This invention relates generally to cranes and refers more particularly to improvements in double hook cranes. In the manufacture of double hook cranes, it has been the practice to provide a separate hoisting mechanism for each hook and in many instances the primary purpose of the second hoisting mechanism is to enable varying the elevation of one hook relative to the other to permit lifting a relatively long work object suspended from the hooks. For example, in the manufacture of products such as lengths of tubing or pipes, it is frequently necessary to dip the product into a treating bath, and it is desirable to tilt the product sufficient to lifting the same out of the bath so that any liquid retained by the product may drain back into the bath before the product is conveyed from the bath. In such instances, two hoisting mechanisms are not actually required to lift the load but are merely provided to enable tilting the product for the purpose stated above.

In installations of the above type, the cost of the second hoisting mechanism along with the necessary controls is substantial and moreover operation of both hoists is complicated due to the necessity of manipulating two sets of controls. With this in view, it is an object of this invention to provide a double hook crane having provision for moving one hook relative to the other to tilt the work object suspended from the hooks by using a single hoisting mechanism which not only simplifies and reduces the cost of the crane structure but, in addition, facilitates handling of the work by the crane. Moreover, elimination of one of the hoisting mechanisms materially reduces the overall weight of the crane and is of prime importance especially when it is considered that the crane is supported by the building structure at a substantial distance above the floor.

The foregoing, as well as other objects, will be made more apparent as this description proceeds especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a side elevational view partly in section of a part of a crane structure embodying the features of this invention;

Figure 2 is a semi-diagrammatic plan view of the structure shown in Figure 1;

Figure 3 is a view similar to Figure 1 of the opposite side of the crane and having certain parts broken away for the sake of clearness;

Figure 4 is a sectional view of the speed reducer;

Figure 5 is a sectional view taken on the line 5—5 on Figure 2; and

Figure 6 is a sectional view taken on the line 6—6 of Figure 3.

The crane structure selected herein for the purpose of illustration comprises a trolley 10, a track 11 for the trolley, and hoisting mechanism 12. The trolley 10 has a supporting frame 13 comprising end members 14 and cross members 15 secured at the opposite ends thereof to the members 14 in lateral spaced relationship. Suitably mounted on the trolley frame 13 at opposite ends thereof are wheels 16 arranged to engage the track 11. The track 11 comprises laterally spaced rails 17 I-shaped in cross section and secured to suitable supporting framework 18 in positions to be respectively engaged by the wheels at opposite ends of the trolley 10. If desired, one or more of the wheels on the trolley 10 may be driven by power means mounted on the trolley and not shown herein.

The hoisting mechanism 12 has a pair of axially aligned drums 19 and 20 secured to a drive shaft 21 in spaced relationship axially of the drive shaft. The shaft 21 extends lengthwise of the trolley 10 and is journaled in bearings 22 which are suitably secured to the trolley frame 13 at opposite ends of the drums. One end of the shaft 21 is connected to the driving shaft of an electric motor 23 by suitable reduction gearing 24 which along with the motor 23 is mounted on the trolley 10 for movement as a unit with the latter. A magnetic brake device 25 is also mounted on the trolley 10 and is connected to the electric motor 23 in a manner to control operation of the hoisting drums in accordance with conventional practice. The specific driving connection between the electric motor 23 and the shaft 21 forms part of the present invention and therefore is not disclosed in detail herein. It will suffice to point out that both hoisting drums on the trolley 20 are driven by a single electric motor 23.

Mounted on the trolley frame 13 is an endless chain 26 which extends substantially parallel to the drive shaft 21 between the hoisting drums and which extends around suitable sprockets 27 and 28. The sprocket 27 is mounted on a shaft 29 for rotation about an axis extending perpendicular to the axis of the shaft 21 and the sprocket 28 is secured to a power output shaft 30 of a speed reducer 31. The shaft 30 extends parallel to the shaft 29 and is driven through the speed reducer 31 by an electric motor 32. As shown in Figure 4 of the drawings, the speed reducer 31 comprises a worm 33 secured to the drive shaft 34 of the motor 32 and a worm wheel 35 secured to the shaft 30. The motor 32 is of a reversible type and thereby enables driving the chain 26 in opposite directions.

A flexible linear member or cable 36 has its mid portion connected to the bottom run of the chain 26 between the sprockets by a clamp 38. The cable 36 is illustrated as a single continuous member and consists of the portions or elements 37 and 37' extending from opposite sides of the clamp. It is apparent that the cable elements 37 and 37' might also be separate members having their adjacent ends connected to the clamp 38. The cable element 37 extends from the clamp 38 over a guide pulley 39 and projects downwardly from the guide pulley 39 around the underside of a sheave 40. From the sheave 40 the cable element 37 is extended upwardly and is received or wound around the hoisting drum 19. The cable element 37' extends from the clamp 38 over a guide pulley 41 and projects downwardly from the guide pulley 41 around the underside of a sheave 42. From the sheave 42 the cable element 37' is extended upwardly and is wound around the hoisting drum 20.

Respectively swivel mounted on the sheaves 40 and 42 is a pair of hooks 43. As shown in Figure 1 of the drawings the hooks 43 may be respectively connected to the opposite end portions of an elongated length of work such for example as a pipe or a tube 44. Under normal conditions of operation the hooks 43 are supported at the same or substantially the same elevation so that the pipe or the tube 44 assumes a horizontal position beneath the trolley 10. The tube or pipe 44 may be raised or lowered while suspended from the trolley 10 in a substantially horizontal position by manipulating the hoist-
mechanism 12 in accordance with the usual practice. However, should it be desirable to elevate one hook relative to the other, or in other words, to tilt the tube or pipe suspended from the hooks, the operator starts the electric motor 32 to effect movement of the chain 26. The direction of rotation of the motor 32 determines which of the hooks 43 is raised relative to the other hook. In this connection, attention is again directed to Figure 1 of the drawings wherein it will be noted that a switch 45 is supported below one end of the trolley 10 in a convenient position for manipulation by the operator. The switch 45 has two control buttons which respectively start the electric motor 32 and reverse the direction of rotation of said motor. A similar switch 46 is located at the opposite end of the trolley 10 so that the electric motor 32 may be conveniently controlled from either side of the path of travel of the trolley 10.

A pair of limit switches 47 and 48 are secured to the trolley frame 13 adjacent the bottom run of the chain 26 for operation with engagement of the clamp 38. The purpose of the limit switches 47 and 48 is to automatically stop the electric motor 32 before the clamp 38 engages either of the sprockets 27 and 28.

The control system is such that closing of the circuit to the motor 32 causes the chain 26 to travel in one direction around the sprockets 27 and 28. As the clamp 38 is advanced in the aforesaid direction by the chain 26, the cable elements are operated to raise one hook 43 and to lower the other hook so that the pipe or tube suspended from the hooks is tilted. However, the extent of travel of the chain 26 is definitely limited by engagement of the clamp 38 with one of the limit switches which is positioned on the trolley 10 to stop the motor 32 at the required point. The tube or pipe 44 may be restored to its original position by reversing the direction of rotation of the motor 32 with the result that the clamp 38 on the bottom run of the chain 26 is moved in a direction opposite the direction aforesaid. The extent of return travel of the clamp 38 is determined by the position of the second limit switch on the trolley 10 which when engaged by the clamp 38 again stops the electric motor 32. It is apparent from the foregoing that the elevation of the hooks may be very accurately controlled by predetermining the location of the limit switches with respect to each other on the trolley 10. If desired, one of the limit switches may be positiond to assure stopping the electric motor 32 when the hooks 43 are at the same or substantially the same elevation.

What I claim as my invention is:
1. A crane comprising supporting structure, a pair of drums rotatably mounted on the supporting structure in spaced relation to each other, a hoisting mechanism operatively connected to the drums for rotating the latter, a pair of sheaves respectively positioned below the drums, flexible linear elements respectively reeved around the drums and having portions extending downwardly from the drums beneath the respective sheaves, a member connected to the linear elements between the sheaves and mounted on the supporting structure for movement in opposite directions toward and away from the sheaves to change the elevation of one sheave relative to the other, power means carried by the supporting structure and operatively connected to the member for moving the latter in opposite directions, and means respectively supported by the sheaves and attachable to an elongated object at points spaced from each other lengthwise of the object.
2. The structure defined in claim 1 wherein the pair of drums are secured to a drive shaft in spaced relation to each other axially of said shaft and wherein the hoisting mechanism comprises an electric motor operatively connected to the shaft for driving the latter.
3. The structure defined in claim 2 wherein the member is movable in opposite directions lengthwise of the drive shaft and wherein said power means comprises a reversible electric motor operable independently of the hoisting mechanism for moving the member in opposite directions.
4. The structure defined in claim 3 having means responsive to movement of the member in opposite directions to stop the reversible electric motor, and selectively operable means for starting the reversible electric motor and reversing the direction of rotation thereof.
5. A crane comprising supporting structure, a pair of drums rotatably mounted on the supporting structure in spaced relation to each other, a single hoisting mechanism connected to both drums for rotating the latter, first and second sheaves respectively positioned below the drums, flexible linear means having portions respectively reeved around the drums and having portions extending around the undersides of the sheaves in supporting engagement therewith, a pair of spaced wheels movably supported on said supporting structure and having a flexible endless linear member extending around said wheels, power operated means operatively connected to one of said wheels to drive said member in opposite directions, means connecting one side of said member to the flexible linear means between said sheaves whereby movement of said member in one direction raises the first sheave relative to the second sheave and movement of said member in the opposite direction lowers the first sheave relative to the second sheave, and work supporting means respectively carried by the sheaves.
6. The structure defined in claim 5 wherein the hoisting drums are secured to a common drive shaft in spaced relation to each other axially of the shaft, and wherein said member extends in the general direction of length of the shaft.
7. The structure defined in claim 5 wherein said power operated means comprises a reversible electric motor, selectively operable means for reversing said motor, and means responsive to movement of said member for stopping said motor prior to engagement of the connecting means with either of said wheels.
8. A crane comprising supporting structure, a pair of drums rotatably mounted on said supporting structure in spaced relation to each other, a hoisting mechanism operatively connected to said drums for rotating the latter, a pair of sheaves respectively positioned below said drums, flexible linear elements respectively reeved around said drums and extending downwardly from said drums to the other side of the latter, a member connected to the portions of said linear elements which extend from said sheaves at the said other side thereof, said member being movable in opposite directions relative to said sheaves to change the elevation of one sheave relative to the other, power means operable independently of said member for moving said member in opposite directions, and work supporting means respectively carried by said sheaves.

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