June 24, 1952 H. D. HILBORN ET AL 2,601,611

CROWN BLOCK

Filed April 19, 1947 2 SHEETS—SHEET 1

Fig. 1

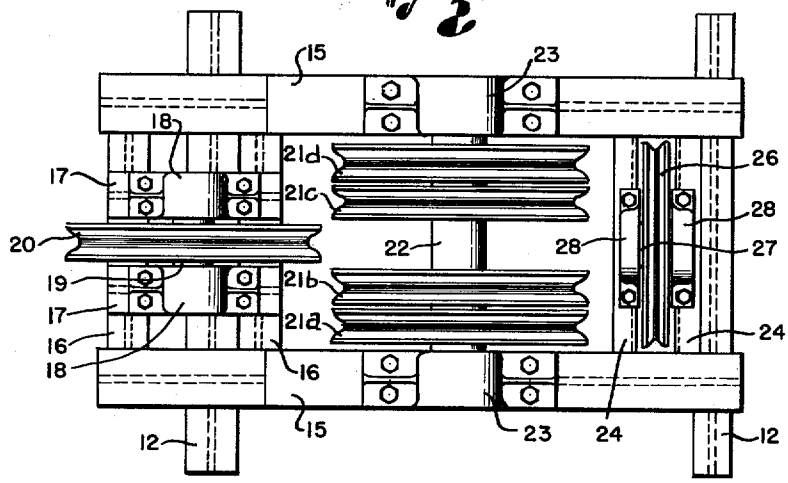
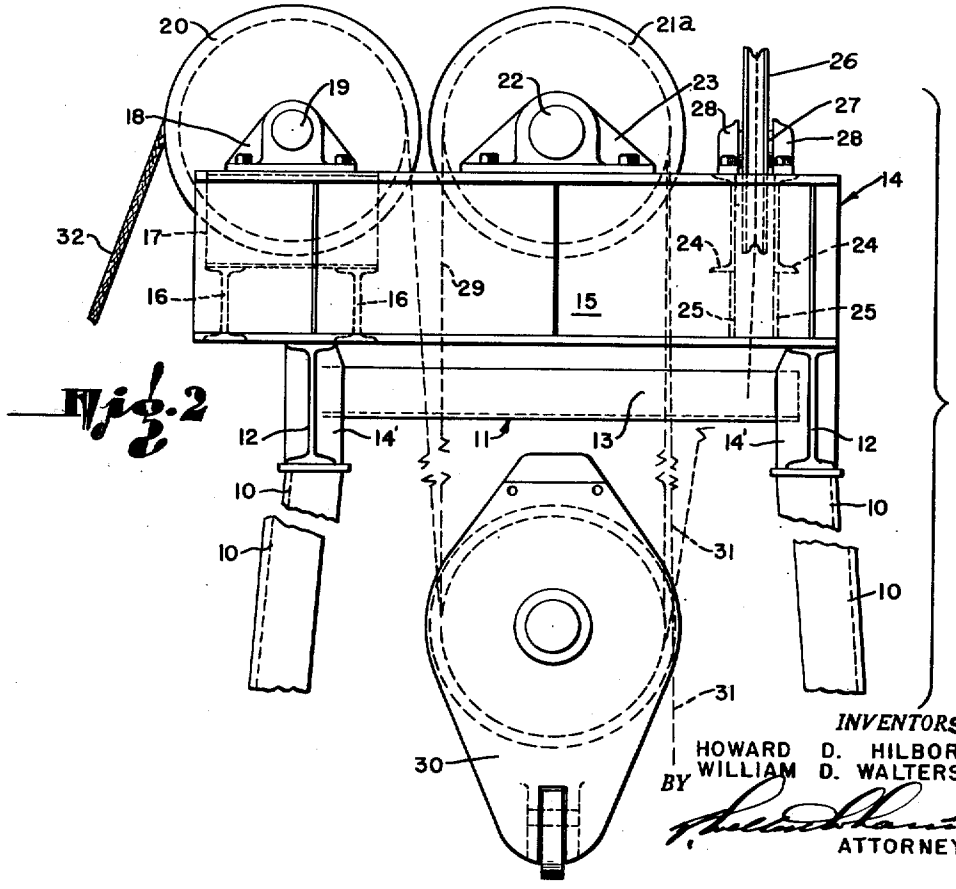


Fig. 2



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Fig. 3

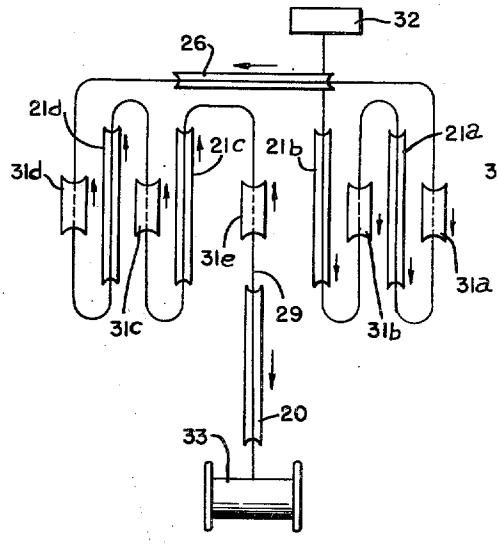


Fig. 4

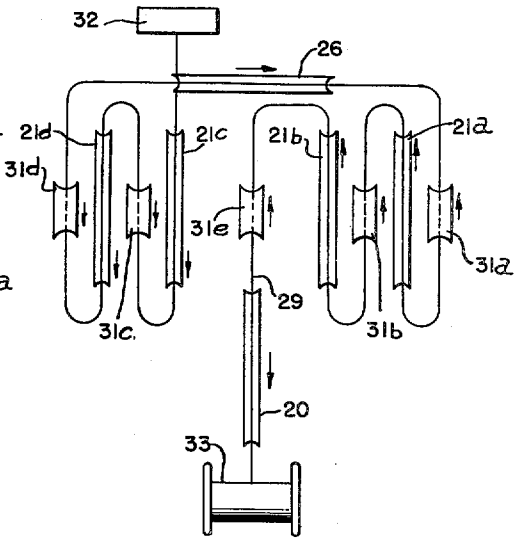


Fig. 5

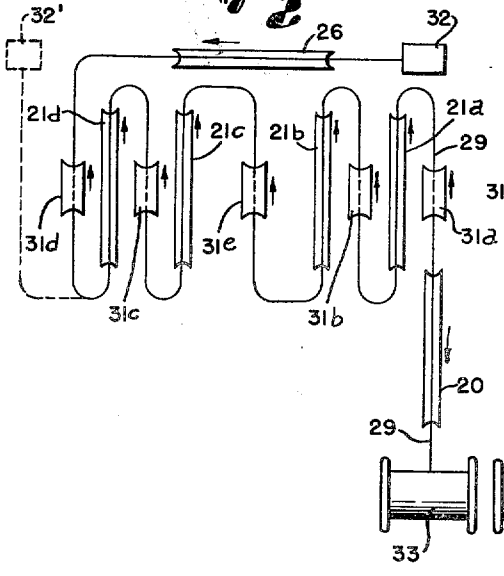
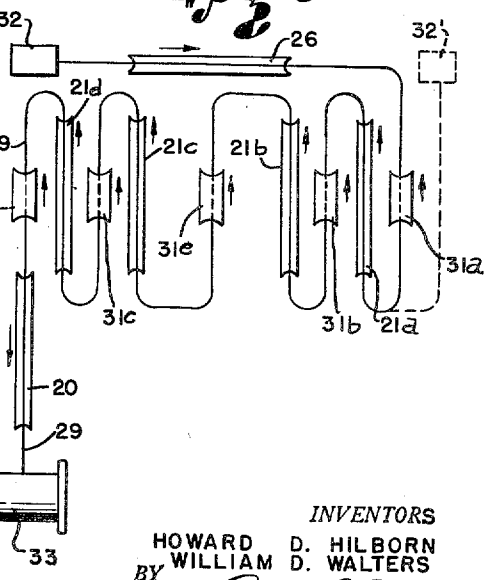


Fig. 6



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CROWN BLOCK

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12 Claims. (Cl. 254—188)

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The present invention relates generally to hoisting apparatus, and is more particularly concerned with crown blocks especially adapted for use in connection with a mast or portable derrick in the drilling of wells, although it is not necessarily limited thereto.

In present day well drilling operations, the trend is toward the handling of greater and greater loads and it is therefore necessary to utilize load handling equipment of increased material strength. For example, larger cables are being utilized and sheaves of greater diameter, which introduce a serious problem from the standpoint of so disposing the load handling equipment that these increased load forces will be property distributed.

More specifically, it becomes extremely important to arrange the distribution of the sheaves constituting the crown block structure at the top of a derrick or mast so that load forces imposed upon associated traveling blocks and forces due to hoisting operations will be more symmetrically applied to the tower or derrick structure.

With the above in view, the present invention seeks to not only provide a crown block structure wherein the sheaves are so mounted that a symmetrical distribution of load forces may be obtained, but the crown block is more readily adapted for assembly and may readily be modified to adapt it for a plurality of varied operations in the field, for example, different modes of reeving the hoisting cable.

It is therefore a primary object of the herein described invention to provide an improved crown block structure of the type wherein the fast-line is brought down to a winding drum outside the derrick areas, as in the case of a mast or portable derrick; which has its sheaves so arranged as to enable leading the dead-line and fast-line portions of the hoisting cable into inner sheaves of the crown block and associated traveling block; which reduces fleet angle and provides better spooling of the hoisting cable, whereby wear on the cable and cable guides may be materially decreased; and in which distribution of the load forces is accomplished in a more symmetrical manner with respect to the derrick structure.

A further object is to provide an improved crown block structure having its sheaves so arranged that increased flexibility in reeving of the cable may be obtained, and the dead-line led out in a plurality of selective directions to permit variations of cable stringing and anchor

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positions to meet the varied requirements of different field personnel and methods of operation.

Still another object is to provide a crown block assembly of simple construction which may be readily adjusted in the field to compensate for derrick settling or other conditions, whereby the traveling block may be kept positioned over the center of the well.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing preferred embodiments of the invention without placing limitations on the scope of the invention defined in the appended claims.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a plan view of a crown block structure embodying the features of the present invention;

Fig. 2 is a fragmentary view of the upper end of an oil well derrick, showing a crown block structure according to the present invention mounted thereon, and its association with the usual traveling block;

Figs. 3 and 4 diagrammatically illustrate alternate modes of stringing a hoisting cable between the crown block and traveling block to secure alternate locations of the dead-line anchor; and

Figs. 5 and 6 respectively diagrammatically illustrate modified arrangements of the off-set sheave and other stringing arrangements in order to locate the dead-line anchors at different desired locations.

As shown on the drawings, Fig. 2, the numeral 10 designates generally the upper part of a typical steel oil well derrick top which may be of conventional construction. This derrick top includes a water table 11 of substantially rectangular construction, being composed of spaced beams 12—12 which are secured in spaced relation by means of lateral or side spacer channels 13 interconnected at their ends to connecting ribs 14' of the beams 12. In this construction, the height of the beams 12 exceeds that of the spacer channels, so that the upper surfaces of the beams may serve as a support for a rigid box base structure 14 of the crown block assembly which will be now described.

The base structure 14 is fabricated from structural members which may be welded or otherwise secured together in conventional manner to form a rigid box construction which may be supported as a unit on top of the water table.

More specifically the base structure includes a pair of spaced base beams 15—15 which are interconnected at their left ends as viewed in Figs. 1 and 2 by means of a pair of spacer beams 16—16 of approximately one-half the height of the base beams 15. The spacer beams provide a support for spaced apart cross beams 17—17 which have their uppermost surfaces lying in the plane of the upper surfaces of the base beams 15—15, and serve as mountings for supporting bearing brackets 18—18 in which the respective ends of a sheave shaft or pin 19 of an off-set sheave 20 are operatively associated.

Intermediate the ends of the beams 15—15, there is rotatably mounted a plurality of sheaves 21*a*, 21*b*, 21*c*, and 21*d*, these sheaves being mounted with their planes of rotation parallel to that of the off-set sheave 20 and having a common axis of rotation with respect to a common sheave shaft or pin 22 having its ends supported in brackets 23—23 secured to the upper surfaces of the edgewise positioned beams 15—15.

It will be observed from Fig. 1 that the sheaves 21*a* and 21*b* are positioned together to form a group adjacent one end of the shaft 22; whereas, sheaves 21*c* and 21*d* are similarly positioned to form a group adjacent the other end of the shaft 22. Thus, adjacent inner sheaves 21*b* and 21*c* are spaced apart a distance slightly greater than the width of the off-set sheave 20 with the plane of rotation of the sheave 20, when extended, passing midway between the sheaves 21*b* and 21*c*. Moreover, it will be noted that diametrically opposed points of the off-set sheave and the sheaves 21*a* to 21*d* inclusive are adjacently disposed. That is, the right side of the groove of the off-set sheave 20 is substantially in alignment with the left side of the grooves of the sheaves 21*a* to 21*d*.

At the other ends of the beams 15—15 there is provided a pair of spaced apart transversely extending channel members 24—24 having their uppermost surfaces lying in the same plane as the upper surfaces of the beams 15—15. These channel members are positioned edgewise and are secured at their ends to the beams 15—15, respectively, and have interconnecting ribs 25—25 forming a part of the end connections.

The channels 24—24 form a support for a cross-over sheave 26 supported with its plane of rotation at right angles to the planes of rotation of the other sheaves of the crown block upon a shaft or sheave pin 27 supported at its respective ends by brackets 28—28 positioned on the channel members 24—24. As thus mounted, the center line of the shaft 27, if extended, passes between the sheaves 21*b* and 21*c* and in the same plane as the central plane of rotation of the off-set sheave 20. It will be observed that the diameter of the cross-over sheave 26 corresponds substantially to the distance between the outer faces of the sheaves 21*a* and 21*d*.

In the arrangement described above, it will be observed that the left end of the base structure 14, as viewed in Figs. 1 and 2, is mounted in overhanging relation to the adjacent side of the derrick so that the shaft or pin 19 of the off-set sheave 20 is positioned substantially directly above the edge of the water table at this side. The support for the cross-over sheave 26 is centrally positioned at the other side of the water table, and the sheaves 21*a*—21*d* are symmetrically arranged at the center of the water table. This gives a symmetrical arrangement so that a

hoisting line 29 may rove over the sheaves of the crown block and through the sheaves of a traveling block 30 with a dead-line end portion 31 disposed or leading off within the derrick and a fast-line portion 32 carried over the off-set sheave and leading off outside the derrick to the winding drum in such a manner that load forces will be more symmetrically and equally distributed to the derrick structure.

The crown block assembly may be removably secured to the water table so as to permit shifting of the crown block structure on the water table to compensate for any settling of the derrick or other condition which might tend to throw the traveling block off center of the derrick.

A further feature of the arrangment of sheaves in the crown block of my invention resides in the fact that with this construction it is possible to mount the sheaves with their axes of rotation lying sustantially in a common plane. The surfaces upon which the supporting brackets for the sheave shafts or pins are in the same plane and constitute the top surface of the base structure 14. This will enable, as will hereinafter be explained, a modified positioning of the off-set sheave from its normal central position between the sheaves 21*b* and 21*c*, so as to readily adapt the crown block structure for different stringing arrangements and for different positions of the anchor for the dead-line portion of the hoisting line. These changes may be accomplished in the field and enable the use of my improved crown block arrangement under a plurality of situations and conditions, due to its flexibility of adaptation.

By having the off-set sheave mounted substantially at the center of its associated side of the water table, the fast-line will be wound on the drum from a central position and hoisting forces will be symmetrically applied to the derrick. Also, cable wear and wear on cable guides will be materially decreased. The utilization of a cross-sheave in the manner disclosed reduces fleet angle and contributes to the efficiency of the operation of the crown block, and likewise is effective in reducing cable wear.

Referring to Figs. 3 and 4 of the drawings, we have illustrated the stringing arrangement of the hoisting line which will usually be utilized with the crown block constituting the present invention. In this diagrammatic illustration, the sheaves of the associated traveling block, in this case, five in number, have been indicated respectively as 31*a*, 31*b*, 31*c*, 31*d*, and 31*e*. The anchor for the dead-line end of the hoisting line or cable is indicated at 32, and the winding drum by the numeral 33.

In both of the arrangements shown in Figs. 3 and 4, the fast-line end portion is led from the winding drum over the off-set sheave 20 and is carried under the middle sheave 31*e* of the traveling block. Depending upon whether the anchor point is desired to be disposed on the right side as shown in Fig. 3, or on the left side as shown in Fig. 4, the hoist line will be brought up to the sheave 21*c* or 21*b*, accordingly. As shown in Fig. 3, the hoisting line is carried over the sheave 21*c*, under 31*c*, over 21*d*, under 31*d*, and thence over the cross-over sheave 26, under sheave 31*a*, over sheave 21*a*, under sheave 31*b*, and thence over the sheave 21*b*, whence it is led off to the anchor 32. A similar arrangement is followed in Fig. 4, except that the winding is reversed and the dead-end line led off from the sheave 21*c* to the anchor 32.

In both arrangements just described, it will be seen that the fast-line and dead-end line portions are brought into innermost sheaves of the traveling block and crown block, thus reducing to a minimum the forces which act to cause a relative twisting of the crown and traveling blocks as experienced in the usual method of stringing of the hoisting line. Moreover, the sheaves of the crown block and traveling block are separated into symmetrical groups on either side of the central sheave of the traveling block and the off-set block **20**, the sheaves of these groups being rotatable in the same direction in the crown block and traveling block, but in opposite directions with respect to the side upon which they are disposed. More specifically, the sheaves **21***a*, **31***a*, **31***b*, and **21***b* rotate in one direction; whereas, sheaves **21***c*, **31***c*, **21***d* and **31***d* rotate in an opposite direction.

Modified stringing arrangements of the hoisting line may be employed as shown in Figs. 5 and 6 in order to bring out the dead-line to different anchor positions, as indicated at **32** and **32'**. In this arrangement, a slight modification in the mounting of the off-set sheave is employed. Instead of having it mounted centrally between the sheaves **21***b* and **21***c*, the off-set sheave is in this instance moved so as to be adjacent the sheave **21***a* or **21***d*, depending upon whether it is desired to string the hoisting line from right to left as shown in Fig. 5, or from left to right as shown in Fig. 6.

In either case, the fast-line leads from the winding drum **33** over the off-set sheave **20** from whence it is carried under an outermost sheave of the traveling block and thence over and under the crown sheaves and traveling block sheaves successively, and is then carried from the traveling block sheave at the opposite end up over the cross-over sheave **26** to the anchor **32**. It will be observed that in utilizing this stringing arrangement, the same crown block sheaves and traveling block are utilized as in the case of the Fig. 3 or Fig. 4 arrangement.

Where it may be desired to have an anchor as indicated at **32'**, the last sheave of the traveling block and the cross-over sheave **26** may be omitted and the dead-line carried directly from the last crown block sheave, namely, the sheave **21***d* in Fig. 5, or **21***a* in Fig. 6. While it has for purposes of illustration been indicated that the end sheave may be omitted in this case, it will be apparent that any one of the sheaves may be omitted, as long as four sheaves are utilized in the traveling block. Thus, if the middle sheave **31***e* is omitted, it will give a symmetrical arrangement. Likewise, this arrangement will enable use of the crown block as described herein with a traveling block having four sheaves, in the event that a four-sheave block is the only one which is available in the field.

From the foregoing, it will be readily appreciated that the crown block of our invention is exceedingly flexible and readily adapted to various stringing arrangements and different locations which may be desired for the dead-line end anchor.

We claim as our invention:

1. A crown block assembly comprising a plurality of sheaves supported for rotation in parallel planes and formed into two spaced apart groups, an off-set sheave supported on one side of said first sheaves in such position that its extended plane of rotation will pass between said groups, and a cross-over sheave supported on the opposite side of said first sheaves in such position that its extended axis of rotation will pass between said groups.

2. A crown block assembly comprising a plurality of sheaves supported for rotation in parallel planes and formed into two spaced apart groups, each of which contains the same number of sheaves, an off-set sheave supported on one side of said first sheaves in such position that its extended plane of rotation will pass between said groups, and a cross-over sheave supported on the opposite side of said first sheaves in such position that its extended axis of rotation will pass between said groups.

3. A crown block comprising a group of sheaves mounted for rotation in uniformly spaced parallel planes, one of said sheaves between the end sheaves of said group being laterally off-set to bring a diametric side thereof into adjacent relation with the corresponding diametrically opposite sides of the other sheaves, and cross-over sheave means supported on the side of said group of sheaves opposite from said sheave which is offset.

4. A crown block structure comprising a plurality of first sheaves supported in face to face relation, two of said sheaves being spaced apart a distance greater than the spacing between the remaining sheaves, an off-set sheave adjacent said first sheaves supported to have a plane of rotation parallel to said first sheaves and aligned with the space between said spaced apart sheaves, and cross-over sheave means supported with its plane of rotation at right angles to that of the other sheaves.

5. A crown block structure as defined in claim 4, characterized by said off-set sheave and cross-over sheave being disposed on opposite sides of said common axis.

6. A crown block structure comprising a group of first sheaves supported for rotation about a common axis, an off-set sheave supported with its plane of rotation parallel to said first sheaves and between the ends of said group, and a cross-over sheave supported with its plane of rotation at right angles to that of the other sheaves, said off-set sheave having a plane of rotation and said cross-over sheave an axis of rotation lying substantially in a common plane.

7. In combination, a traveling block having a set of sheaves supported with their planes of rotation parallel; a crown block comprising a set of sheaves supported with their planes of rotation parallel, an off-set sheave and a cross-over sheave having their planes of rotation disposed at right angles; and a hoisting line rove over the sheaves of said blocks, said line having one end leading off over said off-set sheave and another end leading off over an inner sheave of said set of sheaves in the crown block.

8. In combination, a traveling block having a set of sheaves supported with their planes of rotation parallel; a crown block comprising a set of sheaves supported with their planes of rotation parallel, an off-set sheave and a cross-over sheave having their planes of rotation disposed at right angles; and a hoisting line rove over the sheaves of said blocks, said line having a running end leading off from an inner sheave of the traveling block over said off-set sheave, and an anchored end leading off over an inner sheave of said set of sheaves in the crown block.

9. A crown block assembly comprising a plurality of sheaves supported for rotation in side by side relation and formed into two spaced apart

groups, an off-set sheave supported on one side of said first sheaves in such position that its extended plane of rotation will pass between said groups, and a cross-over sheave supported on the opposite side of said first sheaves in such position that its plane of rotation will be in crossing relation to the planes of rotation of said first sheaves.

10. A crown block assembly comprising a plurality of sheaves supported for rotation in side by side relation and formed into two groups, an off-set sheave supported on one side of said first sheaves in such position that its extended plane of rotation will pass between said groups, and cross-over sheave means disposed along a side of said first sheaves in crossing relation to the planes of rotation of said first sheaves.

11. A crown block assembly comprising a plurality of sheaves supported for rotation in side by side relation and formed into two groups, an off-set sheave supported on one side of said first sheaves in such position that one side of its periphery will be disposed close to the plane of division between said groups, and cross-over sheave means disposed along a side of said first sheaves in crossing relation to the planes of rotation of said first sheaves.

12. In combination, a traveling block having sheaves supported with their planes of rotation parallel; a crown block comprising set of sheaves supported in face to face relation, an off-set sheave on one side of said set and cross-over sheave means on the other side of said set; and a hoisting line rove over the sheaves of said blocks, said line having one end leading off over said off-set sheave and the other end leading off over an inner sheave of said set of sheaves.

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