PORTABLE WELL DRILLING STRUCTURE

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Application October 28, 1953, Serial No. 388,864

2 Claims. (Cl. 189—11)

This invention relates to oil well drilling masts, and more particularly to a collapsible mast permanently mounted on a portable base.

When a well drilling mast is permanently mounted on a portable base along with the drawworks and engines, there are certain limitations on load dimensions that have to be observed before the unit can be moved over highways. During transportation the mast must be in substantially horizontal or reclin ing position, so the drawworks and engines should be located below it. Also, during transportation the gin pole likewise should be disposed in a reclining position, in which it will not project materially above the reclining mast. In raising such a mast to upright position by means of a sling connected with the gin pole and with the drawing line that passes over the crown block to the drawworks, the operator has to be very careful to disconnect the power from the drawing line at just the right moment. If he stops too soon, the mast may not be in position for attachment to the gin pole. If he does not stop soon enough, he may pull the mast too far and break a cable or even cause the mast to buckle or "pull in."

It is among the objects of this invention to provide a compact mast structure of the character just described, in which a reclining gin pole is automatically swung up into operative position at the beginning of the mast raising operation, in which the mast cannot be swung past the head of the gin pole, in which the operator is given some leeway in the time during which he must cut off the power to the raising line, in which the upright mast is automatically latched to the gin pole, and in which the gin pole is lowered automatically at the end of the mast lowering operation.

In accordance with this invention the lower end of an upright mast is pivotally mounted on a base so that the mast can be swung downward to the ground for movement to another location. A gin pole also is mounted on the base behind the mast. The mast and upper end of the gin pole are provided with plungers and plunger-receiving members that cooperate to hold the mast in upright position. Means are provided for retracting the plungers to remove them from the plunger-receiving members preparatory to lowering the mast. Suitable means, such as springs, can be provided for projecting the plungers into openings in the plunger-receiving members, which preferably are plates secured to the mast. The openings in the plates may be slots, in which case means are provided for holding the plungers in one end of the slots. The plungers have to be withdrawn from the slotted plates before the mast can be lowered.

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

Fig. 1 is a side view of our mast...structure ready for transportation to a new location or for elevation of the gin pole and mast;

Fig. 2 is a side view showing the gin pole and mast swung up into operative position and fastened together;

Fig. 3 is a rear view of the structure shown in the preceding figure;

Fig. 4 is an enlarged fragmentary side view of the connected portions of the mast and gin pole;

Fig. 5 is an enlarged fragmentary rear view of the connected portions of the mast and gin pole, with parts shown in vertical section;

Figs. 6 and 7 are vertical sections taken on the lines VI—VI and VII—VII, respectively, of Fig. 5; and

Fig. 8 is a horizontal section taken on the line VIII—VIII of Fig. 5.

Referring to Fig. 1 of the drawings, an oil well mast base 1 is shown which may be part of a truck trailer if desired. Mounted on this base is the usual drawworks 2, in front of which are posts 3 forming an elevated support that extends a considerable distance above the level of the top of the drawworks. The upper ends of the posts are pivotally connected to the scene. A reclining mast 4 that extends substantially horizontally back against the drawworks and rests face up on a suitable support 5. The posts must be tall enough to allow the mast to pass over the drawworks, but no taller than permitted by highway load height restrictions. When the mast is tall, it is divided into two sections that are telescoped together for transportation as shown. The front legs 7 of the mast, which are at the upper side of the reclining mast, are connected by suitable conventional bracing to the rear legs 8 which are at the lower side of the reclining mast. The rear legs do not extend to the foot of the mast, but terminate near the rear end of the drawworks at what is called the heel of the mast. They are connected by inclined braces 9 to the lower ends of the front legs of the mast.

Behind the drawworks an upright framework 11, which is mounted on the base near its opposite sides, extends up a short distance into the bracing free space between the opposite sides of the reclining mast above the base. This framework can be braced by braces 12 connecting it with posts 3. The upper end of this framework pivotally supports the foot of a gin pole 13 which, in its lower full line position in Fig. 1, extends forward over the drawworks and between posts 3. The top or head of the reclining gin pole does not project appreciably above the level of the upper side of the reclining mast. The gin pole is narrow enough to fit in the space between the opposite sides of the lower portion of the mast. A traveling block 15 inside the mast is connected by the usual drilling line 16 with the crown block 17 and with the drawworks. The hook of the traveling block is hooked onto a sling 18 that is formed from a cable doubled on itself. The sides of the sling extend forward over a pair of sheaves 19 journaled at the head of the gin pole. From these sheaves the sling extends backward under the mast, the opposite ends of the sling cable being anchored to the lower side of the mast in any suitable manner near its heel.

When it is desired to raise the mast, the mast first is extended full length and then the drawworks is operated to pull the traveling block and sling 18 toward the crown block. As the sling is pulled, it first swings the gin pole upward and backward between the opposite sides of the mast's bifurcated lower portion. When the pole has reached a predetermined inclined position, shown is broken lines in Fig. 1, its movement is stopped by jointed braces 22 pivotally connected to posts 3 and to forks 23 that straddle sheaves 19. With the top of the gin pole now located in fixed position above the reclining mast, further pulling on the sling by the traveling block will cause the sling to pull upward on the mast and the mast by swinging it upward and forward toward the upright operating position shown in Fig. 2.

It is a feature of this invention that when mast reaches
upright position it is automatically connected to the head of the gin pole, which then supports the mast. Accordingly, the mast and the head of the gin pole are provided with plungers and plunger-receiving members, the plungers being urged toward their receiving members by springs. The preferred construction of this connection, as shown in Fig. 5, the upper ends of the gin pole legs 13 are connected by a tubular cross member 26, near the opposite ends of which sheaves 19 are journalled. Slidably mounted in each end of the cross tube is a hollow plunger 27 which normally projects a predetermined distance from the end of the tube. Each plunger is urged outwardly by a coil spring 28 compressed between its inner end and a ring 29 welded in the tube.

The plunger receiving members on the mast are in the form of parallel metal plates 31 that extend downward from the heel of the reeling mast in Fig. 1 at the lower ends of inclined braces 9. These plates are at the inside of the bifurcated lower portion of the mast at points where they will engage the gin pole plungers when the mast is raised. The plates are located farther apart than the ends of cross tube 26, but closer together than the projecting ends of the projecting plungers and are provided with openings 32 for receiving the plungers. In order to force the plungers back into the cross tube so that the inner surfaces of the plates can slide across them until they spring out into the plate openings, a guide member 33 extends forward through the mast from each plate. As shown in Fig. 8, the two guide members diverge as they approach the front of the mast so that their front ends are farther apart than the ends of the projecting plungers. The guide members may be formed from angle irons and their inner surfaces are flush with the inner surfaces of the plates. As the mast swings forward across the head of the gin pole, the guide members engage the outer ends of the plungers and slide forward across them. In doing so the converging guide members force the plungers inward against the compression of coil springs 28 until the openings in plates 31 reach the plungers. The springs then drive the plungers out into those openings.

Another feature of this invention is that the operator of the drawworks does not have to disengage its clutch and apply its brake at a certain instant, in order to stop the mast the moment the plungers shoot out into plates 31 for he is allowed a short but adequate period of time in which he can do those things. The desirable result is obtained by making each of the plate openings 32 in the form of a slot which extends nearly horizontally when the mast is erect, as shown in Fig. 6. The operator can tell when the plungers are forced out through the slotted plates, by the noise they create. He then is given a few seconds, while the rear ends of the slots are approaching the plungers, in which to engage the clutch of the hoist and to apply the brake. This short interval of time is long enough for him to avoid pulling in the mast or breaking the cable. The operator then releases the tension on the line enough to allow the mast to settle by gravity until the front ends of the slots engage the front of the plungers. The mast then is in proper operative position.

To prevent the wind or loads on the mast from swinging it back and forth, due to the slots in the plate, means are provided for locking the plungers in the front ends of the slots. For this purpose a latch 36 is pivotally suspended from a cross pin 37 at the heel of the mast in a position that permits its lower end to be swung forward along the outer surface of the adjacent slotted plate 31. The latch preferably is channel shaped and has the lower end of its web slotted for reception of an eyebolt 38 pivoted on a bracket 39 in brace 9. A nut 41 on the outer end of the bolt can be tightened to force the latch forward toward the mast so that the inner flange of the latch will press against the projecting end of the adjoining plunger and hold it in the front end of the slot.

Also is desirable to provide the projecting end of the plunger with a peripheral groove 42, into which the inner flange of the latch projects so that the plunger cannot be withdrawn from the projecting plungers. The plunger-engaging flange of the latch may be made wider than the outer flange and provided with an arcuate recess so that it will fit part way around the plunger in the groove, as shown in Fig. 4. After the mast has been erected, the sling is unlashed from the traveling block and removed or lashed to the mast in a position where it will not interfere with the drilling operation.

The raising procedure just described is reversed in lowering the mast for transportation to another location, but the plungers must first be withdrawn from the slotted plates and held in retracted position until the inner surfaces of the plates can move back far enough to engage the end surfaces of the plungers. The plungers then will be held back in the cross tube by means of the plates and guide members 33, but as the mast is lowered the forwardly diverging guide members will permit the plungers to slide out of the tube again to their normal retracted position.

For retracting the plungers to release them from the slotted plates, a long bolt 45 (Figs. 5 and 7) extends through each plunger and has its front end extending through and anchored to a cross piece 46 welded in the outer end of the plunger. The bolt also extends back through the adjoining coil spring 28 and ring 29 and has its rear end pivotally connected to the inner end of a bell crank 47 that extends through a slot 48 in the bottom of the cross tube 26. The crank is pivotally mounted on a pin 49 extending through brackets 51 welded to the outside of the tube. The inclined outer arm of the crank is double and straddles the tube. The adjacent ends of these outer arms are pivotally connected by links 52 to a cross pin 53 below the tube. Suspended from this pin is a clevis 54, to which a rope 55 is fastened. When it is desired to retract the plungers after the latches have been released from their outer ends, the rope is pulled to swing the outer ends of the bell cranks downward away from the cross tube. This swings their inner arms toward each other and thereby pulls the plungers back into the tube. As soon as the rope is released, the coil springs move the plungers outward again until stopped by engagement of cross pin 53 with the bottom of the tube.

The mast can be permitted to swing backward by gravity after the plungers have been withdrawn from the slotted plates. Of course, tension is kept on the sling at this time to control the lowering speed of the mast. When tension is taken off the sling after the mast has been lowered onto back rest 9, the gin pole will swing forward down to its reeling position shown in Fig. 1. A compact unit thus is formed which can be erected again in just a few minutes.

The raising and lowering operations are greatly simplified by using a sling to raise and lower the gin pole as well as the mast and to do it in a continuous operation that does not require the sling to be removed from the raised gin pole and then attached to the reeling mast. Moreover, as soon as the mast reaches upright position it is automatically connected to the gin pole, by which it is held upright while the latches are tightened to lock the mast in operative position. The plungers are protected by mounting them inside of the gin pole head.

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. A well drilling structure comprising a base having
front and rear ends, a reclining mast extending lengthwise over the base and having a head and a foot, the foot of the reclining mast being located above the front end of the base, means on the base pivotally supporting the foot of the mast, a reclining gin pole above the base having a head and a foot, means on the base behind said mast-supporting means pivotally supporting the foot of the gin pole, the gin pole extending toward the foot of the mast and being narrower than the adjacent portion of the mast, said portion of the mast being bifurcated to permit the gin pole to be swung upward into it, plungers projecting laterally from opposite sides of the head of the gin pole, means urging the plungers outward, a pair of plates projecting downward from opposite sides of the rear end of said bifurcated portion of the reclining mast, means limiting said upward movement of the gin pole, cable means connecting the mast behind the head of the reclining gin pole with said gin pole head and adapted to be pulled for first swinging the head of the gin pole backward and up above the reclining mast until stopped by said limiting means and then swinging the mast up and forward to upright position, said plates being provided with slots extending substantially horizontally when the mast is upright to receive said plungers, latches connected to the mast and adapted to be pressed against the back of the plungers to hold them in the front ends of the slots, and means for retracting the plungers to remove them from said slots preparatory to lowering the mast and gin pole.

2. A well drilling structure comprising a base having front and rear ends, a mast extending above the base, means on the base pivotally supporting the lower end of the mast so that the mast can be swung backward and downward to lower it, a gin pole mounted on the base behind the mast, the lower portion of the mast being bifurcated to swing back over the gin pole, plungers projecting laterally from opposite sides of the upper end of the gin pole, means urging the plungers outward, a pair of plates carried by the mast and provided with slots extending substantially horizontally receiving the plungers, the plungers projecting from said plates and being provided with radial grooves adjacent the outer faces of the plates, latches supported by the mast behind the plungers and inserted in said grooves, detachable means holding the latches tightly against the plungers to press them against the front end walls of the slots to hold the mast upright, and means for retracting the plungers from said slots in order to disconnect the mast from the gin pole preparatory to lowering the mast away from the gin pole.

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