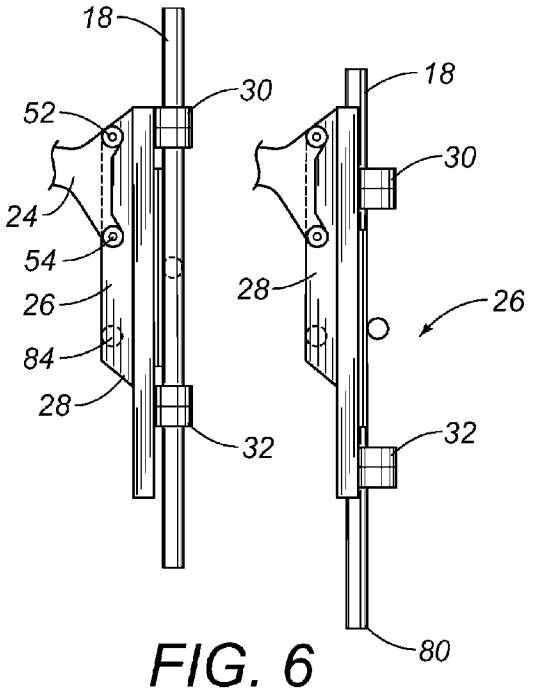
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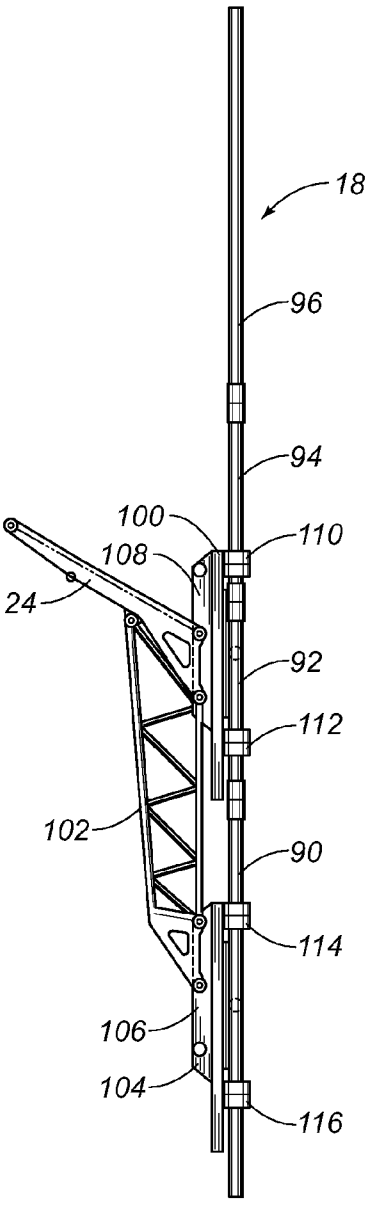
FIG. 6



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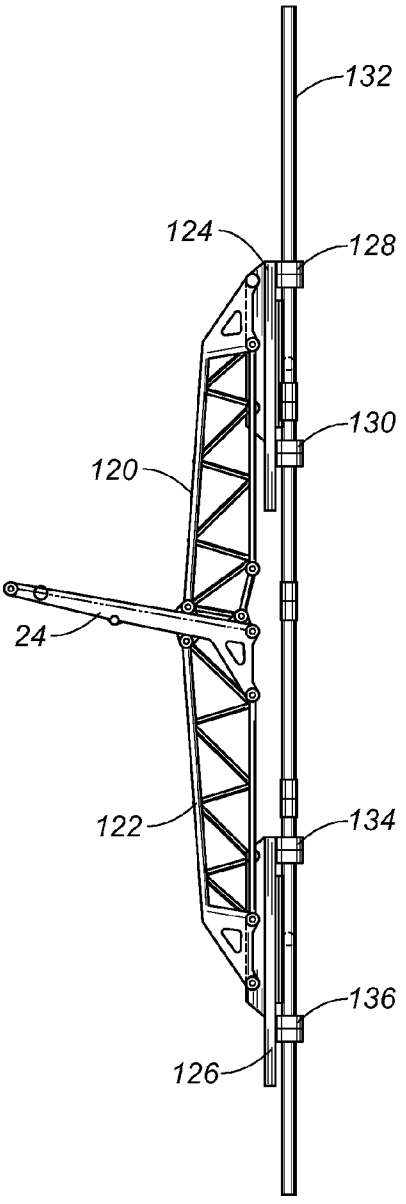

FIG. 8

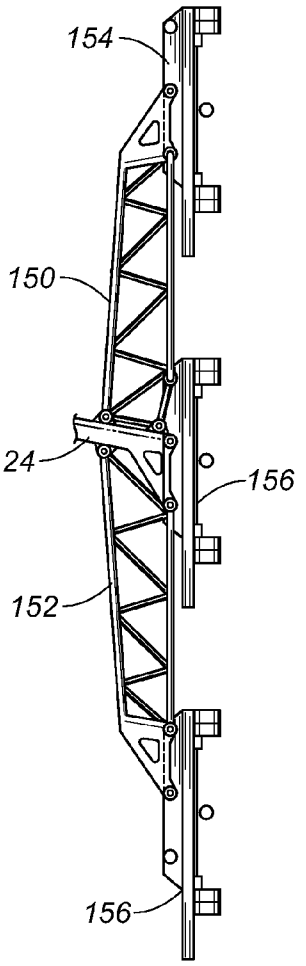

FIG. 9

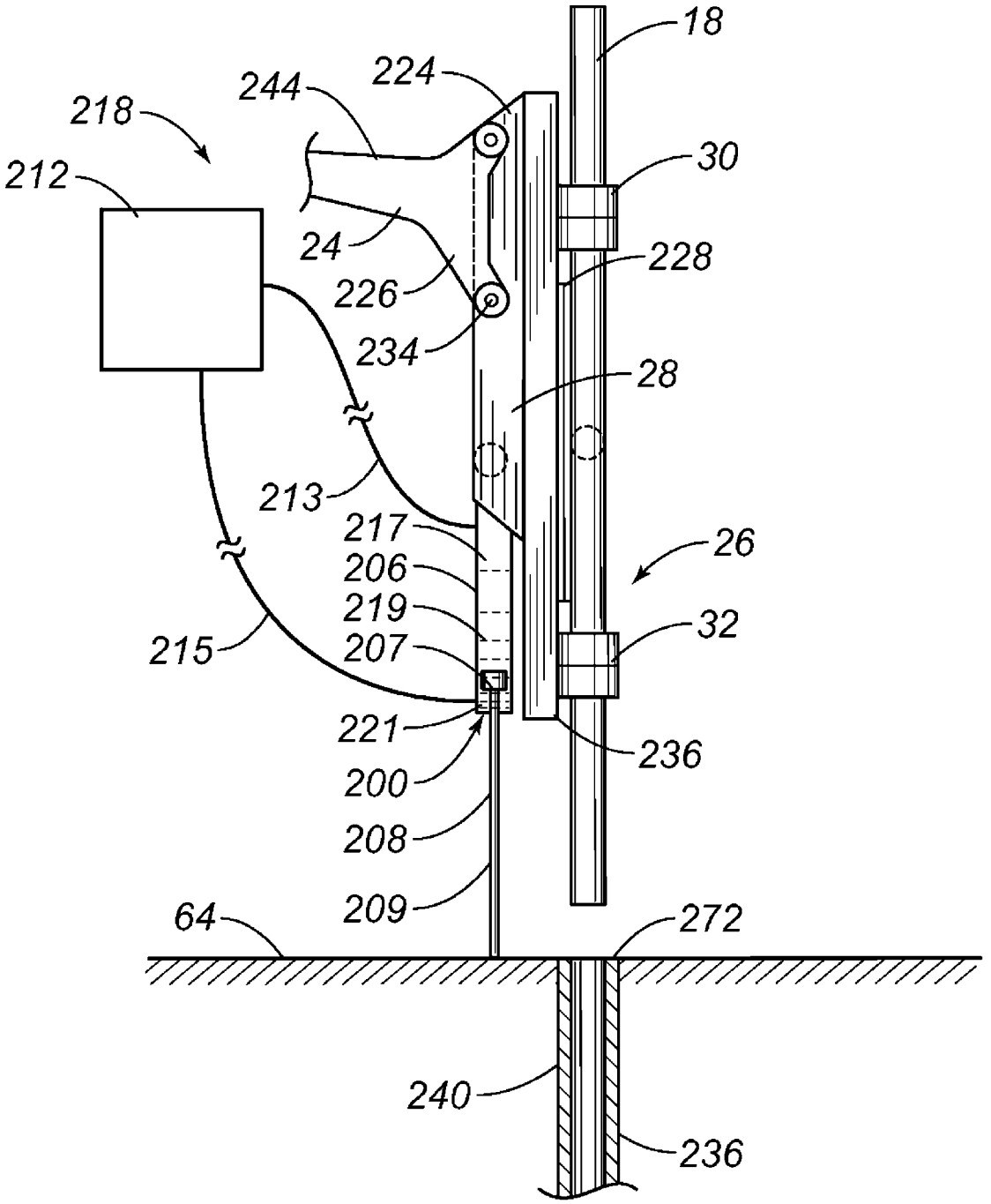
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FIG. 10

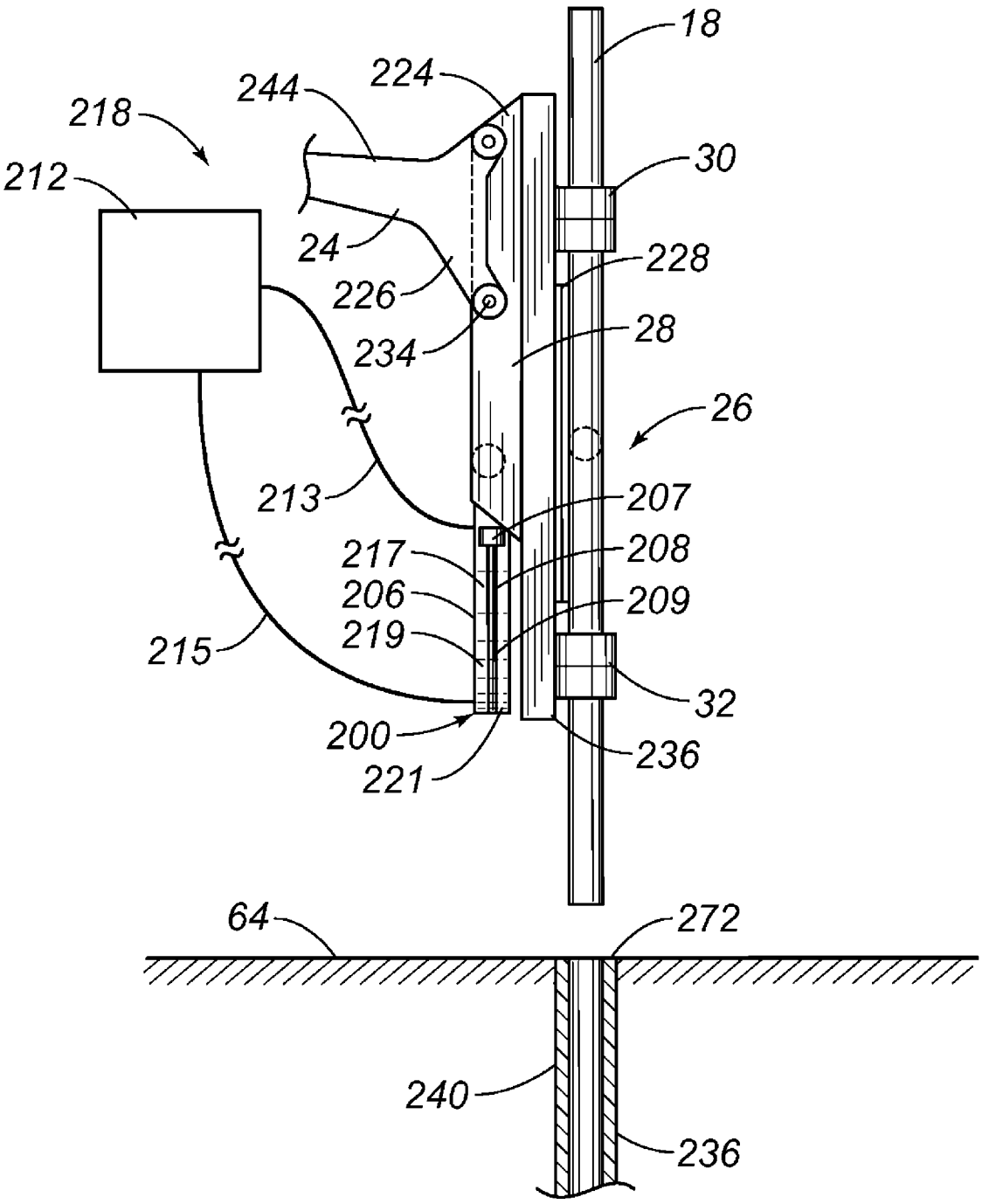
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FIG. 11

TELESCOPING JACK FOR A GRIPPER ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. application Ser. No. 11/923,451, filed on Oct. 24, 2007, entitled "Pipe Handling Apparatus and Method," presently pending.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

Not applicable.

INCORPORATION-BY-REFERENCE OF MATERIALS SUBMITTED ON A COMPACT DISC

Not applicable.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a pipe handling apparatus. More particularly, the present invention the relates to a pipe handling apparatus for moving a pipe from a vertical orientation to a horizontal orientation. More particularly, the present invention the relates to a pipe handling apparatus that removes pipe from a well head.

2. Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 37 CFR 1.98.

Drill rigs have utilized several methods for transferring tubular members from a pipe rack adjacent to the drill floor to a mousehole in the drill floor or the well bore for connection to a previously transferred tubular or tubular string. The term "tubular" or "pipe" as used herein includes all forms of drill pipe, drill collars, casing, liner, bottom hole assemblies (BHA), and other types of tubulars known in the art.

Conventionally, drill rigs have utilized a combination of the rig cranes and the traveling system for transferring a tubular from the pipe rack to a vertical position above the center of the well. The obvious disadvantage with the prior art systems is that there is a significant manual involvement in attaching the pipe elevators to the tubular and moving the pipe from the drill rack to the rotary table. This manual transfer operation in the vicinity of workers is potentially dangerous and has caused numerous injuries in drilling operations. Further, the hoisting system may allow the tubular to come into contact with the catwalk or other portions of the rig as the tubular is transferred from the pipe rack to the drill floor. This can damage the tubular and may affect the integrity of the connections between successive tubulars in the well.

One method of transferring pipe from the rack to the well platform comprises tying one end of a line on the rig around a selected pipe on the pipe rack. The pipe is thereafter lifted up onto the platform and the lower end thereof is placed into the mousehole. The mousehole is simply an upright, elongate cylindrical container adjacent the rotary table which supports the pipe temporally. When it is necessary to add the pipe to the drill string, slips are secured about the drill string on the rotary

table thereby supporting the same in the well bore. The pipe is disconnected from the traveling equipment and the elevators, or the kelly, are connected to the pipe in the mousehole. Next, the traveling block is raised thereby positioning the pipe over the drill string and tongs are used to secure the pipe to the upper end of the drill string. The drill pipe elevators suspend the drill pipe from a collar which is formed around one end of the pipe and do not clamp the pipe thereby permitting rotational pipe movement in order to threadably engage the same to the drill string.

A prior art technique for moving joints of casing from racks adjacent to the drilling rig comprises tying a line from the rig onto one end of a selected casing joint on the rack. The line is raised by lifting the casing joint up a ramp leading to the rig platform. As the rope lifts the casing from the rack, the lower end of the casing swings across the platform in a dangerous manner. The danger increases when a floating system is used in connection with drilling. Since the rope is tied around the casing at one end thereof, the casing does not hang vertically, but rather tilts somewhat. A man working on a platform elevated above the rig floor must hold the top of the casing and straighten it out while the casing is threaded into the casing string which is suspended in the well bore by slips positioned on the rotary table.

It would be desirable to be able to grip casing or pipe positioned on a rack adjacent a drilling well, move the same into vertical orientation over the well bore, and thereafter lower the same onto the string suspended in the well bore.

In the past, various devices have been created which mechanically move a pipe from a horizontal orientation to a vertical orientation such that the vertically oriented pipe can be installed into the well bore. Typically, these devices have utilized several interconnected arms that are associated with a main rotating structural member. In order to move the pipe, a succession of individual movements of the levers, arms, and other components of the boom must be performed in a coordinated manner in order to achieve the desired result. Typically, a wide variety of hydraulic actuators are connected to each of the components so as to carry out the prescribed movement. A complex control mechanism is connected to each of these actuators so as to achieve the desired movement. Advanced programming is required of the controller in order to properly coordinate the movements in order to achieve this desired result.

Unfortunately, with such systems, the hydraulic actuators, along with other components, can become worn with time. Furthermore, the hydraulic integrity of each of the actuators can become compromised over time. As such, small variations in each of the actuators can occur. These variations, as they occur, can make the complex mechanism rather inaccurate. The failure of one hydraulic component can exacerbate the problems associated with the alignment of the pipe in a vertical orientation. Adjustments of the programming are often necessary to as to continue to achieve the desired results. Fundamentally, the more hydraulic actuators that are incorporated into such a system, the more likely it is to have errors, inaccuracies, and deviations in the desired delivery profile of the tubular. Typically, very experienced and knowledgeable operators are required so as to carry out this pipe movement operation. This adds significantly to the cost associated with pipe delivery.

In the past, various patents have issued relating to such pipe handling devices. For example, U.S. Pat. No. 3,177,944, issued on Apr. 13, 1965 to R. N. Knight, describes a racking mechanism for earth boring equipment that provides for horizontal storage of pipe lengths on one side of and clear of the derrick. This is achieved by means of a transport arm which is

pivoted toward the base of the derrick for swing movement in a vertical plane. The outer end of the arm works between a substantially vertical position in which it can accept a pipe length from, or deliver a pipe length to, a station in the derrick, and a substantially horizontal portion in which the arm can deliver a pipe length to, or accept a pipe length from, a station associated with storage means on one side of the derrick.

U.S. Pat. No. 3,464,507, issued on Sep. 2, 1969 to E. L. Alexander et al., teaches a portable rotary pipe handling system. This system includes a mast pivotally mounted and movable between a reclining transport position to a desired position at the site drilling operations which may be at any angle up to vertical. The mast has guides for a traveling mechanism that includes a block movable up and down the mast through operation of cables reeved from the traveling block over crown block pulleys into a drawwork. A power drill drive is carried by the traveling block. An elevator for drill pipe is carried by arm swingably mounted relative to the power unit. Power tongs, slips, and slip bushings are supported adjacent the lower end of the mast and adapted to have a drill pipe extend therethrough from a drive bushing connected to a power drive whereby the drill pipe is extended in the direction of the hole to be drilled.

U.S. Pat. No. 3,633,771 issued on Jan. 11, 1972 to Woolslayer et al., discloses an apparatus for moving drill pipe into and out of an oil well derrick. A stand of pipe is gripped by a strongback which is pivotally mounted to one end of a boom. The boom swings the strongback over the rotary table thereby vertically aligning the pipe stand with the drill string. When both adding pipe to and removing pipe from the drill string, all vertical movement of the pipe is accomplished by the elevator suspended from the traveling block.

U.S. Pat. No. 3,860,122, issued on Jan. 14, 1975 to L. C. Cernosek, describes an apparatus for transferring a tubular member, such as a pipe, from a storage area to an oil well drilling platform. The positioning apparatus includes a pipe positioner mounted on a platform for moving the pipe to a release position whereby the pipe can be released to be lowered to a submerged position. A load means is operably attached or associated with the platform and positioning means in order to move the pipe in a stored position to a transfer position in which the pipe is transferred to the positioner. The positioner includes a tower having pivotally mounted thereon a pipe track with a plurality of pipe clamp assemblies which are adapted to receive a pipe length. The pipe track is pivotally movable by hydraulic power means or gear means between a transfer position in which pipe is moved into the plurality of clamp assemblies and the release position in which the pipe is released for movement to a submerged position.

U.S. Pat. No. 3,986,619, issued on Oct. 19, 1976 to Woolslayer et al., shows a pipe handling apparatus for an oil well drilling derrick. In this apparatus the inner end of the boom is pivotally supported on a horizontal axis in front of a well. A clamping means is pivotally connected to the outer end of the boom on an axis parallel to the horizontal axis at one end. The clamping means allows the free end of the drill pipe to swing across the boom as the outer end of the boom is raised or lowered. A line is connected at one end with the traveling block that raises and lowers the elevators and at the other end to the boom so as to pass around sheaves.

U.S. Pat. No. 4,172,684 issued on Oct. 30, 1979 to C. Jenkins, shows a floor level pipe handling apparatus which is mounted on the floor of an oil well derrick suitable structure. This apparatus includes a support that is rockable on an axis perpendicular to the centerline of a well being drilled. One end of an arm is pivotally mounted on the support on an axis transverse to the centerline of the well. The opposite end of the arm carries a pair of shoes having laterally opening pipe-receiving seats facing away from the arm. The free end of the arm can be swung toward and away from the well centerline and the arm support can be rocked to swing the arm laterally.

U.S. Pat. No. 4,403,666 issued on Sep. 13, 1983 to C. A. Willis, shows self-centering tongs and a transfer arm for a drilling apparatus. The clamps of the transfer arm are resiliently mounted to the transfer arm so as to provide limited axial movement of the clamps and thereby of a clamped down hole tubular. A pair of automatic, self-centering, hydraulic tongs are provided for making up and breaking out threaded connections of tubulars.

U.S. Pat. No. 4,407,629, issued on Oct. 4, 1983 to C. A. Willis, teaches a lifting apparatus for downhole tubulars. This lifting apparatus includes two rotatably mounted clamps which are rotatable between a side loading-position so as to facilitate the loading and unloading in the horizontal position, and a central position, in which a clamped tubular is aligned with the drilling axis when the boom is in the vertical position. An automatic hydraulic sequencing circuit is provided to automatically rotate the clamps into the side-loading position whenever the boom is pivoted with a down-hole tubular positioned in the clamp. In this position, the clamped tubular is aligned with a safety plate mounted on the boom to prevent a clamped tubular from slipping from the clamps.

U.S. Pat. No. 4,492,501 provides a platform positioning system for a drilling operation which includes a support structure and a transfer arm pivotally connected to the support structure to rotate about a first axis. This platform positioning system includes a platform which is pivotally connected to the support structure to rotate about a second axis, and rod which is mounted between the transfer arm and the platform. The position of the arm and platform axes and the length of the rod are selected such that the transfer arm automatically and progressively raises the platform to the raised position by means of the rod as the transfer arm moves to the raised position. The transfer arm automatically and progressively lowers the platform to the lowered position by means of the rod as the transfer arm moves to the lowered position.

U.S. Pat. No. 4,595,066 issued on Jun. 17, 1986 to Nelmark et al., provides an apparatus for handling drill pipes and used in association with blast holes. This system allows a drill pipe to be more easily connected and disconnected to a drill string in a hole being drilled at an angle. A receptacle is formed at the lower end of the carrier that has hydraulically operated doors secured by a hydraulically operated lock. A gate near the upper end is pneumatically operated in response to the hydraulic operation of the receptacle lock.

U.S. Pat. No. 4,822,230 issued on Apr. 18, 1989 to P. Slettedal, teaches a pipe handling apparatus which is adapted for automated drilling operations. Drill pipes are manipulated between substantially horizontal and vertical positions. The apparatus is used with a top mounted drilling device which is rotatable about a substantially horizontal axis. The apparatus utilizes a strongback provided with clamps to hold and manipulate pipes. The strongback is rotatably connected to the same axis as the drilling device. The strongback moves up or down with the drilling device. A brace unit is attached to the strongback to be rotatable about a second axis.

U.S. Pat. No. 4,834,604 issued on May 30, 1989 to Brittain et al., provides a pipe moving apparatus and method for moving casing or pipe from a horizontal position adjacent a well to a vertical position over the well bore. The machine includes a boom movable between a lowered position and a raised position by a hydraulic ram. A strongback grips the pipe and holds the same until the pipe is vertically positioned.

Thereafter, a hydraulic ram on the strongback is actuated thereby lowering the pipe or casing onto the string suspended in the well bore and the additional pipe or casing joint is threaded thereto.

U.S. Pat. No. 4,708,581 issued on Nov. 24, 1987 H. L. Adair, provides a method for positioning a transfer arm for the movement of drill pipe. A drilling mast and a transfer arm is mounted at a first axis adjacent the mast to move between a lowered position near ground level and an upper position aligned with the mast. A reaction point anchor is fixed with respect to the drilling mast and spaced from the first axis. A fixed length link is pivotably mounted to the transfer arm at a second axis, spaced from the first axis, and a first single stage cylinder is pivotably mounted at one end to the distal end of the link and at the other end to the transfer arm. A second single stage hydraulic cylinder is pivotably mounted at one end to the distal end of the link and at the other end to the reaction point.

U.S. Pat. No. 4,759,414 issued on Jul. 26, 1988 to C. A. Willis, provides a drilling machine which includes a drilling superstructure skid which defines two spaced-apart parallel skid runners and a platform. The platform supports a drawworks mounted on a drawworks skid and a pipe boom is mounted on a pipe boom skid sized to fit between the skid runners of the drilling substructure skid. The drilling substructure skid supports four legs which, in turn, support a drilling platform on which is mounted a lower mast section. The pipe boom skid mounts a pipe boom as well as a boom linkage, a motor, and a hydraulic pump adapted to power the pipe boom linkage. Mechanical position locks hold the upper skid in relative position over the lower skid.

U.S. Pat. No. 5,458,454 issued on Oct. 17, 1995 to R. S. Sorokan, describes a pipe handling method which is used to move tubulars used from a horizontal position on a pipe rack adjacent the well bore to a vertical position over the wall center. This method utilizes bicep and forearm assemblies and a gripper head for attachment to the tubular. The path of the tubular being moved is close to the conventional path of the tubular utilizing known cable transfer techniques so as to allow access to the drill floor through the V-door of the drill rig. U.S. Pat. No. 6,220,807 describes apparatus for carrying out the method of U.S. Pat. No. 5,458,454.

U.S. Pat. No. 6,609,573 issued on Aug. 26, 2003 to H. W. F. Day, teaches a pipe handling system for an offshore structure. The pipe handling system transfers the pipes from a horizontal pipe rack adjacent to the drill floor to a vertical orientation in a set-back area of the drill floor where the drill string is made up for lowering downhole. The cantilevered drill floor is utilized with the pipe handling system so as to save platform space.

U.S. Pat. No. 6,705,414 issued on Mar. 16, 2004 to Simpson et al., describes a tubular transfer system for moving pipe between a substantial horizontal position on the catwalk and a substantially vertical position at the rig floor entry. Bundles of individual tubulars are moved to a process area where a stand make-up/break-out machine makes up the tubular stands. The bucking machine aligns and stabs the connections and makes up the connection to the correct torque. The tubular stand is then transferred from the machine to a stand storage area. A trolley is moved into position over the pick-up area to retrieve the stands. The stands are clamped to the trolley and the trolley is moved from a substantially horizontal position to a substantially vertical position at the rig floor entry. A vertical pipe-racking machine transfers the stands to the traveling equipment. The traveling equipment makes up the stand connection and the stand is run into the hole.

U.S. Pat. No. 6,779,614 issued on Aug. 24, 2004 to M. S. Oser, shows another system and method for transferring pipe. A pipe shuttle is used for moving a pipe joint into a first position and then lifting upwardly toward an upper second position.

In response to the above-identified problems of the pipe handling apparatus, the present inventor filed U.S. patent application Ser. No. 11/923,451 on Oct. 24, 2007. The application discloses a pipe handling apparatus has a boom pivotally movable between a first position and a second position, a riser assembly pivotally connected to the boom, an arm pivotally connected at one end to the first portion of the riser assembly and extending outwardly therefrom, a gripper affixed to a opposite end of the arm suitable for gripping a diameter of the pipe, a link pivotally connected to the riser assembly and pivotable so as to move relative to the movement of the boom between the first and second positions, and a brace having a one end pivotally connected to the boom and an opposite end pivotally to the arm between the ends of the arm. The riser assembly has a first portion extending outwardly at an obtuse angle with respect to the second portion.

One problem associated with the pipe handling apparatus disclosed above occurs when the pipe handling apparatus removes a pipe from a well head. The pipe being removed from the wellhead can sometimes get stuck in the well head for various reasons. When this happens, the force required for removing the pipe from the well head is greater than the upward force of the pipe handling apparatus. That is, when the grippers of the pipe handling apparatus grasp the tubular that is being removed from the well head, the pipe handling apparatus does not have enough upward force so as to remove a pipe that is stuck in the well head. Thus, there is a need for a pipe handling apparatus that can overcome the force of a pipe stuck in the wellhead so as to remove the pipe from the wellhead.

Various patents have issued relating to telescoping jacks. For example, U.S. Pat. No. 5,597,987, issued on Jan. 28, 1997 to Gilliland et al., discloses a twin-post telescoping-jack hydraulic-elevator system. The telescoping jack has a first cylinder, an intermediate cylinder disposed within the first cylinder that is slidable relative thereto through a hydraulic seal, and an inner plunger disposed in the intermediate cylinder that is slidable relative thereto through a hydraulic seal. The intermediate cylinder has a piston which is slidably mounted in the first cylinder. The piston divides the main cylinder into a lower chamber and an upper chamber. A pair of dynamic sensors determine when the telescoping jacks are synchronized. The elevator of the system includes static sensors that determine if one or both intermediate cylinders of the jacks are more than a predetermined distance away from their normal positions when a car is stopped on the floor.

U.S. Pat. No. 5,060,762, issued on Oct. 29, 1991 to White, discloses a hydraulic elevator system. The system includes a synchronized telescoping cylinder with inner and outer reciprocating plungers mounted in a fixed cylinder. A hydraulic fluid pressure intensifier is connected to a pressure chamber of the outer plunger and to a pressure chamber of the inner plunger. Solenoid valves control a flow of hydraulic fluid between the pressure intensifier and the two plunger pressure chambers. Switches mounted on the outer plunger control operation of the solenoid valves. When the inner plunger is too low relative to the outer plunger, the pressure intensifier will raise the pressure in the inner plunger pressure chamber to appropriately lift the inner plunger. When the inner plunger is too high relative to the outer plunger, the pressure intensifier will lower the pressure in the inner plunger pressure chamber so as to lower the inner plunger.

U.S. Pat. No. 7,172,038, issued on Feb. 6, 2007 to Terry et al., discloses a drilling system having a work string supporting a bottom hole assembly. The work string includes lengths of pipe having a non-metallic portion. The work string preferably includes a composite-coiled tubing having a fluid impermeable liner, multiple load carrying layers, and a wear layer. Multiple electrical conductors and data transmission conductors may be embedded in the load carrying layers for carrying a current or transmitting data between the bottom hole assembly and the surface. The bottom hole assembly includes a bit, a gamma ray and inclinometer instrument package, a steerable assembly, an electronics section, a transmission, and a power section for rotating the bit. Hydraulic casing jacks are used to thrust casing into the bore hole.

U.S. Pat. No. 5,186,264, issued on Feb. 16, 1993 to Chaffaut, discloses a device for guiding a drilling tool into a well and for exerting a hydraulic force on the drilling tool. The device includes a tubular body and an outer sleeve rotating about the body and longitudinally displaceable with respect to the body. Radially displaceable pistons come into anchoring engagement with the wall of the well and immobilize the external sleeve when in an extended position. A jack displaces the body and the drilling tool integral therewith respect to the external sleeve. The jack exerts a pushing force onto the tool. Hydraulic circuits and appropriate control assemblies are provided for controlling the execution of a series of successive cycles of anchoring the external sleeve in the well and of displacing the drilling tool with respect to the external sleeve.

U.S. Pat. No. 5,649,745, issued on Jul. 22, 1997 to Anderson, discloses an inflatable gripper assembly for a rock boring or cutting machine. The inflatable gripper assembly has a base member and an elastomeric sheet secured in a fluid-tight and reaction-force secure manner to the base member. The elastomeric sheet expands when fluid is supplied between the base member and the elastomeric sheet. The elastomeric sheet contracts when fluid is removed from between the base member and the elastomeric sheet.

U.S. Pat. No. 4,030,698, issued on Jun. 21, 1977 to Hansen, discloses a jack assembly for use in raising and lowering large platforms on columns. The jack assembly has upper and lower annular portions interconnected by a hydraulic motor for relative vertical movement therebetween, and arcuate pneumatically-operated gripper assemblies positioned in both the upper and lower portions of the jack. Each of the gripper assemblies is removably replaceable from its position in the jack assembly without removal of the jack assembly from the platform which it surrounds.

It is an object of the present invention to provide a pipe handling apparatus for removing a pipe that is stuck in a well head.

It is another object of the present invention to provide a pipe handling apparatus that minimizes the number of components added to such systems.

It is another object of the present invention to provide a telescoping jack that exerts an upward force on the pipe handling apparatus so as to remove a pipe from a well head.

It is another object of the present invention to provide a pipe handling apparatus that exerts an upward force on the gripper assembly thereof so as to remove a pipe from a well head.

It is still another object of the present invention to provide a pipe handling apparatus that has a telescoping jack for removing a stuck pipe from a well head.

It is an object of the present invention to provide a pipe handling apparatus which minimizes the amount of calibration required in order to move the pipe from a horizontal orientation to a vertical orientation.

It is another object of the present invention to provide a pipe handling apparatus which operates with a single degree of freedom so as to move the pipe without adjustments between the components.

It is another object of the present invention to provide a pipe handling apparatus that can be transported on a skid or on a truck.

It is another object of the present invention to provide a pipe handling apparatus which allows for the self-centering of the pipe.

It is another object of the present invention to provide a pipe handling apparatus which can be utilized independent of the existing rig.

It is still a another object of the present invention to provide a pipe handling apparatus which avoids the use of multiple hydraulic cylinders and actuators for moving the pipe between a horizontal and vertical orientation.

It is another object of the present invention to provide a pipe handling apparatus which minimizes the amount of instrumentation and controls utilized for carrying out the pipe handling activities.

It is still another object of the present invention to provide a pipe handling apparatus which allows for the pipe to be loaded beneath the lifting main rotating structural member.

It is still another object of the present invention to provide a pipe handling apparatus which is of minimal cost and easy to use.

It is another object of the present invention to provide a pipe handling apparatus which allows relatively unskilled workers to carry out the pipe handling activities.

These and other objects and advantages of the present invention will become apparent from a reading of the attached specification and appended claims.

BRIEF SUMMARY OF THE INVENTION

The present invention is a pipe handling apparatus comprising a base, a main rotating structural member pivotally connected to the base, a pipe handling means connected to the main rotating structural member, and a jacking means connected to the pipe handling means. The pipe handling means moves the pipe from a generally horizontal orientation to a vertical orientation. The jacking means exerts a downward force in generally parallel relation to the pipe when the pipe is in the vertical orientation.

The pipe handling means comprises a gripping means for gripping an outer surface of the pipe. The pipe handling means also has a lever assembly pivotally connected to the main rotating structural member where the lever assembly has a first portion extending outwardly at an obtuse angle with respect to a second portion, an arm pivotally connected at one end to the first portion of the lever assembly and extending outwardly therefrom, a link pivotally connected to the second portion of the lever assembly where the link is pivotable at an end of the second portion opposite of the first portion so as to move relative to the movement of the main rotating structural member between the first and second positions, and a brace having a one end pivotally connected to the main rotating structural member and an opposite end pivotally connected to the arm between the ends of the arm. The pipe handling means moves the pipe between the generally horizontal orientation to the vertical orientation within a single degree of freedom.

The gripping means comprises a stab frame affixed to the opposite end of the arm, a first gripper extending outwardly of the stab frame on a side opposite the arm, and a second gripper extending outwardly of the stab frame on the side opposite the arm in spaced relation to the first gripper. The first and second

grippers being translatable along the stab frame, the jacking means being connected to the stab frame of the gripping means. The jacking means is affixed to the stab frame of the gripping means.

The jacking means comprises a piston-and-cylinder assembly positioned relative to the stab frame, and a hydraulic actuator connected to the piston-and-cylinder assembly. The hydraulic actuator is suitable for passing hydraulic fluid to the piston-and-cylinder assembly so as to move the piston-and-cylinder assembly from a retracted position to an extended position. The piston-and-cylinder assembly comprises a cylinder positioned relative to the stab frame, and a piston translatably positioned within an interior of the cylinder. The piston comprises a head positioned within the interior of the cylinder, and a rod extending from the head. The rod is suitable for extending outwardly of the cylinder. The cylinder has a first interior and a second interior. The head of the piston is positioned between the first interior and the second interior. The rod of the piston is positioned within the second interior. The hydraulic actuator has a first line connected to the first interior of the cylinder. The hydraulic actuator having a second line connected to the second interior of the cylinder. The hydraulic actuator suitable for passing hydraulic fluid so as to move the piston between the extended position and the retracted position.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a side elevation view showing the pipe handling apparatus in accordance with the teachings of the preferred embodiment of the present invention.

FIG. **2** is a side elevational view showing the pipe handling apparatus of the present invention in a first position.

FIG. **3** is a side elevational view showing the pipe handling apparatus moving from the first position toward the second position.

FIG. **4** is a side elevation view of the pipe handling apparatus showing the pipe handling apparatus as moving the pipe further to the second position.

FIG. **5** is a side elevational view showing the pipe handling apparatus in its second position in which the pipe extends in a vertical orientation.

FIG. **6** is an illustration of the gripper assembly as vertically translating the pipe.

FIG. **7** is a side elevational view of a first alternative embodiment of the gripper assembly of the present invention.

FIG. **8** is a side elevational view showing a second alternative embodiment of the gripper assembly of the present invention.

FIG. **9** is a side elevational view showing a third alternative embodiment of the gripper assembly of the present invention.

FIG. **10** shows an isolated side-elevational view of the preferred embodiment of the jacking means in the extended position.

FIG. **11** shows an isolated side-elevational view of the preferred embodiment of the jacking means in the retracted position.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, there is shown the pipe handling apparatus **10** in accordance with the preferred embodiment of the present invention. The pipe handling apparatus **10** is mounted on a skid **12** that is supported upon the bed **14** of a vehicle, such as a truck. The pipe handling apparatus **10** in particular includes a main rotating structural member **16** that is pivotally movable between a first position and a second position. In FIG. **1**, an intermediate position of the pipe handling apparatus **10** is particularly shown. In this position, the pipe **18** is illustrated in its position prior to installation on the drill rig **20**. A lever assembly **22** is pivotally connected to the main rotating structural member **16**. An arm **24** is pivotally connected to an end of the lever assembly **22** opposite the main rotating structural member **16**. A gripping means **26** is fixedly connected to an opposite end of the arm **24** opposite the lever assembly **22**. The gripping means **26** includes a body **28** and grippers **30** and **32**. A link **34** has one end pivotally connected to the skid **12** and an opposite end pivotally connected to the end of the lever assembly **22** opposite the arm **24**. A brace **36** is pivotally connected to the main rotating structural member **16** and also pivotally connected to the arm **24** between the lever assembly **22** and the body **28** of gripping means **26**.

In the present invention, the main rotating structural member **16** is a structural framework of struts, cross members and beams. In particular, in the present invention, the main rotating structural member **16** is configured so as to have an open interior such that the pipe **18** will be able to lifted in a manner so as to pass through the interior of the main rotating structural member **16**. As such, the end **38** of the main rotating structural member **16** should be strongly reinforced so as to provide the necessary structural integrity to the main rotating structural member **16**. A lug **40** extends outwardly from one side of the main rotating structural member **16**. This lug **40** is suitable for pivotable connection to the lever assembly **22**. The main rotating structural member **16** is pivotally connected at the opposite end **42** to a location on the skid **12**. The pivotable connection at end **42** of the main rotating structural member **16** is located in offset relationship and above the pivotable connection **44** of the link **34** with the skid **12**. A small frame member **46** extends outwardly from the side of the main rotating structural member **16** opposite the link **34**. This frame assembly **46** has a pivotable connection with the brace **36**.

The lever assembly **22** includes a first portion **48** and a second portion **50**. The first portion **48** extends at an obtuse angle with respect to the second portion **50**. The link **34** is pivotally connected to the end of the second portion **50** opposite the first portion **48**. The arm **24** is pivotally connected to the end of the first portion **48** opposite the second portion **50**. The lug **40** of the main rotating structural member **16** is pivotally connected in an area generally between the first portion **48** and the second portion **50**. This unique arrangement of the lever assembly **22** facilitates the ability of the present invention to carry out the movement of the pipe **18** between the horizontal orientation and the vertical orientation.

The arm **24** has an end pivotally connected to the end of the first portion **48** of the lever assembly **22**. The opposite end of the arm **24** is connected to the gripping means **26**. In particular, a pair of pin connections engage a surface of the body **28** of the gripping means **26** so as to fixedly position the gripping means **26** with respect to the end of the arm **24**. The pin connections **52** and **54** can be in the nature of bolts, or other fasteners, so as to strongly connect the body **28** of gripping means **26** with the arm **24**. The bolts associated with pin connections **52** and **54** can be removed such that other gripping means **26** can be affixed to the end of the arm **24**. As such, the pipe handling apparatus **10** of the present invention can be adaptable to various sizes of pipe **18** and various heights of drilling rigs **20**.

The gripping means **26** includes the stab frame **28** with the grippers **30** and **32** translatable along the length of the stab frame **28**. This vertical translation of the grippers **30** and **32**

allows the pipe **18** to be properly moved upwardly and downwardly once the vertical orientation of the pipe **18** is achieved. The grippers **30** and **32** are in the nature of conventional grippers which can open and close so as to engage the outer surface of the pipe **18**, as desired.

The link **34** is a elongate member that extends from the pivotable connection **44** to the pivotable connection **68** of the second portion **50** of the lever assembly **22**. The link **34** is non-extensible and extends generally adjacent to the opposite side from the main rotating structural member **16** from that of the arm **24**. The link **34** will generally move relative to the movement of the main rotating structural member **16**. The brace **36** is pivotally connected to the small framework **46** associated with main rotating structural member **16** and also pivotally connected at a location along the arm **26** between the ends thereof. Brace **36** provides structural support to the arm **24** and also facilitates the desired movement of the arm **24** during the movement of the pipe **18** between the horizontal orientation and the vertical orientation.

Actuators **56** and **58** are illustrated as having one end connected to the skid **12** and an opposite end connected to the main rotating structural member **16** in a location above the end **42**. When the actuators **56** and **58** are activated, they will pivot the main rotating structural member **16** upwardly from the horizontal orientation ultimately to a position beyond vertical so as to cause the pipe **18** to achieve is vertical orientation. Within the concept of the present invention, a single hydraulic actuator can be utilized instead of the pair of hydraulic actuators **56** and **58**, as illustrated in FIG. **1**.

The drilling rig **20** is illustrated as having drill pipes **60** and **62** extending upwardly so as to have an end above the drill floor **64**. When the pipe **18** is in its vertical orientation, the translatable movement of the grippers **30** and **32** can be utilized so as to cause the end of the pipe **18** to engage with the box of one of the drill pipes **60** and **62**.

In FIG. **1**, the general movement of the bottom end of the pipe **18** is illustrated by line **66**. The movement of the pivot point **68** of the connection between the lever assembly **22** and the link **34** is illustrated by line **70**. Curved line **72** illustrates the movement of the pivotable connection **40** between the main rotating structural member **16** and the lever assembly **22**.

In the present invention, the coordinated movement of each of the non-extensible members of the apparatus **10** is achieved with proper sizing and angular relationships. In essence, the present invention provides a four-bar link between the various components. As a result, the movement of the drill pipe **18** between a horizontal orientation and a vertical orientation can be achieved purely through the mechanics associated with the various components. As can be seen, only a single hydraulic actuator may be necessary so as to achieve this desired movement. There does not need to be coordinated movement of hydraulic actuators. The hydraulic actuators are only used for the pivoting of the main rotating structural member. Since the skid **12** is located on the bed of a vehicle **14**, the vehicle **14** can be maneuvered into place so as to properly align with the centerline of the drill pipe **60** and **62** of the drilling rig **20**. Once the proper alignment is achieved by the vehicle **14**, the apparatus **10** can be operated so as to effectively move the drill pipe to its desired position. The gripper assemblies of the present invention allow the drill pipe **18** to be moved upwardly and downwardly for the proper stabbing of the drill pipes **60** and **62**. The present invention is adaptable to various links of pipe **18**.

Various types of gripping means **26** can be installed on the end of the arm **24** so as to proper accommodate longer lengths of pipe **18**. These variations are illustrated herein in connections FIGS. **6-9**.

As such, instead of the complex control mechanisms that are required with prior art systems, the present invention achieves it results by simple maneuvering of the vehicle **14**, along with operation of the hydraulic cylinders **56** and **58**. All other linkages and movement of the pipe **18** are achieved purely because of the mechanical connections between the various components. As such, the present invention assures a precise, self-centering of the pipe **18** with respect to the desired connecting pipe. This is accomplished with only a single degree of freedom in the pipe handling system.

Referring still to FIG. **1**, the pipe handling apparatus **10** has a base **214**, a main rotating structural member **16** pivotally connected to the base **214**, a pipe handling means **218** connected to the main rotating structural member **16** for moving the pipe **18** from a generally horizontal orientation to a vertical orientation, and a jacking means **200** connected to the pipe handling means **218** for exerting a downward force in generally parallel relation to the pipe **18** when the pipe **18** is in the vertical orientation. The pipe handling means **218** has a gripping means **26** operatively connected to the frame **244** for gripping an outer surface of the pipe **18**. The jacking means **200** is affixed to the stab frame frame **28**. The pipe handling means **218** moves the pipe **18** between the generally horizontal orientation to the vertical orientation within a single degree of freedom. The pipe handling means **218** has a lever assembly **22** pivotally connected to the main rotating structural member **16**. The lever assembly **22** has a first portion **48** extending outwardly at an obtuse angle with respect to a second portion **50**. An arm **24** is pivotally connected at one end **246** to the first portion **48** of the lever assembly **22** and extending outwardly therefrom. A link **34** is pivotally connected to the second portion **50** of the lever assembly **22**. The link **34** is pivotable at an end of the second portion **50** opposite the first portion **48** so as to move relative to the movement of the main rotating structural member **16** between the first and second positions. A gripping means **26** is affixed to an opposite end **246** of the arm **24** for gripping an outer surface of the pipe **18**. A brace **36** has one end **250** pivotally connected to the main rotating structural member **16** and an opposite end **252** pivotally connected to the arm **24** between the ends **226** and **246** of the arm **24**.

FIG. **2** illustrates the drill pipe **18** in a generally horizontal orientation. In the present invention, it is important to note that the drill pipe can be delivered to the apparatus **10** in a position below the main rotating structural member **16**. In particular, the drill pipe can be loaded upon the skid **12** in a location generally adjacent to the grippers **30** and **32** associated with the gripping means **26**. As such, the present invention facilitates the easy delivery of the drill pipe to the desired location. The gripper **30** and **32** will grip the outer surface of the pipe **18** in this horizontal orientation.

In FIG. **2**, it can be seen that the main rotating structural member **16** resides above the drill pipe **18** and in generally parallel relationship to the top surface of the skid **12**. The lever assembly **22** is suitably pivoted so that the arm **24** extends through the interior of the framework of the main rotating structural member **16** and such that the gripping means **26** engages the pipe **18**. The brace **36** resides in connection with the small framework of the main rotating structural member **16** and also is pivotally connected to the arm **24**. The link **34** will reside below the main rotating structural member **16** generally adjacent to the upper surface of the skid **12** and is

connected to the second portion **50** of the lever assembly **22** below the main rotating structural member **16**.

FIG. **3** shows an intermediate position of the drill pipe **18** during the movement f the horizontal orientation to the vertical orientation. As can be seen, the gripping means **26** has engaged with the pipe **18**. The lever assembly **22** is pivoting so that the end **70** of pipe **18** will pass through the interior of the framework of the main rotating structural member **16**. Also, the arm associated with the gripping means **26** serves to move the stab frame **28** of the gripping means **26** through the interior of the framework of the main rotating structural member **16**. The brace **36** is pulling on the first portion **48** of lever assembly **22** so as cause this motion to occur. The link **34** is pulling on the end of the second portion **50** of the lever assembly **22** so as to draw the first portion **48** upwardly and to cause the movement of the stab frame **28** of the gripping means **26**. The hydraulic actuators **56** and **58** have been operated so as to urge the main rotating structural member **16** pivotally upwardly.

FIG. **4** shows a further intermediate movement of the drill pipe **18**. Once again, the hydraulic actuators **56** and **58** urge the main rotating structural member **16** angularly upwardly away from the top surface of the skid **12**. This causes the link **34** to have a pulling force on the pivotal connection **68** of the second portion **50** of the lever assembly **22**. This causes the first portion **48** of the lever assembly **22** to move upwardly thereby causing the arm **24**, in combination with the brace **36** to lift the gripping means **26** further upwardly and draw the pipe **18** completely through the interior of the main rotating structural member **16**. As can be seen, the relative size and relation of the various components of the present invention achieve the movement of the pipe **18** without the need for separate hydraulic actuators.

The gripping means **26** has a stab frame **28** having a surface **224** affixed to an opposite end **226** of the arm **24**, a first gripper **30** extending outwardly of the stab frame **28** on a side **228** opposite the arm **24**, a second gripper **32** extending outwardly of the stab frame **28** on the side **228** opposite the arm **24** in spaced relation to the first gripper **30**. The first and second grippers **30** and **32** are translatable along the stab frame **28** of the gripping means **26**.

FIG. **5** illustrates the drill pipe **18** in its vertical orientation. As can be seen, the drill pipe **18** is positioned directly above the underlying pipe **62** on the drilling rig **20**. The further upward pivotal movement of the main rotating structural member **16** is caused by the hydraulic cylinders **56** and **58**. This causes the link **34** to rotate and draw the end of the second portion **50** of the lever assembly **22** downwardly. The lever assembly **22** rotates about the pivot point **40** such that the first portion **48** of the lever assembly **22** has a pivot **72** at its upper end. The brace **36** is now rotated in a position so as to provide support for the arm **24** in this upper position. The gripping means **26** has the gripper **30** and **32** aligned vertically and in spaced parallel relationship to each other. If any further precise movement is required between the bottom end **80** of the pipe **18** and the upper end **82** of pipe **62**, then the vehicle **14** can be moved slightly so as to achieve further precise movement. In the manner described hereinbefore, the drill pipe **18** has achieved a completely vertical orientation by virtue of the interrelationship of the various components of the present invention and without the need for complex control mechanisms and hydraulics.

In order to install the drill pipe **18** upon the pipe **62**, it is only necessary to vertically translate the gripper **30** and **32** within the stab frame **28** of the gripping means **26**. As such, the end **80** can be stabbed into the box connection **82** of pipe **62**. Suitable tongs, spinner, or other mechanisms can be utilized so as to rotate the pipe **18** in order to achieve a desired connection. The gripper **30** and **32** can then be released from the exterior of the pipe **18** and returned back to the original position such that another length of drill pipe can be installed. The jacking means **200** can be seen as affixed to the stab frame **28**. The gripping means **26** is attached to the pipe handling structure **244**.

FIG. **6** is a detailed view of the gripping means **26** of the present invention. In FIG. **6** the pin connections **52** and **54** have been installed into alternative holes formed on the stab frame **28** of the gripping means **26**. The holes, such as hole **84** can be formed in a surface of the stab frame **28** so as to allow selective connection between the end of the arm **24** and the stab frame **28** of gripping means **26**. As such, the position of the gripping means **26** in relation to the arm **24** can be adapted to various circumstances.

It can be seen that the pipe **18** is engaged by gripper **30** and **32** of the gripping means **26**. The configuration of the gripper **30** and **32**, as shown in FIG. **6**, is particularly designed for short length (approximately 30 feet) of drill pipe. In FIG. **6**, it can be seen that the gripper **30** and **32** is translated relative to the stab frame **28** so as to lower end **80** of pipe **18** downwardly for connection to an underlying pipe.

Occasionally, it is necessary to accommodate longer lengths of pipes. In other circumstances, it is desirable to accommodate pipes that are already assembled in an extended length. In FIG. **7**, it can be seen that the drill pipe **18** is formed of separate sections **90**, **92**, **94** and **96** that are joined in end-to-end connection so as to form an extended length of the of the pipe **18**. When such pipe arrangements are required, the gripping means **26** of the present invention will have to be adapted so as to accommodate such extended lengths. Fortunately, the structure of the apparatus **10** of the present invention can accommodate such an arrangement. As can be seen in FIG. **7**, the arm **24** is connected to a first gripper assembly **100** and connected by stab frame **102** to a second gripper assembly **104**. The second gripper assembly **104** is located directly below and vertically aligned with the first gripper assembly **100**. The stab frame **102** includes a suitable pin connection for engaging the body **106** of the second gripper assembly **104**. The first gripper assembly **100** has body **108** that is directly connected to the pin connections associated with the arm **24**. The gripping assembly **100** includes grippers **110** and **112** which engage in intermediate position along the length of pipe **18**. The grippers **114** and **116** of the second gripper assembly **104** engage the lower portion of the pipe **18**. The method of moving the pipe **18** from the horizontal position to the vertical position is similar to that described hereinbefore.

It should be noted that the arm **24** can extend at various angles with respect to the gripper assembly. In the preferred embodiment, the arm **24** will be generally transverse to the length of the body associated with the gripper assemblies. However, if needed to accommodate certain drilling rig height and arrangements, the arm **24** can be angled up to 30° from transverse with respect to the body associated with the gripper assembly.

In FIG. **8**, it an be seen that the arm **24** has a first stab frame **120** extending upwardly from the top of the arm **24** and a second stab frame **122** extending below the arm **24**. The stab frame **120** includes a gripper assembly **124** affixed thereto. The stab frame **122** includes a gripper assembly **126** connected thereto. The arm **24** will include suitable pin connections located on the top surface thereof and on the bottom surface thereof so as to engage with the stab frames **120** and **122**. The gripper assembly **124** has suitable grippers **128** and **130** for engaging an upper portion of the pipe **132**. The gripper assembly **126** includes grippers **134** and **136** for engaging

with a lower portion of the pipe **132**. As illustrated in FIG. **8**, the pipe **132** is a multiple section pipe. However, pipe **132** can be an extended length of a single pipe section.

FIG. **9** shows still another embodiment of the gripper assembly structure of the present invention. In FIG. **9**, the arm **24** is connected to the upper stab frame **150** and to the lower stab frame **152**. Gripping assemblies **154**, **156** and **158** are provided. The gripper assembly **154** is connected to an upper end of the upper stab frame **150**. The gripper assembly **158** is connected to a lower end of the lower stab frame **152**. The gripper assembly **156** is intermediately located directly on the opposite side of the end of the arm **24** and connected to the lower end of the upper stab frame **150** and to the upper end of the lower stab frame **152**. As such, the present invention provides up to three gripper assemblies to be connected. This can be utilized so as to accommodate even longer lengths of pipe, if needed.

The present invention achieves a number of advantages over the prior art. Most importantly, the present invention provides a pipe handling apparatus and method that minimizes the number of control mechanisms, sensors and hydraulic systems associated with the pipe handling system. Since the movement of the pipe is achieved in a purely mechanical way, only a single hydraulic actuator is necessary for the movement of the main rotating structural member. All of the other movements are achieved by the interrelationship of the various components. As such, the present invention achieves freedom from the errors and deviations that can occur through the use of multiple hydraulic systems. The simplicity of the present invention facilitates the ability of a relatively unskilled worker to operate the pipe handling system. The amount of calibration is relatively minimal. Since the skid **12** associated with the present invention can be transported by a truck, various fine movements and location of the pipe handling apparatus can be achieved through the simple movement of the vehicle. The pipe handling apparatus of the present invention is independent of the drilling rig. As such, a single pipe handling apparatus that is built in accordance with the teachings of the present invention can be utilized on a number of rigs and can be utilized at any time when required. There is no need to modify the drilling rig, in any way, to accommodate the pipe handling apparatus of the present invention. Since the pipes are loaded beneath the main rotating structural member, the providing of the pipe to the pipe handling apparatus can be achieved in a very simple manner. There is no need to lift the pipes to a particular elevation or orientation in order to initiate the pipe handling system.

In FIGS. **1-9**, the jacking means **200** of the present invention is discreetly located on the stab frame **28** of the gripping means **26** of the pipe handling apparatus **10**. The jacking means **200** remains in a retracted position, as shown in FIGS. **1-9**, while the pipe handling apparatus **10** delivers tubulars **18** to and from the drill pipe **62**. That is, the jacking means **200** is in the retracted position while the pipe handling apparatus **10** moves pipe **18** between vertical and horizontal orientations.

Referring to FIG. **10**, there is shown an isolated side-elevational view of the preferred embodiment of the jacking means **200** attached to the stab frame **28** of the pipe handling means **218**. The jacking means **200** is affixed to the stab frame **28**. The embodiment of the jacking means **200** shown in FIG. **10** is a piston-and-cylinder assembly. The piston **208** is movable within the cylinder **206**. The piston **208** has a head **207** that separates the inside of the cylinder **206** into two interiors. A rod **209** is attached to the head **207** so as to form the piston **208**. The head **207** and rod **209** move within the cylinder **206**.

When the gripping means **26** does not have the necessary force required to remove the pipe **18** that is stuck in the well bore **238**, the hydraulic actuator **212** pumps hydraulic fluid **217** through first line **213** into the first interior **219** of the cylinder **206** so as to move the piston **208** downwardly so that the rod **209** touches the well floor **64** and can push the stab frame **28** upwards, along with the pipe **18**. Hydraulic fluid **217** within the second interior **221** exits the cylinder **206** through second line **215** and is recycled back to the hydraulic actuator **212**. The pressure of the hydraulic fluid **217** in the first interior **219** is greater than the pressure of the hydraulic fluid **217** in the second interior **221**. Hydraulic actuator **212** can be located near the pipe handling means **218** or remotely therefrom. The pipe handling means **218** can be any pipe handling apparatus. The jacking means **200** is shown in the extended position in FIG. **10**. The jacking means **200** has removed the pipe **18** that was stuck in the well bore **238**. The pipe **18** is positioned above the well head **242**. In FIG. **10**, the volume of the first interior **219** is greater than the volume of the second interior **221** when the jacking means **200** is in the extended position.

Referring to FIG. **11**, there is shown an isolated side-elevational view of the preferred embodiment of the jacking means **200** in the retracted position. The jacking means **200** was retracted after the jacking means **200** removed the pipe **18** from the well bore **238**. The piston **208** of the jacking means **200** resides within the interior of the cylinder **206**. The head **207** of the piston resides near the top of the cylinder **206**. Hydraulic fluid **217** was removed from the first interior **219** of the cylinder by the hydraulic actuator **212** through line **213**. Hydraulic fluid **217** was pumped into the second interior **221** by the hydraulic actuator **212** through line **215**. In FIG. **11**, the volume of the second interior **221** is greater than the volume of the first interior **219** when the jacking means **200** is in the retracted position.

The hydraulic actuator **212** shown in FIGS. **10** and **11** can pump hydraulic fluid **217** back and forth through lines **213** and **215** so as to increase or decrease the volumes of the first and second interiors **219** and **221** so as to move the piston **208** and cylinder **206** of the jacking means **200** between the extended and retracted positions.

The method for the present invention for withdrawing a pipe from a well head includes the steps of forming a pipe handling apparatus **10** shown in FIGS. **1-9**. The pipe handling apparatus **10** has a gripper **32** on an end thereof. Referring to FIGS. **10** and **11**, the gripper **32** is positioned above the well head **242** so as to receive the pipe **18** therein. The gripper **32** grips the pipe **18**. The stab frame **28** has a jacking means **200** positioned on a bottom **232** thereof. The jacking means **200** has piston **208** telescopically positioned adjacent the stab frame **28**. The jacking means **200** is activated so as to telescopically move the piston **208** to an extended position relative to stab frame **28**. Once the pipe **18** has been removed from the well bore **238**, as shown in FIG. **10**, the jacking means **200** is retracted so as to telescopically move the piston **208** to a retracted position relative to the base, as shown in FIG. **11**. The retracted position of the jacking means **200** can be seen in FIG. **11**.

While the jacking means **200** of the preferred embodiment is shown in FIGS. **10-11** has has one piston **208** in a single cylinder **206**, the present invention contemplates that the jacking means **200** can have any number of piston-and-cylinder assemblies in series or in parallel that are suitable for a particular application at a well head.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof. Various changes in the details of the illustrated construction can be made within the scope of the appended claims without departing from the true spirit of the invention. The present invention should only be limited by the following claims and their legal equivalents.

I claim:

1. A pipe handling apparatus for manipulating drilling tubulars adjacent a drill platform, the apparatus comprising:
- a boom pivotally mounted to a base, the boom movable between first and second positions;
- a gripper pivotally mounted to the boom, the gripper configured to selectively grip a tubular and, in cooperation with the boom, move the tubular from a stored position to a position over the drill platform;
- a jack associated with the gripper, the jack configured to exert a downward force against a portion of the drill platform, causing an upward movement of the gripper and the tubular gripped in the gripper, wherein a stuck tubular can be extricated by application of the force;
- a lever assembly pivotally connected to the boom, the lever assembly having a first portion extending outwardly at an obtuse angle with respect to a second portion;
- an arm pivotally connected at one end to the first portion of the lever assembly and extending outwardly therefrom;
- a link pivotally connected to the second portion of the lever assembly, the link pivotable at an end of the second portion opposite of the first portion so as to move relative to the movement of the boom between the first and second positions;
- a brace having a one end pivotally connected to the boom and an opposite end pivotally connected to the arm between the ends of the arm; and
- wherein the first position of the boom being generally horizontal, the gripper having a vertical orientation when the boom is in the second position.

2. The pipe handling apparatus of claim 1, wherein the gripper further comprises:
- a stab frame coupled to the boom, the jack being carried by the stab frame of the gripper.

3. The pipe handling apparatus of claim 1, wherein the jack further comprises:
- a piston-and-cylinder assembly; and
- an hydraulic actuator connected to the piston-and-cylinder assembly, the hydraulic actuator passing hydraulic fluid to the piston-and-cylinder assembly so as to move the piston-and-cylinder assembly from a retracted position to an extended position.

4. The pipe handling apparatus of claim 1, the gripper further comprising:
- a stab frame secured to the opposite end of the arm;
- a first gripper extending outwardly of the stab frame on a side opposite the arm; and
- a second gripper extending outwardly of the stab frame on the side opposite the arm in spaced relation to the first gripper.

5. The pipe handling apparatus of claim 4, the first and second grippers being translatable along the stab frame, and the jack being connected to the stab frame.

6. A pipe handling apparatus for manipulating drill pipe adjacent a drill platform, the apparatus comprising:
- a base disposed adjacent the drill platform;
- a boom pivotally connected to the base, the boom having an open frame and being movable between first and second positions;
- a gripper assembly connected to the boom and configured to grip drill pipe and connect or disconnect a drill pipe to a second drill pipe at a wellhead below the drill platform, the gripper moving through the open frame of the boom as the boom moves between the first and second positions;
- a jack connected to the gripper assembly and configured to exert a vertical force so as to remove the drill pipe from the second drill pipe, the vertical force exerted by the jack creating an upward movement of the gripper and the drill pipe;
- a lever assembly pivotally connected to the boom, the lever assembly having a first portion extending outwardly at an obtuse angle with respect to a second portion;
- an arm pivotally connected at one end to the first portion of the lever assembly and extending outwardly therefrom;
- a link pivotally connected to the second portion of the lever assembly, the link pivotable at an end of the second portion opposite of the first portion so as to move relative to the movement of the boom between the first and second positions; and
- a brace having a one end pivotally connected to the boom and an opposite end pivotally connected to the arm between the ends of the arm.

7. The pipe handling apparatus of claim 6, the jack being configured to exert the vertical force when the drill pipe is stuck in the second drill pipe.

8. The pipe handling apparatus of claim 6, the gripper assembly further comprising:
- a stab frame, the jack being secured to the stab frame; and
- gripper jaws carried by the stab frame and configured to grip an outer surface of the drill pipe.

9. The pipe handling apparatus of claim 6, wherein the jack further comprises:
- a piston-and-cylinder assembly; and
- an hydraulic actuator connected to the piston-and-cylinder assembly, the hydraulic actuator passing hydraulic fluid to the piston-and-cylinder assembly so as to move the piston-and-cylinder assembly from a retracted position to an extended position.

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