

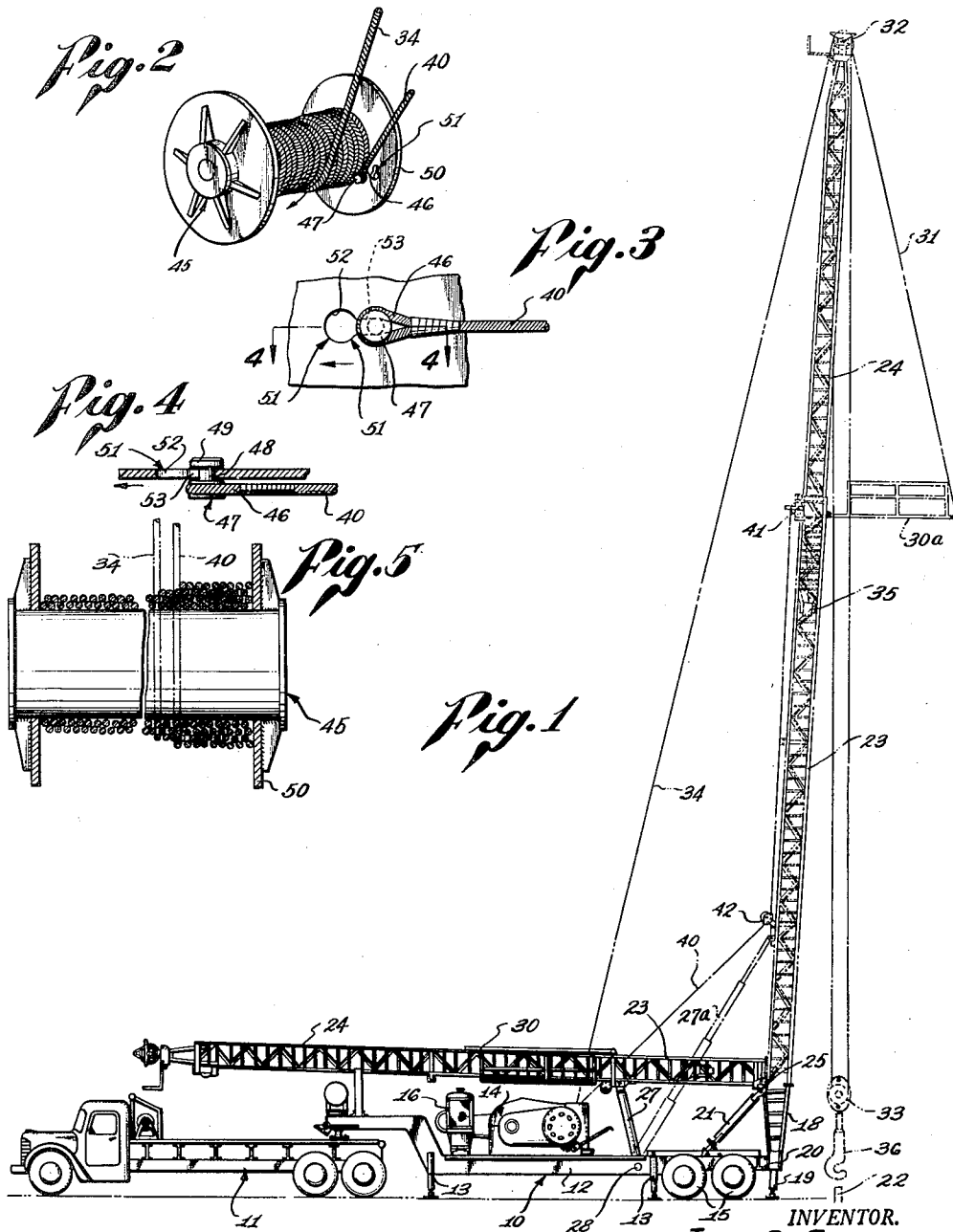
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OVERLAY HOISTING WINCH FOR PORTABLE WELL DERRICKS

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OVERLAY HOISTING WINCH FOR PORTABLE
WELL DERRICKS

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My invention relates generally to portable well derricks such as those used in the drilling and servicing of oil wells, water wells, and the like, and more particularly, to an improved winch and supplemental hoisting line for raising the upper mast section of portable derricks of the type having telescoping mast sections.

Portable derricks of the class described which are built onto the body of either a truck or a trailer have come into relatively common use, and the development of large and heavy-duty truck and trailer equipment, and of superior roads and highways has made it possible to construct portable derricks approaching in size and capacity the more conventional permanent well derricks.

While the smaller portable derricks are constructed as single units adapted to fold from a horizontal, traveling position to a vertical operating position, larger models, that is, those in the neighborhood of one hundred feet in height or larger, are preferably constructed with the mast in two or more telescoping sections, which sections are telescoped together prior to lowering the mast to its horizontal traveling position and remain telescoped during transportation. Such contraction of the mast height is necessary in order to make the structure reasonably portable over roads and highways having sharp turns or steep rises and dips.

While telescoping masts of the type just described have been known and used for considerable length of time, the procedures of raising such masts into operating position and lowering them have given rise to a number of difficulties and dangers which have not been overcome prior to the present invention.

It is the usual practice to construct derricks of the class described, particularly those that are used in connection with oil wells, as entirely self-contained units, that is, units in which the draw works, comprising the winch and power plant, is mounted on the same truck or trailer which carries the mast. Inasmuch as a winch of the capacity necessary for oil field operation such as pulling casings, lifting drill stems, pulling sucker rod assemblies, and the like, together with its attendant controls, brakes, power plant, fuel supply, and the like, occupies considerable space on the bed of the truck or trailer unit, it is desirable to do away if possible with any additional winches or other heavy lifting machinery. Furthermore, the derrick assembly may, and often does include other heavy machinery, such as slush pumps, and thus there is little room on the

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structure for "excess baggage," such as a special winch for lifting the telescoping mast.

Due to the fact that the operating tackle of derricks of the type under discussion is fairly complex and the cable system is reeved through a number of pulley blocks, it is undesirable to have to unreeve the operating draw works and unwind the cable from the main winch solely for the purpose of winding a supplemental cable onto the winch in order to lift the mast section during the erecting operations. Such raising of the mast being performed only once during the erecting operations, however, it is, as previously mentioned, inefficient and wasteful to provide an entire separate winch and power transmission system for this one operation.

In spite of the difficulties just discussed, it has been conventional practice heretofore in erecting telescoping masts to either employ the main draw works for this purpose, or to provide a separate winch and power transmission system and a separate lifting cable, the sole purpose of which was the raising of the upper mast section.

Bearing in mind the foregoing discussion, it is a major object of the present invention to provide a modified winch which is capable of efficient operation, both in connection with the main draw works and as a means for uptilting the mast and/or raising the upper mast section of a telescoping portable derrick.

It is another object of the present invention to reduce the dangers attendant upon raising telescoping masts by the use of the main draw works in the conventional manner herein described.

It is still another object of the invention to avoid the necessity of building into a portable derrick expensive and complicated lifting equipment, the sole function of which is to raise or lower a telescoping derrick mast.

The foregoing and additional objects and advantages will be apparent from a consideration of the following detailed description of a presently preferred embodiment of the invention, such consideration being given likewise to the attached drawings, in which:

Figure 1 is a side elevational view of a portable oil well derrick, the mast being shown in folded and telescoped traveling position in full line, and in erected position in phantom line;

Figure 2 is a perspective view of a winch drum incorporated in the draw works of the derrick illustrated in Figure 1;

Figure 3 is an enlarged fragmentary elevational view looking outwardly toward one of the

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flanges of the winch drum illustrated in Figure 2;

Figure 4 is a horizontal section taken on the line 4—4 in Figure 3; and

Figure 5 is a vertical, axial section taken through the drum illustrated in Figure 2.

In the drawings, the portable derrick structure proper is identified by the reference character 10, and a tractor-truck employed to transport the derrick structure from place to place is identified by the reference character 11. The derrick 10 is mounted on a relatively low-bed trailer 12 which also carries a conventional winch 14, powered by a prime mover 16, for example, a diesel or gasoline engine. Other conventional instrumentalities employed in oil field work, such for example, as slush pumps, prime movers therefor, mud screens, and the like, may be mounted on the trailer bed 12, or the truck 11. Inasmuch as these conventional elements form no essential part of the present invention, they are not shown in the drawings.

When the derrick 10 has been moved to the desired location in preparation for erecting the same, a number of adjustable jacks 13, carried by the trailer 12, are lowered into ground-engaging contact so that the entire weight of the derrick structure is supported solidly against the ground rather than by the pneumatic tired wheels 15 of the trailer 12.

When the weight of the derrick 10 has been taken on the jacks 13, and the body of the trailer 12 leveled up by appropriate manipulation of the jacks, the truck 11 may be detached from the trailer 12 and removed from the scene of operations.

The mast of the derrick 10 is comprised generally of three sections, the lowermost 18 being a relatively short base section provided with thrust receiving jacks 19 which may be lowered into contact with the ground so as to support the thrust load of the mast directly against the ground. The base section 18 is hingedly attached to the rear of the trailer body 12 at the point indicated by the reference character 20, and is additionally braced by a diagonal strut 21, the length of which may be adjusted so as to place the base section in exactly the desired angular relationship to the horizontal whereby the upper end of the derrick mast, when erected, will be directly over the point of desired operations, such as indicated by the reference character 22.

When the base section 18 of the mast has been appropriately adjusted, the two remaining sections 23 and 24 are tilted upwardly about a hinged point 25 at which the intermediate mast section 23 is attached to the base section 18. During the uptilting operation just described, the mast sections 23 and 24 remain in their telescoped positions. The uptilting operation is performed, in the illustrated embodiment, by a hydraulic ram 27 which is pivotally secured at its lower end to the body of the trailer 12 at the point indicated by the reference character 28, and comprises a number of telescoping sections so as to extend into the elongated position illustrated in phantom line in Figure 1, and identified by the reference character 27a. Other means for uptilting the mast are sometimes used in conventional structures, such, for example, as gin poles and a hoisting line connected to the draw works winch, or a cat head thereon.

When the intermediate and upper mast sections 23 and 24 have been raised into alignment with the base section 18, the intermediate section

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23 is then locked to the base section 18 by appropriate means (not shown) so as to become, in effect, an integral part of the base section in alignment therewith.

The details of the telescoping construction of the mast sections 23 and 24 do not form an essential part of the present invention, and accordingly, such details are not illustrated in the drawings. The winch construction and reeving system embodying the present invention is useful in erecting various types of portable derricks, such for example, as that shown in the co-pending application of John P. Selberg and Arnold A. Kahn, filed, April 25, 1951, bearing Serial No. 222,888, and entitled Telescoping Self Erecting Derrick.

Suffice it to say for the purpose of the present discussion that the upper mast section 24 is disposed within the hollow interior of the lower section 23, and appropriate guide means are provided so that the upper section 24 may be slid upwardly to the position illustrated in phantom line in Figure 1, and the sections 23 and 24 may be locked together in this extended position so as to form a single, substantially vertical mast.

Hingedly supported to the upper mast section 24 is a more or less conventional pipe-racking platform 30a, the outboard end of which is supported by one or more diagonal suspension cables 31, as shown in Figure 1. During transportation, the racking platform is adapted to fold against the mast section 24, as indicated by the reference character 30 in Figure 1, the working position being indicated by the reference character 30a.

A conventional crown block 32, having the usual plurality of parallel sheaves, is supported at the top of the upper mast section 24, and a hoisting line 34, sometimes called a "fast line," which is used during well drilling and similar operations to carry the weight of the drill string, for lifting casings, or for similar operations, extends from the winch 14 upwardly over one of a number of sheaves in the crown block 32 and downwardly around one of a number of sheaves in a conventional traveling block 33. The line 34 passes between the crown block 32 and the traveling block 33 a number of times (six in the present case), circling the corresponding sheaves of the crown block and traveling block in the conventional fashion. The dead end of the hoisting line is secured to the derrick structure, as for example, by bringing the same downwardly through the hollow interior of the mast sections 23 and 24, and securing the same adjacent the bottom of the mast, whereby appropriate tension-indicating devices may be associated with the hoisting line.

Before proceeding with a discussion of the apparatus and rigging embodying the present invention, a short discussion of the conventional telescoping derrick erecting procedure is in order. It has been conventional practice to provide a "telescoping" line which is secured to the intermediate section adjacent its upper end, passed under a pulley (not shown) at the bottom end of the upper mast section (indicated in the present drawings by the reference character 35), and returned upwardly and secured to the hook 36 of the traveling block 33. It will be realized, of course, that at the initial point in the hoisting of the telescoping mast sections 23—24, the bottom of the upper section 24 is roughly adjacent the hinge point 25 near the bottom of the mast. Having made the telescoping line connections just de-

scribed, it will be observed that, as the traveling block 33 is pulled upwardly by drawing in on the hoisting line 34, the upper section 24 will be raised, providing, of course, that the number of lines extending between the crown block and the traveling block provides a sufficient mechanical advantage. It will also be noted, however, that the downward tension in the hoisting line 34 between the crown block and the winch 14, and also the tension of the section extending from the crown block to the dead end connection previously described, will resist the upward movement of the mast section 24. Thus, the modus operandi just described, while effective to raise the mast, is most inefficient and results in unnecessary and excessive stresses being developed, both in the hoisting line 34 and in the telescoping line.

Also, inasmuch as the conventional arrangement of the erecting or telescoping line, which has been just described, provides for a two-to-one mechanical advantage, it is necessary, in order to completely raise the upper mast section 24, that the traveling block 33 move twice the distance of that traversed by the mast section 24. Accordingly, the entire procedure must be stopped midway, the mast section 24 locked in partially erected position, and the traveling block 33 lowered to take a new "bite" on the telescoping line.

Both the interruption of the hoisting operation and the excessive stresses heretofore mentioned make the conventional erecting operation in which the main draw works and traveling block are employed quite dangerous, in that failure of the intermediate locking system may occur, allowing the upper mast section to drop, or the excessive stresses produced by the inefficient mechanical arrangement of cables may cause one of the lines to part, or may cause a structural failure in some other part of the derrick.

The mast erecting system of the present invention includes a single telescoping line 40, which is directly secured at its outer end to the lower end of the upper mast section 24 at 35, passes upwardly over a telescoping line sheave 41, mounted at the upper end of the intermediate derrick section 23, passes downwardly under a guide sheave 42, also carried by the intermediate mast section 23, and thence diagonally to the winch 14 for attachment to the drum in a manner about to be described.

In raising the upper mast section 24 with the rigging embodying the present invention, the erecting or telescoping line is wrapped onto the drum 45 on top of the hoisting line 34, thus obviating the necessity of removing the latter during the erecting operations. The attachment means for securing the end of the telescoping line 40 to the drum 45 is illustrated in Figures 2 through 4. Here it will be seen that the line 40 has an eye 46 spliced into the winch end thereof, and that a solid thimble or attachment button 47 is secured in the eye 46.

The terminal attachment button 47 has a necked-down extension 48, on the outer end of which is an enlarged head 49. In one of the flanges 50 of the drum 45 is a keyhole-shaped aperture 51, having a relatively large portion 52 adjacent one end, of sufficient diameter to pass the head 49 of the attachment button 47, and from which extends a relatively narrow slot portion 53 of such width as to just embrace the necked-down extension 48.

Thus, the telescoping line 40 is removably secured to the winch flange 50 by passing the head

49 through the aperture portion 52 and then sliding the button 47 into the slot portion 53. It will be noted from an examination of Figure 2 that the keyhole slot 51 is so disposed that rotation of the drum in a clockwise direction, as indicated by the curved arrow in Figure 2, will draw the button 47 tightly into the slot 53, due to the tension in the line 40. In Figure 5, it will be seen that the lines 34 and 40 are wound in layers of mutually contacting turns on the drum 45.

In operation of the present invention, after the mast sections 23 and 24 have been uptilted to a near-vertical position and locked in such position, the traveling block 33 is lowered to a point near the ground, and to a point in which all but a few turns of the line 34 in a given layer have been stripped from the drum 45, the remaining turns being adjacent the modified flange 50. At this point, the telescoping line is attached to the drum flange 50 in the manner previously described, and the winch drum rotated in a clockwise direction whereby to wind in both the hoisting line 34 and the telescoping line 40.

Inasmuch as the rigging just described effects a straight lift of the upper mast section 24 without mechanical advantage, only a relatively few turns of the winch drum 45 are required to completely raise the mast section. The corresponding length of the hoisting line 34 which is drawn in during this raising operation, results in considerable less movement of the traveling block 33 relative to the crown block 32, since a number of turns of line are passed around the crown block and traveling block as previously described.

While it is possible in conventional structures to entirely unwind the hoisting line 34 from the drum 45 and thereafter secure a telescoping line of the type just described to the drum 45, the just-named type of operation is extremely unsatisfactory in that the excess line unreels and must be restrained from tangling itself, and further, care must be taken that, while it is detached from the winch, the line is not dislodged from any one of the various sheaves over which it passes.

The weight of the upper mast section 24 is relatively slight compared to the loads which the derrick must be constructed to support, and accordingly, insofar as stress is concerned, it would be possible to use a telescoping line of considerable less diameter than that of the hoisting line 34. The use of such a light line is not satisfactory, however, since the same tends to embed itself between the turns of the hoisting line 34 in such manner that the light line will not unreel from the drum once the erecting operation has been completed. This is due particularly to the fact that the turns of the hoisting line 34 which underlie the telescoping line 40 are relatively loose, because no load is being applied to the traveling block 33.

On the other hand, if the telescoping line is substantially larger in diameter than the hoisting line 34, the laying down of the turns on the drum 45 will again be uneven since the overlying turns cannot continuously nest in the interstices between adjacent turns of the hoisting line 34. Furthermore, a larger telescoping line will increase the width of its layer of turns more rapidly than the underlying layer and cause tangling of the lines.

Accordingly, it has been found to be advantageous, and in fact necessary, to use a telescoping line which is of the same diameter as the hoisting line 34, even though the tensile stresses

on the telescoping line are relatively slight in comparison to its ultimate strength.

As has been previously stated, only a relatively few turns on the drum are required to completely raise the mast section 24. For example, in the particular structure illustrated in the drawings, the amount of upward movement of the upper mast section 24 in erecting the mast is approximately forty-five feet, while the mean diameter of the turns on the drum 45 is approximately one and one-half feet. Thus, approximately ten and one-half turns are required to completely raise the upper mast section, which is considerably less than half the total number of turns in one layer on the drum 45. Since the group of lines extending between the crown block and the traveling block constitutes at least a "six part" line, that is, there are six supporting lines in the group, it will be seen that the traveling block moves approximately twenty-two and one-half feet with respect to the upper mast section 24, during the above-described erecting operation. Seven and one-half feet of this movement is caused by winding forty-five feet of hoisting line onto the drum. An additional fifteen feet of traveling block movement is caused by the length of the fast line and dead line, both being increased by the distance traveled by the top mast section 24.

Alternatively, if it is desired to use a two part telescoping line, i. e., to dead end the telescoping line at the top of the lower mast section 23 and run it under a sheave at the bottom end 35 of the upper mast section, as described in connection with the conventional lifting system, the movement of the traveling block 33 with respect to the upper mast section during the erecting operation, will be approximately thirty feet.

When the erecting operation has been completed, the telescoping line may be unwound, and quickly detached from the drum flange 50, and the extra line stored by coiling the same on appropriate storage hooks (not shown) at the base of the mast. When it is desired to lower the upper mast section 24, the operations just described are reversed, that is, the telescoping line is again attached and wound onto the drum, the strain of the upper mast section weight is taken on the telescoping line 40, and the winch brake thereafter used to slowly lower the mast section into its telescoped position. The telescoping line may then be left wound on the winch drum during transportation of the derrick to be in readiness for the next erecting operation.

While the form of the invention shown and described herein is fully capable of achieving the objects and providing the advantages hereinbefore stated, it will be realized that it is capable of some modification without departure from the spirit of the invention. For this reason, I do not mean to be limited to the form shown and described, but rather to the scope of the appended claims.

I claim:

1. In a portable derrick: a bed; a mast on said bed having a movable portion adapted for movement from a lowered, traveling position to an erect, operating position; a winch drum on said bed; an end flange on said drum with a keyhole-shaped aperture therein having a relatively large portion and an adjoining slot portion disposed with its long axis perpendicular to a radius of said flange; a crown block on the upper end of said mast; a traveling block below said crown block; a hoisting line reeved through said blocks

and partially wound on said drum in layers of mutually contacting turns, the outermost of said layers commencing at said end flange inwardly of said aperture; an erecting line secured at an outboard end thereof to said mast to erect said movable portion upon tension being applied to said erecting line; and a member secured to the inboard end of said erecting line, said member having a head portion of dimensions to pass through the large portion of said aperture, and a necked-down portion adjacent said head portion received in said slot portion and closely embraced thereby, whereby rotation of said drum in a direction to wind said hoisting line on said drum draws said member tightly into said slot portion to wind said erecting line on top of said outermost layer of said hoisting line to erect said mast portion.

2. In a portable derrick: a bed; a mast on said bed having a movable portion adapted for movement from a lowered, traveling position to an erect, operating position; a winch drum on said bed; an end flange on said drum with attachment means formed thereon to receive and removably secure a line to said winch; multiple line hoisting gear supported from the upper end of said mast; a hoisting line reeved through said hoisting gear and partially wound on said drum in layers of mutually contacting turns, the outermost of said layers commencing at said end flange inwardly of said attachment means; an erecting line secured at an outboard end thereof to said mast to erect said movable portion upon tension being applied to said erecting line, the inboard end of said erecting line being removably secured to said attachment means; whereby rotation of said drum in a direction to wind said hoisting line on said drum also winds said erecting line on top of said outermost layer of said hoisting line to erect said mast portion.

3. In a portable derrick: a bed; a mast on said bed having a movable portion adapted for movement from a lowered, traveling position to an erect, operating position; a winch drum on said bed; an end flange on said drum with a slot-shaped aperture therein disposed with its long axis perpendicular to a radius of said flange and having a relatively large portion adjacent one end of said axis; hoisting gear supported from the upper end of said mast; a hoisting line reeved through said hoisting gear and partially wound on said drum in layers of mutually contacting turns, the outermost of said layers commencing at said end flange inwardly of said aperture; an erecting line secured at an outboard end thereof to said mast to erect said movable portion upon tension being applied to said erecting line; and a member secured to the inboard end of said erecting line, said member having a head portion of dimensions to pass through the large portion of said aperture, and a neck-down portion adjacent said head portion received in the remaining portion of said aperture closely embraced thereby, whereby rotation of said drum in a direction to wind said hoisting line on said drum draws said member tightly into said remaining portion to wind said erecting line on top of said outermost layer of said hoisting line to erect said mast portion.

4. In a portable derrick: a bed; a mast on said bed having a movable portion adapted for movement from a lowered, traveling position to an erect, operating position; a winch drum on said bed; an end flange on said drum with an aperture therein; a hoisting gear supported from the upper end of said mast; a hoisting line reeved

through said hoisting gear and partially wound on said drum in layers of mutually contacting turns, the outermost of said layers commencing at said end flange inwardly of said aperture; an erecting line secured at an outboard end thereof to said mast to erect said movable portion upon tension being applied to said erecting line; and a member secured to the inboard end of said erecting line, said member having a head portion of dimensions to pass through said aperture, and a necked-down portion adjacent said head portion and cooperating therewith to engage an edge of said aperture upon rotation of said flange whereby rotation of said drum in a direction to wind said hoisting line on said drum draws said member tightly into said engagement to wind

said erecting line on top of said outermost layer of said hoisting line to erect said mast portion.

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