Oct. 4, 1966 W. M. MARKS ETAL 3,276,749

MULTISHEAVE BLOCKS

Filed Oct. 7, 1964 3 Sheets-Sheet 1

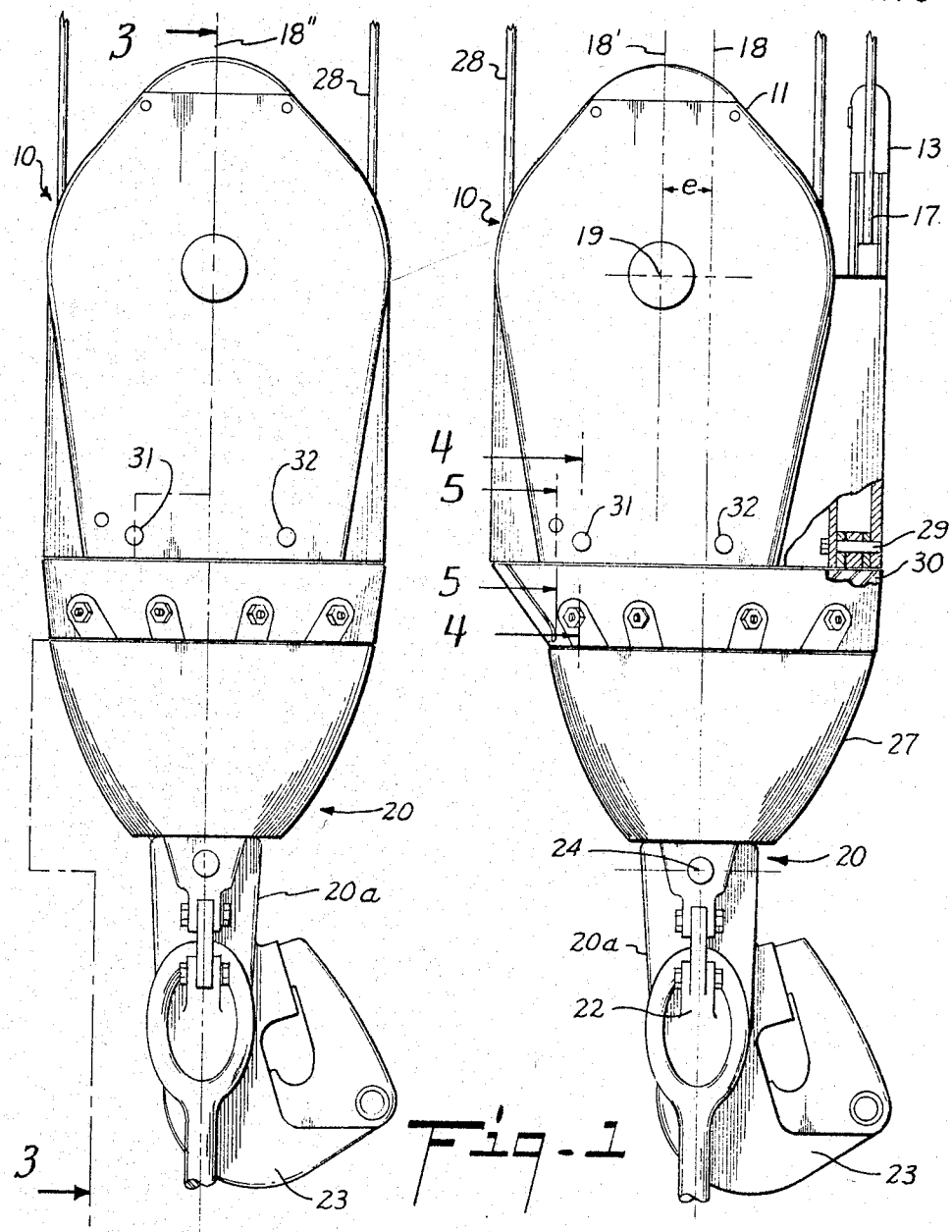


Fig-1

Fig-2

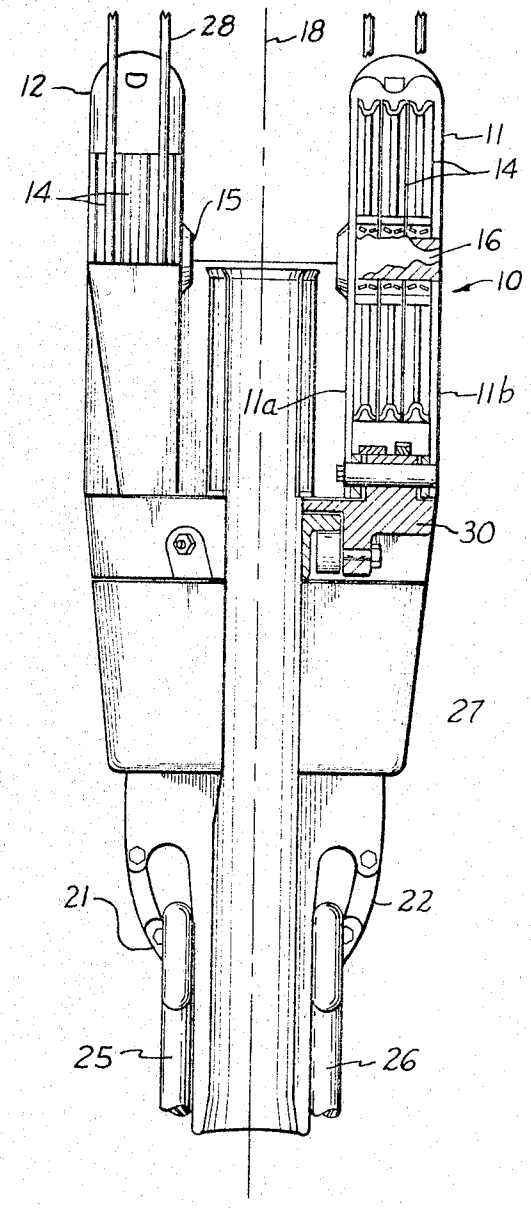
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MULTISHEAVE BLOCKS

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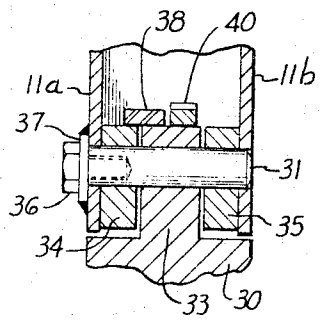


Fig-4

Fig-3

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3 Sheets-Sheet 3

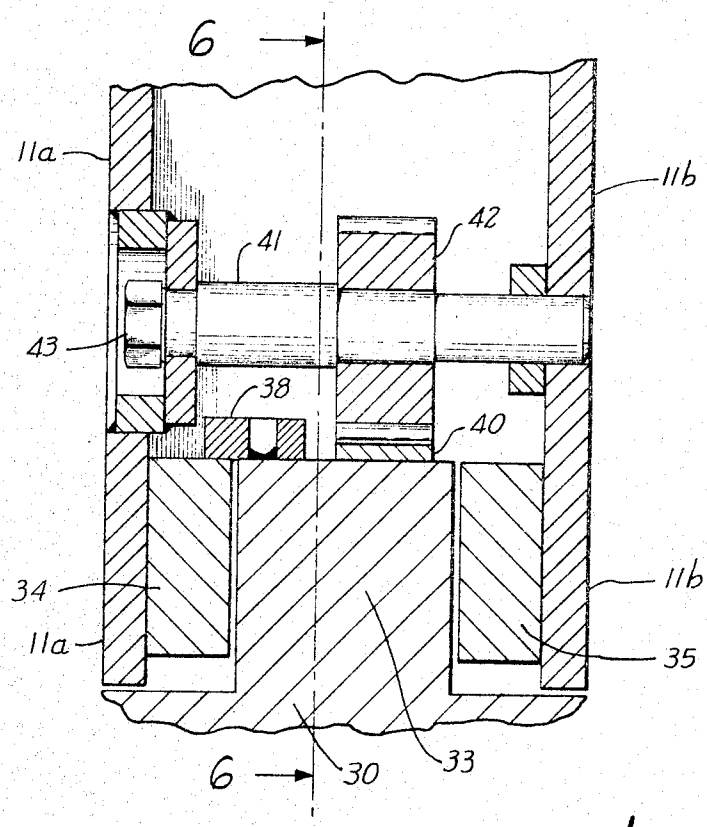


Fig. 5

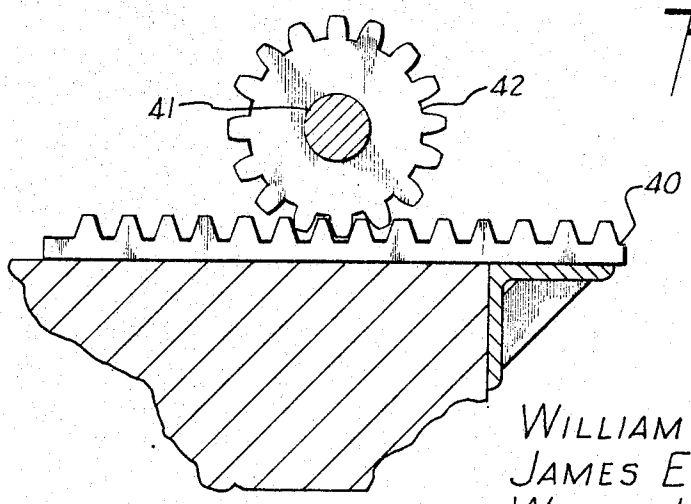


Fig. 6

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MULTISHEAVE BLOCKS

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This invention relates to a multisheave block generally, and, in particular, to multisheave traveling blocks where a change in the number of sheaves in use can affect the centerline of support of the block.

This invention has utility in any application where a multisheave block is used to move a load and it is desirable to keep the centerline of support of the block in line with the center of gravity of the load it is supporting. This invention has particular utility, however, in the drilling industry where during the total weight of pipe, to be handled by the hoisting equipment of the drilling rig, increases as the well gets deeper. It is common practice in the drilling industry not to change traveling blocks as the pipe weight increases, but to use a multisheave traveling block and crown block and to string more lines between these two members as the load increases. Thus at the beginning of drilling operations, there usually will be some sheaves in both the crown block and traveling block which will not be in service. With many traveling blocks it is possible to maintain the centerline of support of the block in alignment with the center of gravity of the load it is carrying, by properly selecting the sheaves to be reeved. However, there are occasions where it is not possible to do this.

Therefore, it is an object of this invention to provide a traveling block having a laterally adjustable centerline of support.

It is another object of this invention to provide a traveling block when can adjust its centerline of support laterally when required by a change in the number of its sheaves in service.

It is another object of this invention to provide a multisheave traveling block and hook assembly having a detachable sheave, which is not mounted for rotation on the same horizontal axis as the other sheaves, with the centerline of the block being movable laterally to adjust the centerline of support of the block as required by the removal of the detachable sheave.

It is another object of this invention to provide a multisheave traveling block for supporting a hook with the centerline of support of the block being movable laterally to maintain it in line with the centerline of the load carried by the hook as the number of sheaves supporting the hook is changed.

These and other objects, advantages, and features of the invention will be apparent to one skilled in the art from a consideration of this specification, appended claims, and attached drawings.

To obtain these objectives, in accordance with this invention, at least a portion of the sheaves of the traveling block are mounted for lateral movement relative to the center of gravity of the load they are carrying. Thus, when the number of sheaves in service is increased or decreased, at least a portion of these sheaves can be adjusted laterally, as required, to maintain the centerline of support of the block in the desired position relative to whatever load the block is supporting.

The invention will now be described, in detail, in connection with the embodiment of the invention shown in the attached drawings in which,

FIGURE 1 is a side view of a traveling block and hook assembly, the block, being of the type commonly referred to as a "split" block, having a detachable sheave, which is located in a plane transverse the plane of the rest of the sheaves making up the block;

FIGURE 2 is a side view of the traveling block and hook assembly of FIGURE 1 with the detachable sheave removed and the other sheaves shifted laterally to maintain the centerline of support of the block in line with the downward load imposed on the block by the hook assembly so that no turning moment or other undesirable stresses will be imposed by either member on the connection between the two;

FIGURE 3 is a front view of the hook assembly of FIGURE 2, illustrating the arrangement of the sheaves in the two spaced sheave cases which form opposite sides of the vertical opening extending through the block and also illustrating the method used in this embodiment for attaching the sheaves to the support base of the block for lateral movement relative to the support base;

FIGURE 4 is a sectional view taken along line 4—4 of FIGURE 1 showing the connection between one of the sheave cases and the support base of the block to better illustrate the connection therebetween;

FIGURE 5 is a view taken along line 5—5 of FIGURE 1 illustrating the means employed in this embodiment of the invention to move a portion of the sheaves of the block laterally relative to the support base to shift the centerline of support of the block relative to the base when these sheaves are in service; and

FIGURE 6 is a view taken along lines 6—6 of FIGURE 5 showing a side view of the shifting means employed in this embodiment of this invention.

Split blocks of the type shown in the attached drawings accentuate the problem of a shifting centerline of support because of their unique arrangement of the sheaves. In these blocks the sheaves are mounted for rotation around two separate horizontal axes. With this arrangement, when some or all of the sheaves rotating around one axis are taken out of service, the lateral shift in the centerline of support of the block is considerable.

Thus, in the split type block shown in the drawings, which is generally indicated by the number **10**, three sheave cases **11**, **12** and **13** are arranged with sleeve cases **11** and **12** in spaced, parallel, relationship and sheave case **13** located adjacent the ends of the other two and extending transversely between them. Each sheave case may contain any number of sheaves. In the embodiment shown, sheave cases **11** and **12** are provided with three sheaves each, the sheaves being generally indicated by the number **14**, whereas case **13** contains only sheave **17** to provide a total of seven sheaves for the traveling block.

The sheaves **14** are mounted for rotation on shafts **15** and **16** whose longitudinal axes are in alignment so that the sheaves **14** all rotate around the same horizontal axis, which is generally indicated by the number **19**. Sheave **17**, however, in sheave case **13** is mounted to rotate around a horizontal axis, which, in the embodiment shown, intersects the axis of the rotation of the other sheaves but is perpendicular thereto. Thus, when the detachable sheave case **13** is attached to the block and all the sheaves are strung in the manner shown in FIGURE 1, the centerline of support of the block, generally indicated by the number **18**, is located between sheave case **13** and horizontal axis **19** of the sheaves **14** and equidistant between sheave cases **11** and **12**.

As explained above, it is desirable, for the centerline of support of the block to be in line with the load which is imposed on the block. In the embodiment shown, traveling block **10** has attached thereto a spring hook assembly generally indicated by the number **20**.

In the hook assembly shown, the hook portion **20***a* is pivotally attached to spring housing **27** to pivot around horizontal axis **24**. This allows the elevator link support-

ing ears 21 and 22 to be laterally offset from the swivel bail supporting portion 23 yet each, when loaded will rotate the hook section 20*a* around axis 24 until the center of gravity of the load is in vertical alignment with axis 24.

For example, as shown in FIGURES 1 and 2 elevator links 25 and 26 are in vertical alignment with axis 24 and with the vertical axis of the spring housing 27 of the hook aseembly. When the swivel bail (not shown) is picked up by the swivel bail supporting section 23, then the hook will pivot around horizontal axis 24 until the swivel bail is supported in line with the vertical axis of the hook assembly. Thus, whether the load is imposed upon the hook by elevator links 25 and 26 or by a swivel bail, the resultant line of force of the load will be the same. If this line of force coincides with the centerline of support 18 of block 10 no unbalanced forces will be imposed on the hook and block assembly or on any of the portions of drilling lines 28 which extend from the crown block (not shown) to the sheaves on the traveling block. If they do not coincide a turning moment will be imposed on the block and hook assembly.

For a complete description of this hook assembly, see co-pending patent application entitled "Hook Assembly" which was filed on October 7, 1964, and given Serial Number 402,070.

Early in the drilling operations of a well it is not usually necessary or desirable to have all of the sheaves of the traveling and crown block in operation. For example, in the initial stages of drilling operations with a block of the type shown in the drawings only eight lines or four sheaves may be necessary to support the load imposed on the block. It is, of course, desirable to keep the number of lines strung between the crown block and the traveling block to a minimum for as the number of lines increases, the speed of the traveling block for a given hoisting rate decreases, and speed of movement of the traveling block is very important when moving pipe in and out of the hole.

Therefore, assume in the initial stages of drilling operations two sheaves in each of sheave cases 11 and 12 are in service. The sheaves to use can easily be chosen to maintain centerline of support 18, equidistant between sheave cases 11 and 12. For example, as shown in FIGURE 3, with the out-board and in-board sheaves of each sheave case in service, centerline of support 18 of the block is located equidistant between sheave cases 11 and 12. The centerline of support, however, will not remain located between horizontal axis 19 and sheave case 13, as was the case in FIGURE 1 when all sheaves were in operation, but will shift to intersect axis 19 around which all of the sheaves in operation are rotating. Thus, with the block assembled as shown in FIGURE 1, but with only four sheaves in service, the new centerline of support of the block 18′ is out of alignment with the resultant line of force of the load, a distance "e." This eccentricity "e" would cause the block and hook assembly to tend to rotate to compensate for it and result in unbalanced loading on various members of the assembly.

Therefore, in accordance with this invention, means are provided for moving the sheaves of the block laterally with respect to the load imposed on the block to shift the centerline of support of the block into vertical alignment with the load. In the embodiment shown, sheave cases 11 and 12 are attached to support base 30, by means of removable pins which extend laterally through the sheave cases and openings in the support base. The support base holds the sheave cases in spaced relationship, and also connects the sheave cases to hook assembly 27. Only pins 31 and 32, which are employed to attach sheave case 11 to base 30 and pin 29 which attaches sheave case 13 to base 30, are shown in the drawings. Two pins per sheave case are used in the embodiment shown and each connection is generally the same, therefore, only one will be described in detail.

The details of the connection between sheave case 11 and support base 30 is shown in FIGURE 4 where a vertical section through pin 31 is shown. Thus, sheave case 11 is provided with two vertical side plates 11*a* and 11*b* between which the sheaves are rotatably mounted. Support base 30 is provided with upwardly extending flange 33 which is located between the side plates. Spacers 34 and 35 are positioned between the side plates and flange 33 and all of the components making up the connection, side plates, spacers and upwardly extending flange, are provided with openings which can be positioned in alignment to receive pin 31 in the manner shown in the drawings. Pin 31 is held in position in the opening by cap screw 36 which engages a tapped hole in the end of pin 31 and holds the pin against washer 37, which is attached, as by welding, to the outside surface of side plate 11*a*.

In accordance with the invention, means are provided to mount the sheaves so that their position relative to support base 30 can be changed. In the embodiment shown, spacer 34 is attached to the inside surface of plate 11*a* and has laterally extending bearing member 38 attached thereto. The bearing member is positioned to engage the upper surface of flange 33 and slidably support the sheave case on the flange. Thus, by providing a plurality of appropriately spaced openings in flange 33, sheave case 11 can be moved laterally to a variety of positions relative to the support base.

In the embodiment shown, two pins such as pin 31 are employed to attach each sheave case to support member 30. Therefore, only four holes in each flange 33 are necessary to shift sheave case 11 and 12 into position to maintain the centerline of support of the block in vertical alignment with the load imposed thereon. In other words, with the block shown in the drawings, it is contemplated that the centerline of support 18 of the block will be either along line 18 as when sheave 17 is in service, or along line 18′ when sheave 17 is not in service. Therefore, only two positions for sheave cases 11 and 12 are required: the one shown in FIGURE 1 and the one shown in FIGURE 2 when sheaves 14 have been moved laterally relative to the load (hook assembly 20 in this case) until its centerline of support 18′ is in line with the centerline of the load along line 18″.

Means are also provided for moving at least a portion of the sheaves of the block in service laterally relative to the load the block is supporting to maintain the centerline of support of the block in line with the center of gravity of the load as required by changes in the sheaves in service. In the embodiment illustrated, it is desirable to shift both sheave cases 11 and 12 and in this embodiment each sheave case is provided with its own shifting means. They are both the same, therefore, only the one employed to shift sheave case 11 is shown and will be described in detail.

As shown in FIGURES 5 and 6, rack 40 is attached to the top of upwardly extending flange 33 on support base 30. The rack should be long enough to provide adequate movement to the sheave case. Rotatably mounted in side plates 11*a* and 11*b* of sheave case 11 and extending laterally across rack 40 is pinion shaft 41 which supports pinion 42 in engagement with rack 40. Pinion 42 is keyed or otherwise connected to pinion shaft 41 so rotation of the shaft will rotate the pinion. The shaft is provided with hexagonal head portion 43 to receive a wrench socket (not shown) to rotate the shaft and the pinion in the desired direction to move sheave case 11 relative to support base 30.

For example, assume that the well has reached a point where it is necessary to employ all the sheaves of the block, or, possibly, it is time to run a casing string which has considerable weight. Therefore, sheave case 13 with extra sheave 17 is to be added to the assembly. In the embodiment illustrated, this is accomplished, while maintaining the center of support of the block in vertical alignment with the hook assembly, as follows: Pins 31 and 32 are removed from the holes in which they are located in

flange 33. A wrench is then attached to hexagonal head 43 and pinion shaft 41 and pinion 42 is rotated in the proper direction to move pinion 41 along rack 40 and, consequently, move sheave case 11, laterally, relative to support base 30 until the other set of openings provided in flange 33 are in alignment with the pin openings in the side plates 11*a* and 11*b* of the sheave case. The pins are then reassembled through flange 33. This same procedure is followed in connection with sheave case 12 and the block is ready to receive sheave case 13. The centerline of support 18 of the block is now between the horizontal axis of rotation of the sheaves of sheave cases 11 and 12, and sheave case 13 and in line with the line of force imposed on the block by hook assembly 20, in the manner shown in FIGURE 1.

When moving the sheave cases back and forth, and removing and adding sheaves etc., the sheave guards will need to be rearranged somewhat to maintain the proper appearance for the block and also to maintain a smooth outer surface so the block will not tend to snag something as it moves up and down in the derrick. Typical guard arrangements for this type block are shown in the drawings.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus and structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A traveling block provided with a plurality of sheaves divided into two groups with each group of sheaves mounted for rotation around two different horizontal axes, the block having a first centerline of support when all of the sheaves are in service and a second centerline of support when only the sheaves in one group are in service; means for connecting the block to a load; and means for moving the group of sheaves in service laterally relative to the connecting means to maintain the second centerline of support in alignment with the load.

2. A traveling block having a plurality of sheaves arranged in groups to rotate around at least two different horizontal axes; the block having a first centerline of support when all of the sheaves are in service and at least one other centerline of support when less than all of the sheaves are in service; means for connecting the sheaves in service to a load; and means for moving laterally a portion of the sheaves in service to maintain the centerline of support of the block in alignment with the center of gravity of a load as required by changes in the number of sheaves in service.

3. A multisheave traveling block, for supporting a hook assembly, having a group of sheaves mounted for rotation around a horizontal axis and a transverse sheave located on one side of the group of sheaves and mounted for rotation around another horizontal axis, thereby providing the block with a laterally shifted centerline of support when the transverse sheave is not in service; and means for moving the first mentioned group of sheaves laterally toward the location of the transverse sheave when it is not in service to maintain the same centerline of support between the block and a hook it supports, when the transverse sheave is not in service.

4. The traveling block of claim 3 in which the transverse sheave is removably attached to the block to allow it to be removed when not in service.

5. A split traveling block comprising at least two parallel sheaves spaced apart sufficiently to provide a vertically extending opening through the block through which pipe can extend as the block moves vertically relative to the pipe, and a third sheave positioned transverse to the two parallel sheaves at one side of the opening through the block; the block having a first centerline of support when only the two parallel sheaves are in service and a second centerline of support laterally shifted from the first when all of the sheaves are in service; and means for positioning the two parallel sheaves laterally to adjust the first centerline of support of the block laterally into alignment with the second centerline of support when the third sheave is not in service.

6. The traveling block of claim 5 in which the third sheave is removably attached to the block to allow it to be removed when not in service.

7. A traveling block having a plurality of sheaves divided into three groups of at least one sheave each, the sheaves of two groups being mounted to rotate on the same horizontal axis with the two groups in spaced, parallel relationship to provide a vertically extending slot through the block through which pipe can extend as the block moves vertically relative to the pipe; the third group of sheaves being positioned transverse the opening on one side thereof and mounted to rotate on an axis perpendicular to the axis of rotation of the other two groups to provide the block with a first centerline of support when all of the sheaves are in service and a second centerline of support laterally spaced from the first when the sheaves in the third group are not in service; a support base for connecting the sheaves to a load; and means for moving the two parallel groups of sheaves laterally toward the position of the third group when the sheaves in the third group are not in service to shift the second centerline of support into alignment with the first centerline of support, and to shift the two parallel groups of sheaves laterally away from the position of the third group when the sheaves in the third group are in service.

8. The traveling block of claim 7 further provided with two parallel racks mounted on the support base, one adjacent each of the groups of sheaves in parallel relationship and a pinion rotatably supported by each of said groups, each pinion being in engagement with one of the racks for moving the groups of sheaves by rotation of the pinions.

References Cited by the Examiner

UNITED STATES PATENTS

3,179,376 4/1965 Botten ---------- 254—188

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