Feb. 24, 1942. C. C. SCHARPENBERG 2,274,168

DRAW WORKS

Filed July 16, 1940

Fig. 2.

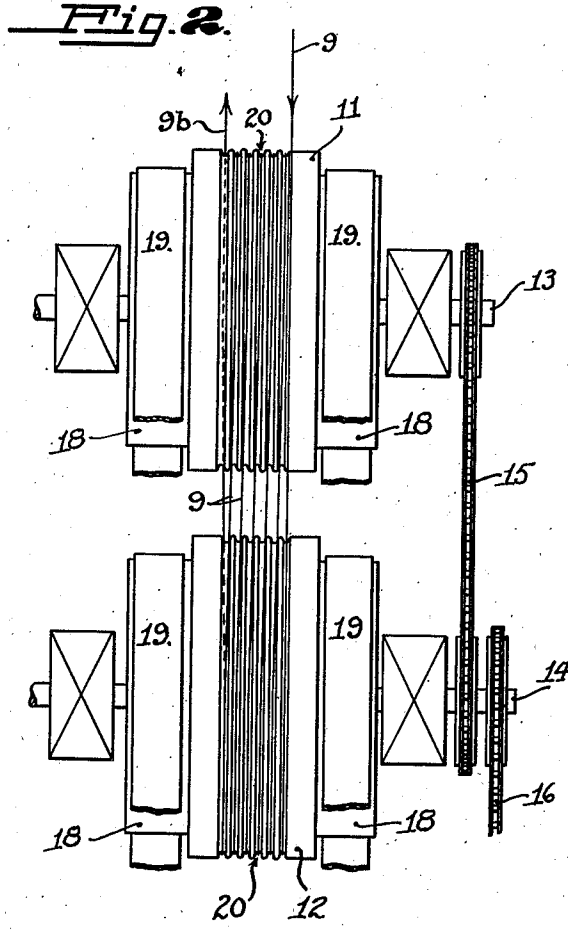


Fig. 1.

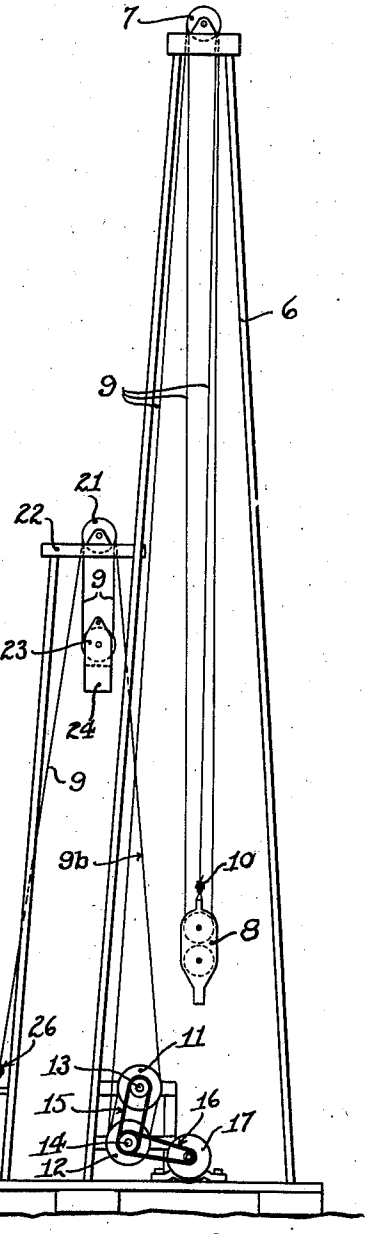
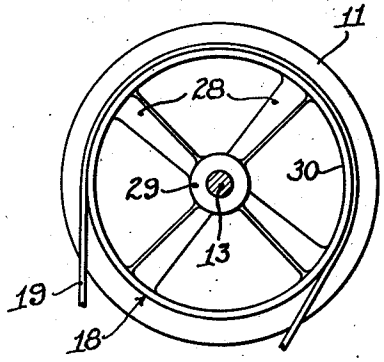


Fig. 3.



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DRAW WORKS

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4 Claims. (Cl. 254—145)

The present invention relates to cable hoisting apparatus. Although illustrated and described herein as a draw works for well drilling rigs, it will be apparent that the invention may be embodied without material change in hoisting apparatus adapted for other purposes.

The principal object of the invention is to provide take-up means for storing the cable as the load is lifted, which take-up means is entirely separate from the driving drum, so that the cable is not stored upon the drum as it is reeled in. This results in several advantages; first, that the cable does not over-ride upon itself on the driving drum, and is, therefore, not subject to crushing and serious wear under high tension; second, that the effective diameter of the drum remains constant regardless of how much cable is reeled in or paid out, and therefore, the power and speed remain constant for any given load throughout the entire range of travel; third, that because the driving drum does not provide room for the storage of cable, it can be made shorter and of larger inside diameter than is customary with a storage drum. The large inside diameter enables the use of interior fan blades to promote cooling of the brake drums.

Another object of the invention is to provide hoisting apparatus in which an unused or spare portion of cable can be stored at the low tension dead end of the useful cable, instead of at the high tension end as is customary in well drilling procedure. Storage of new or spare cable at the low tension end permits the most effective use of cable, because the greatest and most rapid wear occurs at or near the high tension end.

Other objects of the invention are to provide hoisting apparatus which takes up less floor space in the derrick than the usual forms of draw works, and which permits a material increase in the area of brake surface provided on the driving drum. Further objects and advantages of the invention will become apparent from the following specification, which should be read with the understanding that changes, within the limits of the claims hereto appended, may be made in the form, construction and arrangement of the several parts herein described and illustrated.

Reference will be made to the accompanying drawing in which

Fig. 1 is a diagrammatic elevation of a well drilling derrick with a draw works embodying a preferred form of my invention.

Fig. 2 is a partly diagrammatic elevation of the driving drums of my improved draw works as viewed from the left of Fig. 1 and enlarged.

Fig. 3 is an end elevation of one of the driving drums, the shaft thereof being shown in section.

In the drawing, the reference numeral 6 designates a derrick as used in well drilling, having the usual crown block 7 at its top and the usual travelling block 8 to which the load, not shown, is connected. The cable 9 is reeved through the crown block 7 and travelling block 8, in the usual manner, and its dead end is attached to the travelling block at 10.

Instead of the usual driving drum of sufficient length and depth to provide storage for the cable as the load is lifted, I provide two adjacent driving drums 11 and 12, respectively secured upon parallel shafts 13 and 14. The shafts are connected together by a chain 15, and are driven in unison by a chain 16 from a motor 17. Each driving drum is provided with a brake drum 18 at each end, and each brake drum is provided with a band or other form of shoe 19. There are thus four brakes to divide the load between them.

Each of the driving drums is provided with a series of parallel independent grooves 20, and the grooves of one drum are offset axially with respect to the grooves of the other drum by a distance equal to one half of the distance between the center lines of the grooves. The cable 9 is wrapped around the two drums 11 and 12, in a series of successive bights, each bight embracing a portion of a groove of one drum and an opposite portion of an adjacent groove of the other drum. For example, as shown in Fig. 2, the cable enters the first groove of the drum 12, follows said groove for approximately 180°, then passes to the first groove of the drum 11, follows that groove for 180°, then passes back to the second groove of the drum 12, and so forth until it leaves the last groove of the drum 11, as shown. In passing from one drum to the other, the cable necessarily makes a slight angular deviation from the planes of the grooves. The drums should be so designed, however, that this angular deviation, known technically as the fleet angle, is 1½° or less, which is well within the limits of accepted practice. The fleet angle depends upon the lateral spacing of the grooves and the distance between the axes of the drums. The distance between the centers of adjacent grooves divided by two times the distance between the axes of the drums is equal to the tan-

gent of the fleet angle, where both distances are expressed in the same units.

After leaving the driving drum 11, the cable extends upwardly to an auxiliary crown block 21, mounted on an extension frame 22 at the side of the derrick, and is reeved over said auxiliary crown block 21 and an auxiliary travelling block 23, each of which comprises a plurality of independent sheaves as in the case of the main crown block 7 and travelling block 8. The auxiliary travelling block 23 hangs freely and has attached to it a weight 24 for purposes to be explained presently.

After leaving the auxiliary crown block 21, the cable 9 extends downwardly to a dead end anchor preferably provided by wrapping it around any convenient fixed part of the derrick structure, as indicated at 25, and securing it with a clamp 26. It is to be noted that there are no reverse bends in the cable. Its reeving through the auxiliary blocks 21 and 23, around the driving drums 11 and 12, and through the main blocks 7 and 8, is such that every bend is in the same direction, viz: clockwise beginning from the anchor at 25. The absence of reverse bends, which are destructive to wire cable, especially under heavy load, is conducive to long life.

From the clamp 26, the cable may continue, as shown at 9a, to a storage drum 27 on which a new or unused portion or length of cable is stored. It will be seen that as the main travelling block 8 with the load attached thereto is raised and lowered, the auxiliary travelling block 23 is correspondingly lowered and raised. As the load is raised, the cable reeved through the blocks 7 and 8 is transferred to the take-up system comprising the auxiliary blocks 21 and 23, and when the load is lowered the cable is returned to the main system of blocks 7 and 8. The number of reevings of the cable in the main system and the auxiliary or take-up system must be inversely proportional to the respective distances travelled by the main block 8 and the auxiliary block 23.

Power is imparted to the cable in lifting, and taken from it in lowering, by the driving drums 11 and 12, and the length of said driving drums must be sufficient to provide the necessary degrees of contact between cable and drums to transmit the desired power.

The functions of the weight 24 on the auxiliary travelling block 23 are to make said block descend as the cable is paid into the take-up system; and to maintain sufficient tension on that portion of the cable indicated at 9b which runs off from the driving drums. It is also possible, by increasing the weight 24, to make it serve as a partial counterbalance for the weight of the load on the main travelling block 8, but this is not usually desirable in well drilling practice.

The driving drums 11 and 12 are preferably placed one above the other, as indicated, in order to use as little floor space as possible at the base of the derrick. The driving drums can be short and of large diameter because they do not provide room for storage of cable upon them. Their large diameter permits them to be made with interior fan blades 28, Fig. 3, extending from the hub 29 to the rim 30, said blades producing air currents through the interiors of the drums to assist in cooling the brake drums 18. Each drum is preferably provided with two brake drums, as before described, thus doubling the effective brake area over that in common practice.

It will be seen from the foregoing that there is no over-riding of the cable upon itself on the driving drums. The cable is, therefore, not subjected to the crushing and extreme wear which such overriding entails especially under high tension. Cable wear is also minimized by the large diameter of the drums. The effective diameter of the driving drums, moreover, remains constant so that the speed of the load, and the power necessary to raise it, are constant throughout its entire range of travel.

It will also be seen that the forward portion of the cable, between the driving drums and the dead end 10 on the travelling block 8, is subject to the greatest wear, because tension on that portion of the cable is the greatest. The portion of the cable between the driving drums and the take-up system comprising the auxiliary blocks 21 and 23 is under very little tension (unless the weight 24 is sufficient to partially counterbalance the load), and is, therefore, subject to comparatively little wear. As the portion of the cable between the driving drums and the main block system wears out, the clamp 26 is released and the entire cable is drawn through the system until that portion which was normally between the driving drums and the take-up system is advanced to a position between the driving drums and the main system, and a new length of cable is advanced from its rear end into the take-up system. In this way, only that portion of the cable which is subject to the greatest wear need be discarded.

I claim:

1. In a hoisting apparatus for deep well drilling rigs, a derrick, a main crown block thereon, a main traveling block, a cable having a movable forward end portion reeved through said main blocks and an anchored rear end, driving means for said cable comprising two parallel drums each having a circular peripheral groove, the groove of one drum being offset laterally with respect to the groove of the other drum, said cable being passed around the two drums in a bight embracing a portion of the groove of one drum and a portion of the groove of the other drum, an auxiliary crown block mounted on the derrick, and a weighted auxiliary traveling block, the portion of the cable between its anchored rear end and said driving means being reeved through said auxiliary blocks, the auxiliary traveling block moving in directions opposite to the movements of the main traveling block and storing and paying out cable as said main traveling block is raised and lowered.

2. In a hoisting apparatus for deep well drilling rigs, a derrick, a main crown block thereon, a main travelling block, an auxiliary crown block on said derrick, an auxiliary traveling block, a pair of spaced parallel driving drums, a cable having an anchored rear end, said cable being reeved through said auxiliary blocks, thence passing around said driving drums in a bight embracing a portion of each drum, thence being reeved through said main blocks, all the bends in said cable in passing around said blocks and said drums being in the same direction, and said auxiliary blocks operating as a take-up system to store cable when said main traveling block is raised and to pay out said cable when said main traveling block is lowered.

3. In a hoisting apparatus for deep well drilling rigs, a derrick, a crown block thereon, a traveling block, a cable having a movable forward end portion reeved through said blocks and an anchored rear end, driving means for said

cable comprising two spaced drums having parallel axes and each drum having a plurality of parallel equally spaced circular peripheral grooves, the grooves of one drum being offset laterally from the grooves of the other drum by a distance equal to one half the lateral distance between centers of adjacent grooves, and the distance between the axes of said drums being such that said lateral distance between adjacent groove centers divided by two times said distance between the drum axes is equal to the tangent of an angle not greater than one and one-half degrees, said cable being passed around said drums in a series of bights embracing portions of the grooves of one drum and opposite portions of the grooves of the other drum, and movable take-up means over which said cable is passed between said driving means and said anchored rear end, said take-up means storing cable as said traveling block is raised and paying out said cable as said traveling block is lowered.

4. In a hoisting apparatus for deep well drilling rigs, a derrick, a crown block thereon, a traveling block, a movable cable reeved through said blocks, driving means for said cable comprising two spaced drums having parallel axes and each drum having a plurality of parallel equally spaced circular peripheral grooves, the grooves of one drum being offset laterally from the grooves of the other drum by a distance equal to one half the lateral distance between centers of adjacent grooves, and the distance between the axes of said drums being such that said lateral distance between adjacent groove centers divided by two times said distance between the drum axes is equal to the tangent of an angle not greater than one and one-half degrees, said cable being passed around said drums in a series of bights embracing portions of the grooves of one drum and opposite portions of the grooves of the other drum, one end portion of said cable passing from said drums to said blocks and movable means engaging the other end portion of said cable for maintaining tension thereon.

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