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SHOCK ABSORBER FOR DRILLING RIGS

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2 Sheets—Sheet 1

Fig. 1.

Fig. 3.

Fig. 4.

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My invention relates to an improvement in drilling apparatus of the character employed for drilling oil wells.

A salient object of the invention is the provision of a simple form of device for absorbing and eliminating shocks normally imparted to the derrick of the drilling rig during a spudding operation.

In the drilling of oil wells it is economically desirable to employ a steel drilling cable rather than a rope cable. Experience, however, has shown that the economic advantages accruing from the use of a steel cable are largely offset because of the destructive effect of the strains and stresses placed upon the derrick of the drilling rig by the increased weight of the steel cable, particularly during what is known as the “spudding operation.” During such operation the weight of the steel cable attached stem and bit averages around three thousand pounds. This weight is elevated and dropped during the spudding operation at the rate of about forty cycles per minute. These rapidly repeated violent jerks soon destroy the derrick and materially shorten the life of a drilling rig, a drilling rig rarely lasting through the drilling of three wells. Due to the frequent necessity for rebuilding or replacing the drilling rig the cost per well drilled is needlessly increased.

During the spudding operation these repeated jerks and resulting strains are transmitted to the derrick through the drilling cable at its points of contact with the derrick. It is specifically an object of my invention to interpose cushioning devices between the drilling cable and one or more of its points of contact with the derrick, whereby the same is substantially relieved of destructive strains and stresses and the life of the drilling rig greatly prolonged.

In one form of my invention I provide cushioning devices for the bull wheel shaft about which the drilling cable is coiled and from which it is fed to the well.

Referring to the drawings, forming a part of this application—

Fig. 1 is a side elevational view, with parts broken away, of a drilling rig, showing the application of my invention thereto.

Fig. 2 is a side elevational view partly in section of a portion of the derrick shown in Fig. 1.

Fig. 3 is a detail view of one form of shock absorber employed by me.

Fig. 4 shows a modified form of shock absorber for the bull wheel shaft, and

Fig. 5 is a detail view showing the application of a shock absorber to the crown pulley mounted on the crown block at the top of the derrick.

Referring to the drawings wherein like reference characters indicate like parts, the numeral 1 indicates generally a derrick of conventional design. The drilling rig is provided with the usual band wheel 2 driven from a suitable engine (not shown) through the medium of belt 3. The band wheel 2 is provided with a crank arm 4. Adjacent the base of the derrick and to one side thereof is positioned the bull wheel 5 carried by the bull wheel shaft 6 about which is coiled the drilling cable 7 which passes upwardly through the derrick and is trained over the crown pulley 8 mounted on the crown block 9 at the top of the derrick 1. From the crown pulley 8 the drilling cable 7 extends down into the well carrying the stem and bit.

During the spudding operation the pitman 10 associated with the walking beam 11 is disconnected from the crank arm 4 and a cable 12 is then attached to the crank arm 4 and connected to the drilling cable 7 as indicated at 13 at a point well above the bull wheel shaft. It will be seen that during each revolution of the band wheel 2 the tools carried by the drilling cable 7 are first raised and then permitted to drop due to the alternate tightening and slackening of the cable 7 above the bull wheel shaft 6, effected through the medium of the cable 12. Each time the cable 7 is slackened the entire weight of the string of tools carried thereby is transmitted to the derrick through the crown pulley 8 and bull wheel shaft 6. Any strains or stresses must therefore be taken up by the derrick. The structure hereinafter described is conventional and it is to be understood that my invention is readily applicable to drilling rigs of the character now in general operation without the necessity of any material modification in the existing structures.

Coming now to a consideration of the novel features of my invention and referring more particularly to the structures shown in Figs. 2 and 3, each of the bull wheel support-
ing posts 14 is provided with a slot 15 near its lower end adapted to permit a limited vertical movement of the post with respect to the derrick 1. The pins 16 are carried by the base structure of the derrick and project through the slots 15 in the bull wheel supporting posts 14 to limit the vertical movement of such posts. Secured to the upper end of each post 14 is a metallic plate member 16 provided with a central projection or lug 17. A sleeve member 18, of slightly larger cross sectional area than the posts 14, is adapted to receive the upper end of each of the posts 14. These sleeve members 18 are provided with flanges 19 having apertures 20, through the medium of which, the sleeve members 18 are adapted to be rigidly secured to the derrick. They have been shown as secured to the derrick girt 21. It is to be understood that these sleeve members 18 may be secured to the derrick in any desired manner such as, for example, through the medium of the bull wheel post braces. The closed end of each of the sleeve members 18 is also provided with a central projection or lug 22 similar to the lug 17 carried by the plate 16. It will be seen that the lugs 17 and 22 are in vertical alignment when the upper end of the post 14 is received within the sleeve 18. For absorbing shocks a coil spring 23 of suitable strength is housed in each of the sleeve members 18 and held in operative position by the lugs 17 and 22. While I have shown a single coil spring 23 it is to be understood that any other suitable form of spring may be employed or that a plurality of springs may be substituted for the single spring shown.

With reference to the operation of the form of shock absorber above described it will be understood that when the rotation of the band wheel 2 permits a slacking of the cable 7 and the string of tools falls into the well any jerk with its resulting strains and stresses will be taken up by the springs 23 which will yield slightly and permit the bull wheel supporting posts 14, carrying the bull wheel shaft 6 about which the cable 7 is coiled, to have a limited and cushioned vertical movement, thus avoiding the transmission of destructive vibration to the rigid derrick structure.

I have also found it advantageous to provide cushion or shock absorbing bearings for the ends of the bull wheel shaft 6. In Fig. 4 I have shown one means for resiliently mounting the ends of the bull wheel shaft 6 within the bull wheel posts 14. This disclosure is merely illustrative and it is to be understood that other forms of cushioning bearings may be employed. In the structure shown in Fig. 4 it will be noted that each bull wheel shaft supporting post is provided with a vertically elongated slot 24 within which the bearing block 25, for the end of the bull wheel shaft 6, is adapted to have a limited vertical movement. Strong cushioning springs 27 are positioned above and below the bearing block 25, which springs are adapted to absorb shocks transmitted to the bull wheel shaft 6 through the medium of the drilling cable 7 in a manner similar to that above described in connection with springs 23. It is to be understood that the shock absorbing bearings for the ends of the bull wheel shaft 6 may be either employed alone or in combination with the shock absorbers positioned at the upper end of the bull wheel supporting posts 14 shown in Figs. 1 to 3. When the shock absorbing bearings for the bull wheel shaft 6 are employed alone the posts 14 may of course be rigidly secured to the derrick.

The only points of contact between the drilling cable 7 and the derrick 1 are the bull wheel shaft 6 and the crown pulley 8. I have heretofore described shock absorbing devices adapted to be associated with the bull wheel shaft 6. It is also within the contemplation of my invention to eliminate shocks which might be transmitted to the derrick through the crown pulley 8. Referring to Fig. 8 it is to be noted that the crown pulley 8 is rotatably supported in bearing blocks 28. Each of these bearing blocks 28 is adapted to have a limited and cushioned vertical movement within a U-shaped member 29 rigidly secured to the crown block 9. For cushioning the vertical movement of the bearing blocks 28 I have positioned a plurality of springs 30 above and below each bearing block 28. These springs may be held in position in any suitable manner. Other forms of springs may also be substituted for the springs shown. It will be readily apparent that any jerk or strain imparted to the crown pulley 8 through the medium of the drilling cable 7 will be absorbed by the springs 30 thus avoiding the transmission of the strains and stresses to the derrick structure.

It is within the contemplation of my invention to employ any one of the shock absorbing devices herein described either alone or in any desired combination. It may be stated however that the best results are obtained by employing cushioning devices between the cable and each of its points of contact with the derrick. While I have been specific in the description of the shock absorbing devices employed by me it is to be understood that this description is merely illustrative and is not to be construed in a limited sense, since other forms of shock absorbing devices may be employed in lieu of those herein described if within the scope of the appended claims.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An improved drilling rig comprising in combination a derrick, a drilling cable, a bull wheel shaft upon which the cable is adapted to be coiled, means for alternately tight-
ening and slacking the drilling cable and means comprising independent yieldable bearings for the bull wheel shaft for absorbing shocks imparted thereto incident to the slacking of the drilling cable.

2. An improved drilling rig comprising a derrick provided with a bull wheel shaft, means for supporting the bull wheel shaft, said means comprising independent bearings, said bearings arranged to have a limited vertical movement with respect to the derrick and separate yieldable means resisting vertical movement of said independent bearings.

3. An improved drilling rig comprising a derrick, a bull wheel shaft, a crown pulley, a drilling cable coiled on said bull wheel shaft and trained over said crown pulley, a pair of bull wheel supporting posts, means for mounting each of said bull wheel supporting posts on said derrick, said means permitting said bull wheel supporting posts to have a limited vertical movement with respect to said derrick and yieldable means arranged at one end of each of said posts for resisting vertical movement of said posts.

4. An improved drilling rig comprising a derrick, a bull wheel shaft, a crown pulley, a drilling cable coiled on said bull wheel shaft and trained over said crown pulley, a pair of bull wheel supporting posts, means for mounting said bull wheel supporting posts on said derrick, said means permitting said bull wheel supporting posts to have a limited vertical movement with respect to said derrick, and independent resilient means for resisting the vertical movement of each of said bull wheel supporting posts with respect to said derrick.

5. A shock absorber for a drilling rig, adapted to be positioned between a supporting post for the bull wheel shaft and the derrick, comprising a sleeve member rigidly secured to the derrick, adapted to receive the upper end of the bull wheel shaft supporting post and resilient means housed within said sleeve member for absorbing shocks imparted to said bull wheel supporting post.

6. A shock absorber for a drilling rig of the character embodying a derrick, a bull wheel shaft and a drilling cable coiled around the bull wheel shaft, comprising bull wheel shaft supporting posts mounted for a limited vertical movement with respect to the derrick, and resilient means interposed between the upper end of each bull wheel shaft supporting posts and the derrick for cushioning the movement of said supporting posts with respect to the derrick.

7. An improved drilling rig comprising a derrick, bull wheel shaft supporting posts secured to said derrick, a cushion bearing carried by each of said supporting posts, a bull wheel shaft having its ends supported by said cushion bearings whereby shocks transmitted to the bull wheel shaft will be absorbed by said cushion bearings.

8. A drilling rig comprising a derrick, bull wheel shaft supporting posts secured to said derrick, a bearing block carried by each of said supporting posts adapted to have a limited vertical movement with respect to said posts, resilient means for cushioning the vertical movement of said bearing blocks and a bull wheel shaft having its ends rotatably supported in said bearing blocks.

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