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OIL WELL MAST WITH DRILL PIPE TRANSFERRING BOOM

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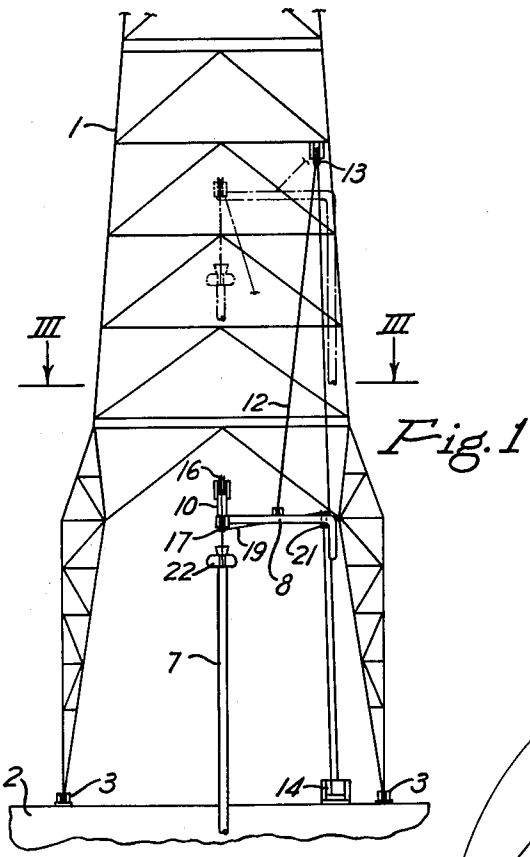

Fig. 1

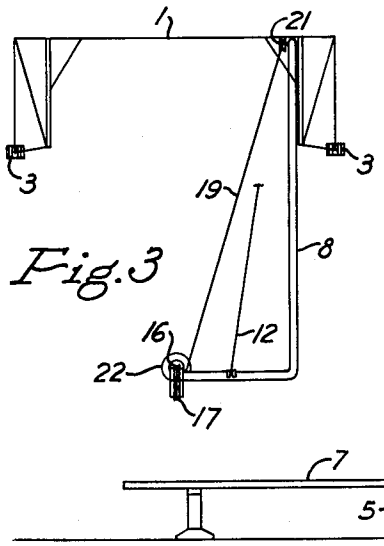

Fig. 3

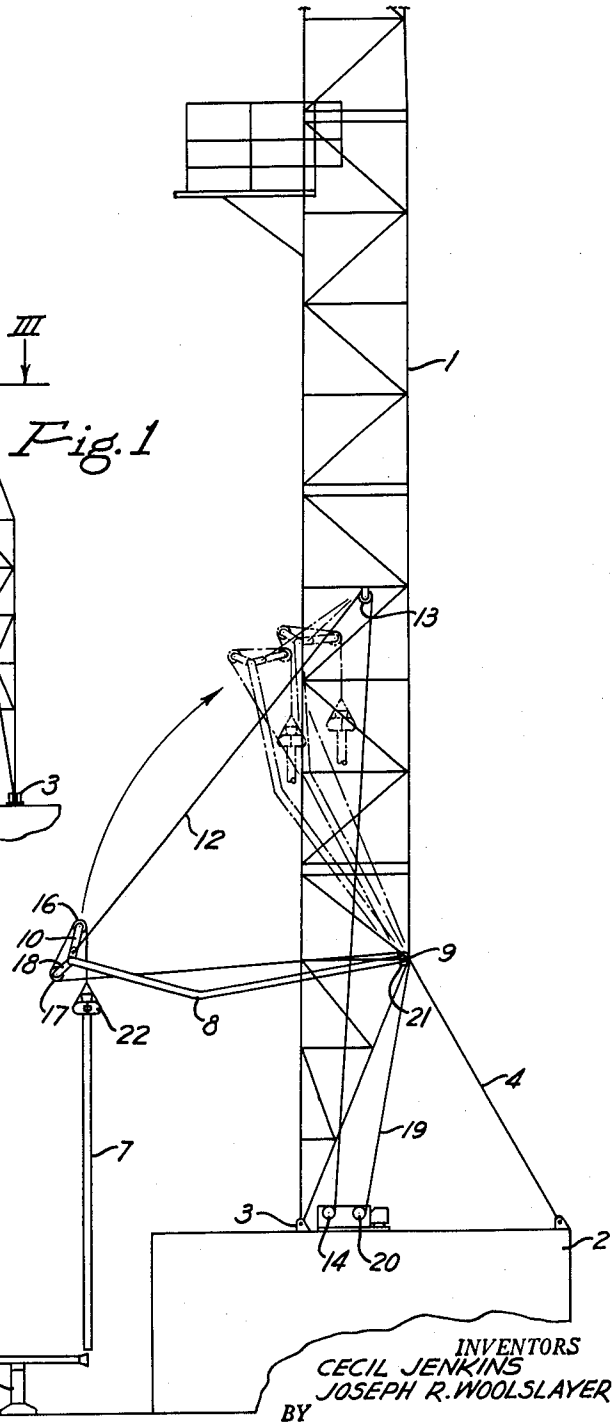

Fig. 2

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OIL WELL MAST WITH DRILL PIPE TRANSFERRING BOOM

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This invention relates to oil well drilling masts, and more particularly to apparatus for transferring drill pipe from a storage point to the mast and for returning it to the storage point.

In the past, the time required to drill down a 30-foot length of pipe was ample to allow the drilling crew to bring in the next joint with the catline and place it in the mouse hole without delaying the drilling operation. However, more recent improved drilling equipment and practices have increased the earth penetration rate so much that a new joint often is needed before the crew is able to get it into place. Consequently, the time required to bring in the new joint and make connections has become a major portion of the total drilling time.

It is among the objects of this invention to provide an oil well drilling mast with apparatus for rapidly transferring drill pipe between the storage area and the inside of the mast and vice versa, in which the transfer apparatus does not obstruct the working space in the mast, and in which the transfer apparatus is carried by the mast itself, is operated from the drilling floor, and is relatively simple in construction and operation.

In accordance with this invention, one end of a boom is pivoted on a horizontal axis near one side of the mast. In its lower position the boom extends forward out of the mast and laterally in front of it to substantially the central vertical plane of the mast. The front end of the boom has an upwardly extending arm, on the upper end of which a sheave is mounted. Preferably, a second sheave is carried by the boom below the first one. Another sheave is supported by the mast in the vicinity of its pivot and a hoist is mounted at the lower end of the mast. A line extends from the hoist up around the mast sheave and forward beneath the boom sheaves and then up and back over the first-mentioned sheave and down behind it. Gripping means below the boom are secured to the line for supporting a drill pipe. Another line is connected to the boom for supporting it and swinging its front end upward and backward to a predetermined upper position at the mast in order to project the first-mentioned sheave into the mast. The boom arm is long enough to locate the gripping means substantially over the well while the boom is in its upper position.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which—

FIG. 1 is a fragmentary front view of a mast equipped with our pipe transferring apparatus;

FIG. 2 is a side view thereof; and

FIG. 3 is a horizontal section taken on the line III—III of FIG. 1.

Referring to the drawings, an upwardly tapered mast 1 of a well known type is U-shape in horizontal section, with its open side facing forward. It is mounted on a substructure 2, to which it is hinged at shoes 3, and it is supported in upright position by the usual gin pole 4. It is equipped with a traveling block (not shown) suspended from its crown block. In front of the substructure there is a pipe rack 5 where drill pipes are stored horizontally.

While a well is being drilled, each successive pipe 7 from the pipe rack is lifted from it and carried into the mast ready to be connected into the string of pipe in the ground. This is done in accordance with this invention by means of a crane boom 8 pivotally connected to the mast. The boom may be formed from a length of heavy tubing which, in the lower position of the boom, extends from the mast forward a considerable distance in front of it to a point above the substructure ends of the drill pipe on the pipe rack. The rear end of the boom is connected to one side of the mast on a pivot 9 near the level of the head of the gin pole. The pivot is usually horizontal and substantially parallel to the front of the mast and far enough behind the well to locate the center of gravity of the boom in front of the pivot for all positions of the boom. The boom extends laterally as well as forward, to substantially the central vertical plane of the mast transverse to the axis of pivot 9. In other words, the plane just mentioned extends from front to back of the mast midway between its two sides, and the boom terminates at or close to that plane. Preferably, the major portion of the boom extends forward from the mast, but the outer end portion of the boom is bent at a right angle to provide a laterally extending portion that approaches the central vertical plane of the mast. The outer end of the boom has an upwardly and somewhat backwardly extending portion that forms an arm 10. This arm may be formed by bending the front portion of the boom at right angles to produce it.

The boom may be raised in various ways, but most suitably it is supported by a line 12 having one end connected to the laterally extending front portion of the boom. The line extends up over a sheave 13 supported by the side of the mast a considerable distance above the boom pivot 9, and then the line extends down to a hoist 14 mounted on the substructure. The forwardly extending portion of the boom is provided with a dog leg, so that when it is swung upward as far as it will go it will overlap and engage the front of the adjoining inclined side of the mast to arrest further backward movement of the boom, as shown in the upper dotted line position in FIG. 2.

A sheave 16 is supported by the upper end of the upwardly extending arm 10 at the outer end of the boom, and a second sheave 17 is journaled in a bracket 18 attached to the boom at the lower end of the arm. Another line 19, connected to a second hoist 20 on the substructure, extends up behind a sheave 21 mounted on an extension of the boom pivot 9. The line extends forward from this sheave and up around the lower boom sheave 17 and then back over the upper boom sheave 16 and down behind it to an elevator 22 that the line supports.

While a well is being drilled, the boom is swung down to its lower position and the elevator is lowered and connected to the adjacent end of a drill pipe lying on the pipe rack 5. The line 19 then is reeled in by hoist 20 to lift the pipe from the rack and suspend it from the elevator, after which the luffing line 12 is reeled in by the other hoist 14 to swing the boom upward and backward toward the front of the mast to the lower dotted line position shown in FIG. 2. In that position, boom sheave 16 is in a location supporting the drill pipe over the conventional mouse hole, so that the pipe can be lowered into the hole to await adding to the string of pipe in the well. The boom is then allowed to swing forward and down again in order to pick up the next length of drill pipe. Of course, the boom can also be used to remove the drill pipe from the mast after a well has been completed and to lay the pipe down on the pipe rack in front of the substructure. When employed for that purpose, the boom is swung to its uppermost position, in which its rear sheave 16 will be located over the well so that the elevator can be attached to a drill pipe that has been raised from the well by the traveling block. The shape of the boom keeps it clear of the working area in the mast.

The boom not only speeds up the transfer of pipe in both directions between the pipe rack and the mast, but it also increases the safety of the operation, it gives the operator better control over the moving load, and it avoids the necessity for the additional rigging that has had to be used heretofore for the same purpose. Our crane boom also can be used effectively with systems of drilling other than the one referred to herein. For example, when another length of drill pipe is required, the kelly can be disconnected from the drill string and the new pipe carried by the boom from the pipe rack directly to a position over the string, thereby avoiding use of the mouse hole. In another system, where the drill string is rotated from a point high up in the mast, the boom likewise is useful for moving drill pipe into and out of operative position.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. In an oil well drilling mast over a well, the mast having a front and a back, apparatus for transferring drill pipe in both directions between the mast and a storage point in front of it, said apparatus comprising a boom near one side of the mast, means near said side of the mast pivoting one end of the boom thereto on an axis substantially parallel to the front of the mast, the boom in its lower position extending from said means forward and laterally in front of the mast to substantially the central vertical plane of the mast transverse to said axis, the front end of the boom having an upwardly extending portion forming an arm, a sheave mounted on the upper end of said arm, a sheave supported by the mast near said pivoting means, a hoist at the lower end of the mast, a line extending from said hoist up around said mast sheave and forward beneath the boom sheave and then up and back over it and down behind it, gripping means below the boom secured to said line for supporting a drill pipe, and means connected with the boom and mast for swinging the front end of the boom upward and backward to a predetermined upper position at the mast to carry said boom sheave into the mast, said arm being long enough to locate said gripping means substantially over the well while the boom is in said upper position.

2. Pipe transferring apparatus as defined in claim 1, in which said boom in its lower position extends from said pivoting means forward to a point in front of the mast and then laterally at a sharp angle toward said central plane.

3. Pipe transferring apparatus as defined in claim 1, in which the boom in its upper position has a substantially vertical upper portion engaging the front of the mast and a lower portion inclined from said upper portion down and rearwardly to said pivoting means.

4. In an oil well drilling mast over a well, the mast having a front and a back, apparatus for transferring drill pipe in both directions between the mast and a storage point in front of it, said apparatus comprising a boom near one side of the mast, means near said side of the

mast pivoting one end of the boom thereto on an axis substantially parallel to the front of the mast, the boom in its lower position extending from said means forward and laterally in front of the mast to substantially the central vertical plane of the mast transverse to said axis, the front end of the boom having an upwardly extending portion forming an arm, a sheave mounted on the upper end of said arm, a sheave supported by the mast near said pivoting means, a hoist at the lower end of the mast, a line extending from said hoist up around said mast sheave and forward beneath the boom sheave and then up and back over it and down behind it, gripping means below the boom secured to said line for supporting a drill pipe, a sheave supported by the mast above said pivoting means, a hoist at the lower end of the mast, and a line attached to said last-mentioned hoist and the boom and passing over said last-mentioned sheave for supporting the boom and swinging its front end upward and backward to a predetermined upper position at the mast to carry said boom sheave into the mast, said arm being long enough to locate said gripping means substantially over the well while the boom is in said upper position, said pivoting means being located behind the center of gravity of the boom when it is in said upper position, whereby upon release of said last-mentioned line the boom will swing forward and down by gravity.

5. In an oil well drilling mast over a well, the mast having a front and a back, apparatus for transferring drill pipe in both directions between the mast and a storage point in front of it, said apparatus comprising a boom near one side of the mast, means near said side of the mast pivoting one end of the boom thereto on an axis substantially parallel to the front of the mast, said means being located behind the center of gravity of the boom in all of its positions, the boom in its lower position extending from said means forward in front of the mast and laterally to substantially the central vertical plane of the mast transverse to said axis, the front end of the boom having an upwardly extending portion forming an arm, a sheave mounted on the upper end of the arm, another sheave carried by the boom below the first sheave, a sheave supported by the mast near said pivoting means, a hoist at the lower end of the mast, a line extending from said hoist up around said mast sheave and forward beneath the lower boom sheave and then up and back over the upper boom sheave and down behind it, gripping means below the upper boom sheave secured to said line for supporting a drill pipe, and means connected with the boom and mast for swinging the front end of the boom upward and backward to a predetermined upper position at the mast to carry said upper boom sheave into the mast, said arm being long enough to locate said gripping means substantially over the well while the boom is in said upper position.

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