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H. W. THORNBURG

SPOOLING DEVICE FOR CABLE TOOL DRILLS

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Fig. 1

Fig. 2

Herbert W. Thornburg
INVENTOR

by

Hoar & Rubloff
ATTORNEYS.
My invention relates to new and useful improvements in spooling devices for cable-tool drills.

Such drills, per se, are well known.

In such drills a rope passes, from a winch drum on the main frame, around a heel sheave at or near the pivot of a spudding beam, thence under a sheave at oscillating end of the spudding beam, thence over a sheave at the upper end of a mast, and thence vertically downward into the hole which is being drilled in the ground. At the lower end of this rope is a string of percussion drilling tools. The spudding beam is oscillated by a pitman, actuated by a rotating crank.

As the rope is payed out to lower the tools as the hole grows deeper, or is taken in to withdraw the tools for any reason, it is desirable that the reach of rope from the winch-drum to the heel sheave shall move from side to side, always in a plane perpendicular to the axis of the drum, spooling the layers of the rope evenly off of or onto the drum; and that the heel sheave shall move from side to side and change its orientation, so as always to lie substantially in the plane defined by the two reaches of rope which run from this sheave.

Accordingly it is the principal object of my invention to devise a mounting for the heel sheave, such that the heel sheave will automatically thus move and thus orient itself, under the influence merely of the tension in these two reaches of rope.

During spudding, there is a tendency to throw slack into the rope at the end of each upstroke of the tools. Furthermore, on the downstroke the rope is stretched and has a tendency to untwist; and, when the rope becomes slack at the end of the upstroke, the rope tends to twist up again.

The net result of these tendencies is for the coils of rope on the drum to expand, and for some coils to become crossed over other coils. This damages the rope.

So it is necessary for a spooling device, in addition to properly shifting and orienting the heel sheave, also to clamp the rope just sufficiently tightly to prevent this whipping and twisting, and yet permit the gradual slipping of the rope past the heel sheave as the tools dig the hole deeper and deeper. Such a clamping means should also be readily releasable during hauling up or lowering of the tools.

Accordingly it is a further object of my invention to incorporate into my spooling device such a clamp.

In addition to my principal objects, above stated, I have worked out a number of novel and useful details, which will be readily evident as the description progresses.

My invention consists in the novel parts and in the combination and arrangement thereof, which are defined in the appended claims, and of which one embodiment is exemplified in the accompanying drawings, which are hereinafter particularly described and explained.

Throughout the description, the same reference number is applied to the same member or to similar members.

Figure 1 is a plan view of a drill embodying my invention.

Figure 2 is a side elevation of the same drill.

In these two figures, the associated parts of the drill have been shown very schematically, and much of the drill (well known to the art) has been omitted.

Figure 3 is a slightly enlarged elevation of one of the links of my invention, taken along the lines 3–3 of Figure 1.

Figure 4 is a slightly enlarged elevation of the heel sheave of my invention, taken along the lines 4–4 of Figure 1.

Figure 5 is a geometric diagram showing the path of the center-point of my heel sheave, and the orientation of that sheave. This diagram is enlarged to six times the scale of Figures 1 and 2.

Referring now to Figures 1 and 2, we see that 11 is the main frame of a drill, supported by wheels 12, and during drilling by blocks 13.

The frame 11 supports a mast 14 (called "derrick" in the art), a motor 15, a winch 16, a spudding gear 17, and associated driving connections, not numbered.

From the winch 16, a rope 18 runs around a heel sheave 19, thence under a spudding-sheave 20, thence over a sheave (not shown) at the top of the derrick 14, thence down to the drilling tools (not shown).

The spudding gear 17 is clutched to and unclutched from a drive connection with the motor 15, by means of a clutch (not shown).

The spudding-sheave 20 is mounted (preferably by means of an offset substantially vertical pivot 21) on the free end of a spudding-beam 22, which in turn is pivoted on horizontal pivots 23 on the frame 11.

The spudding-beam is rocked up and down by the rotation of the spudding gear 17, acting through pitman 24.

The winch 16 is controlled by means of a conventional drive, clutch, brake, and hand-levers (not shown).
The operation of all these conventional parts will be readily understood. Heel sheave 19 is free to slide laterally along a floating rod 25, the ends of which are pivoted on swinging brackets 26, which in turn are pivoted on the frame 21. As shown, sheave 19 slides on rod 25, and turns about that rod as an axis. But, although highly advisable, this is not necessary. Any alternative device, whereby sheave 19 is rotatably mounted, and is free to slide along rod 25, would be sufficient.

The pivot axes A and B, between the brackets 26 and the frame 21, and the pivot axes C and D between these arms and the rod 25, might preferably be so inclined that the plane in which rod 25 moves, will be somewhat upwardly inclined away from the drum 18. My machine was originally built in this manner. But I have found that a considerable angular departure from the theoretically optimum arrangement is possible without appreciably reducing the effectiveness of my invention. And I have found that the theoretically optimum arrangement unfortunately permits the entire linkage to flop around badly, due to the influence of gravity alone, if the rope 18 be slackened. Accordingly I have been forced to compromise between theoretical and practical considerations, by so placing my pivots that rod 25 moves in a horizontal plane.

Of course, I could have biased my linkage against flopping by the use of counterweights or springs; but, finding the simpler expedient to be successful in practice, I adopted it. Preferably CD should be approximately one-half AB; and, when CD is parallel to AB, then AC and BD should each form an angle of 45 degrees with AB. But structural conditions frequently prevent the attainment of this optimum, which can be considerably departed from, without appreciably reducing the effectiveness of my invention. With CD more than one-half AB (as shown) I have found that the angle should be more than 45 degrees.

Turning now to the geometrical diagram which constitutes Figure 5, we see that that figure represents the right half of the linkage of my invention. AC' and AC'' represent the two extreme positions of the right-hand bracket 26; and C'D' and C'D'' represent the corresponding positions of the left-hand bracket. C’C” represents half the path of the center of heel sheave 19, which is diagrammatically illustrated in one of its positions, properly oriented. The center-line of the machine is marked with the monogram CI.

By virtue of its swivel, spudding sheave 20 always lies in the plane of the two reaches of rope running to it.

Turning now to Figure 4, we see heel sheave 19 on rod 25, the latter being shown in cross-section. A rope guard 27 is also journaled on rod 25 at each side of the sheave. A shoe 28 fits in an opening between ribs 29 and 30 of the guard 27. This shoe is constrained by spring 31 and a similar spring on the further side, to bear against the rope, clamping it to the sheave.

The guard 27 is kept from rotating, by beam 32, which slides between projection 33 on the guard and projection 34 on the shoe. Pivot rod 25 is a cam 35. By inserting a bar in the sockets 36 of this cam, and rotating the rod downward through 90 degrees, the cam will bear against the edges of the guard 27, holding the shoe out of clamping position, and thus permitting the rope to run freely.

Having now described and illustrated one form of my invention, I wish to be understood that my invention is not to be limited to the specific form or arrangement of parts herein described and shown, except as limited by my claims.

I claim:

1. A spooling device, comprising: a first sheave; a fixed position drum; a floating sheave; these three elements being adapted to be used in connection with a cable wound around the drum and thence extending around the floating sheave and thence extending around the first sheave; means, comprising a rod on which the floating sheave is slidably mounted, constraining the floating sheave to follow such a path that the reach of rope from the drum to the floating sheave will always lie substantially in a plane perpendicular to the axis of the drum, and the floating sheave will always lie perpendicular to its path and substantially in the plane of the two reaches of rope which extend from it; a floating sheave-guard for embracing the floating sheave and floating therewith; and means to prevent the sheave-guard from rotating with the floating sheave.

2. A sheave-mounting, comprising: a wide-spread base; two converging links, each hinged at one end of the base; a rod, materially shorter than the base and hinged at each end to one of the links; and a sheave mounted for lengthwise sliding along the rod.

3. A kinematic mechanism, comprising: a wide-spread base; two converging links, each hinged at one end of the base; a rod, materially shorter than the base and hinged at each end to one of the links; a movable member mounted to slide along the rod, and to remain at a constant angle thereto; and means to constrain the movable member to occupy predetermined positions in space under respective conditions.

4. A spooling device, comprising: a first sheave, with a substantially horizontal axis; a fixed position drum, with a substantially horizontal axis; a wide-spread base; two converging links, each hinged at one end of the base; a rod, materially shorter than the base and hinged at each end to one of the links; and a sheave mounted for lengthwise sliding along the rod; the plane of the base, the links and the rod, being substantially horizontal; the relative location of the drum, the rod, and the sheave being such that a rope extending from the drum can run first over the sliding sheave and then over the first sheave.

5. A spooling device, comprising: a first sheave; a fixed position drum; a floating sheave; a rope, leading from the drum, thence around the floating sheave, and thence around the first sheave; and means including a floating straight rod on which the floating sheave is slidably mounted, and to restricting and controlling the movement of the floating sheave as to constrain the floating sheave to be in positive equilibrium, under the tension of the rope, when, and only when, the
reach of the rope extending from it to the drum is substantially perpendicular to the axis of the drum; said means also constraining the floating sheave to lie always substantially in the plane defined by the two reaches of the rope extending from it.

6. A spooling device, comprising: a first sheave; a fixed position drum; a floating sheave; a rope, leading from the drum, thence around the floating sheave, and thence around the first sheave; and means including a floating straight rod on which the floating sheave is slidably mounted, and so restricting and controlling the movement of the floating sheave as to constrain the floating sheave to be in positive equilibrium, under the tension of the rope, when, and only when, the reach of the rope extending from it to the drum lies in a plane substantially perpendicular to the axis of the drum.

7. A spooling device, according to claim 1, further characterized by having: a shoe carried by the sheave-guard; and means to constrain the shoe to yieldably clamp any cable trained about the floating sheave against the floating sheave.

8. A spooling device, according to claim 1, further characterized by having: a shoe carried by the sheave-guard; means to constrain the shoe to yieldably clamp any cable trained about the floating sheave against the floating sheave; and means for optionally relieving this constraint.

9. A spooling device, according to claim 1, further characterized by having: a shoe carried by the sheave-guard; means to constrain the shoe to yieldably clamp any cable trained about the floating sheave against the floating sheave; and means for optionally relieving this constraint; said last named means consisting of a cam, pivoted on the shoe, and rotatable to bear against the sheave-guard.

10. A spooling device, according to claim 1, further characterized by having: a shoe carried by the sheave-guard; means to constrain the shoe to yieldably clamp any cable trained about the floating sheave against the floating sheave; and means for optionally relieving this constraint; said last named means consisting of a cam, pivoted on the shoe, and rotatable to bear against the sheave-guard, and having means for the attachment of a lever to rotate the cam.

11. A sheave-mounting, comprising: a widespread base; two converging links, each hinged at one end of the base; a rod, materially shorter than the base, hinged at each end to one of the links; and a sheave mounted directly on the rod, for rotation about the rod, and for sliding along the rod.

HERBERT W. THORBURG.