

April 5, 1966

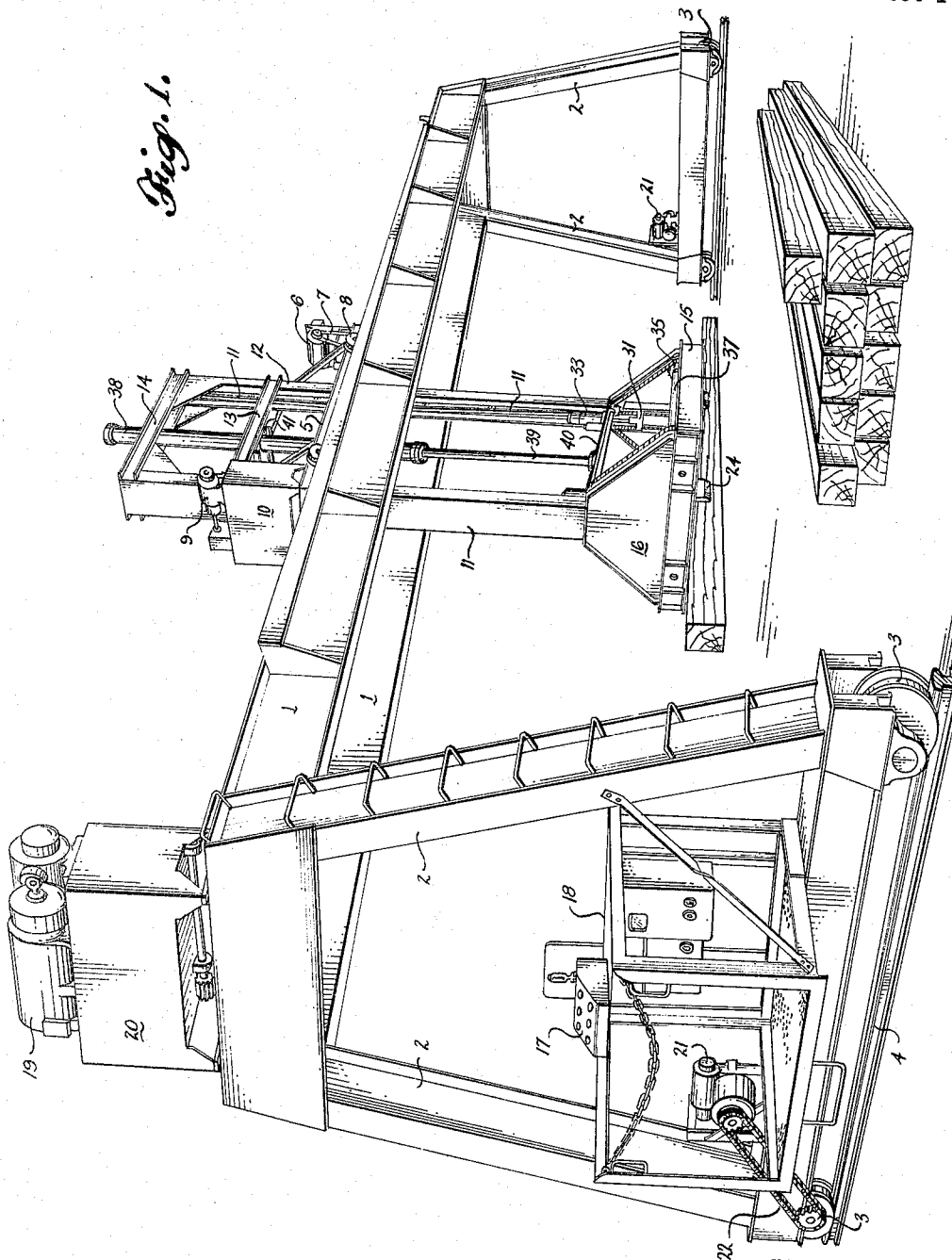
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3,244,291

TIMBER-CARRYING GRAB FOR OVERHEAD CRANE

Filed Jan. 6, 1964

4 Sheets-Sheet 1



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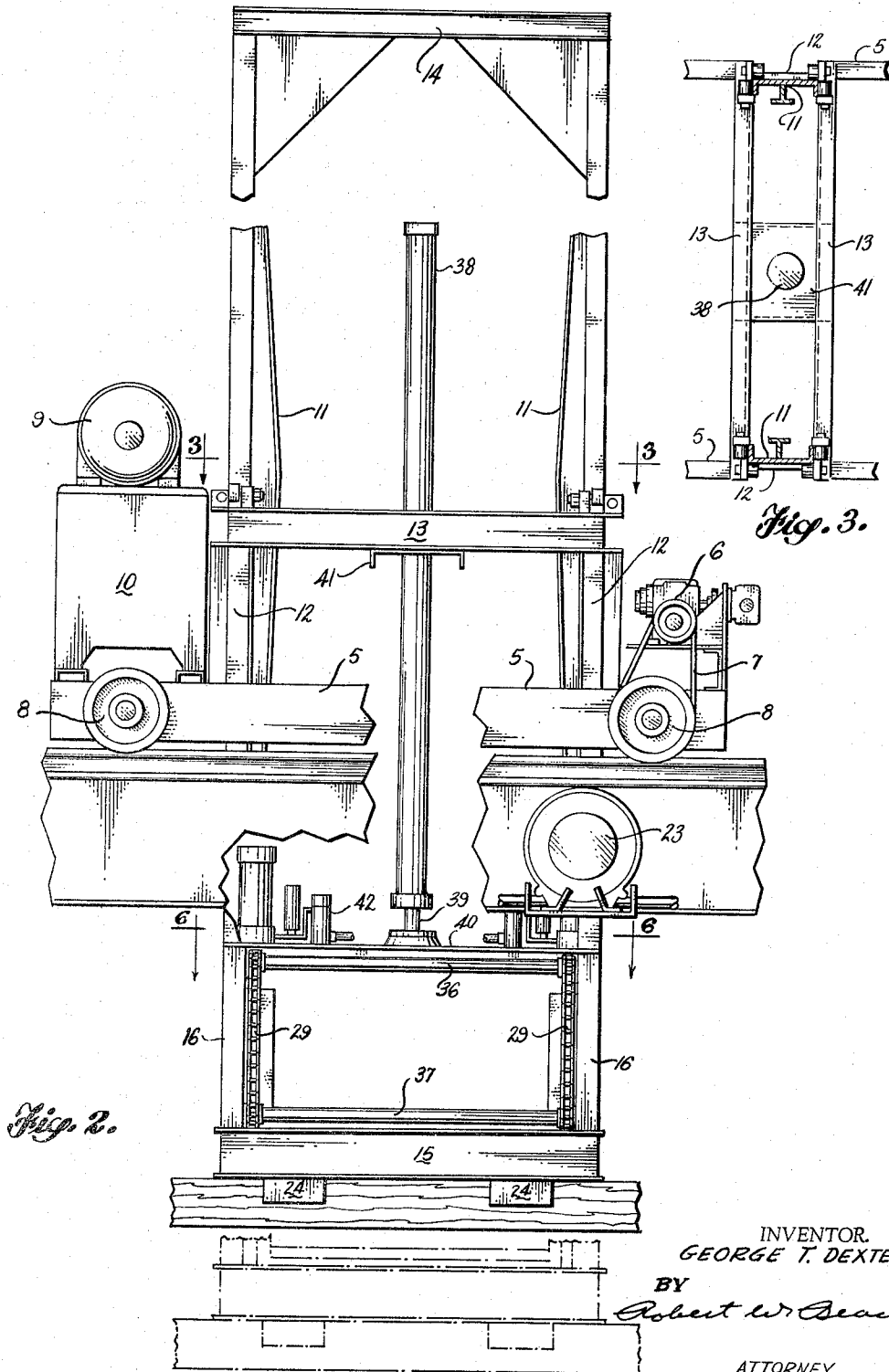
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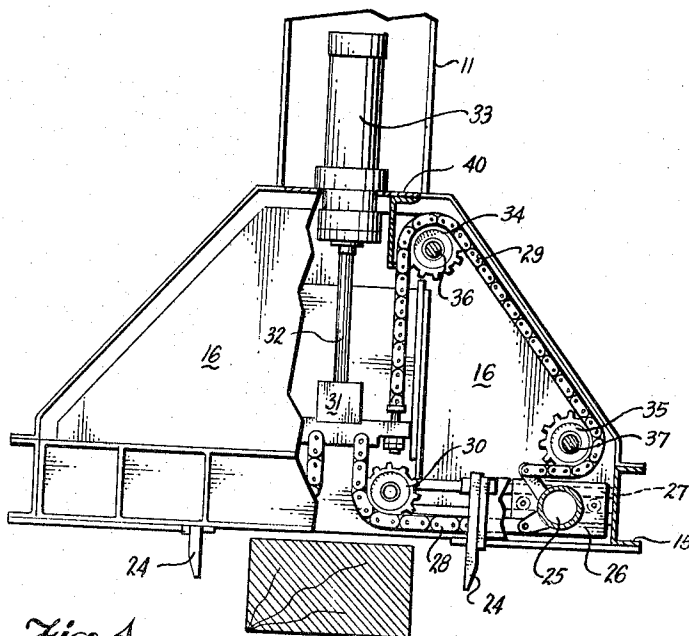


Fig. 4.

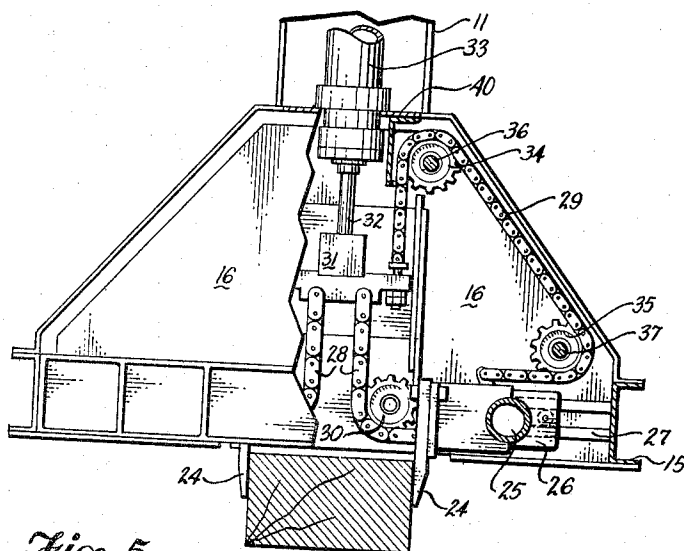


Fig. 5.

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TIMBER-CARRYING GRAB FOR OVERHEAD CRANE

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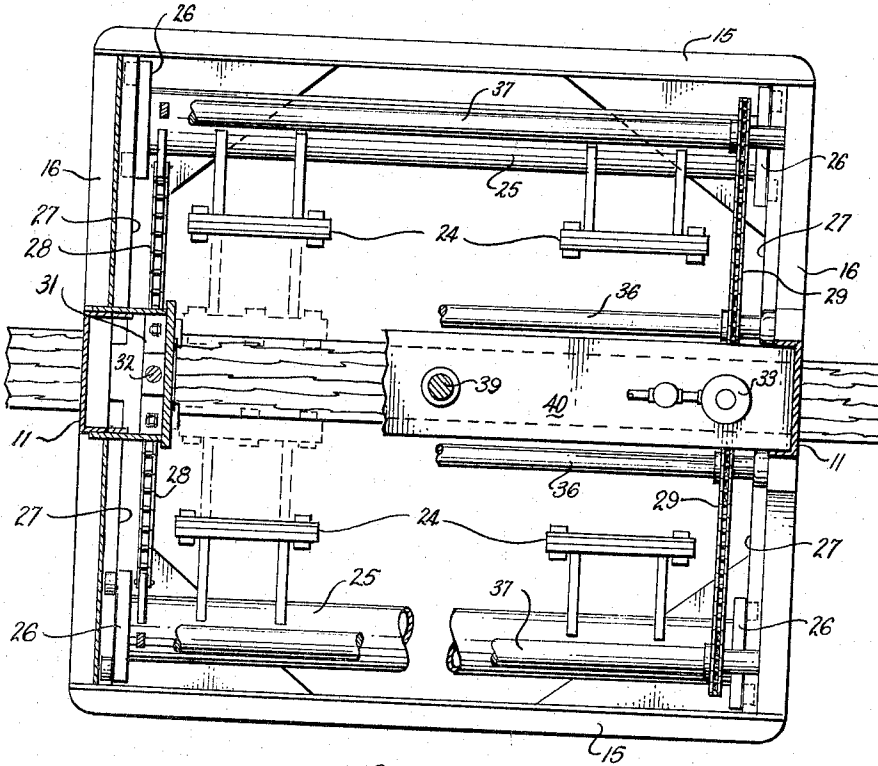


Fig. 6

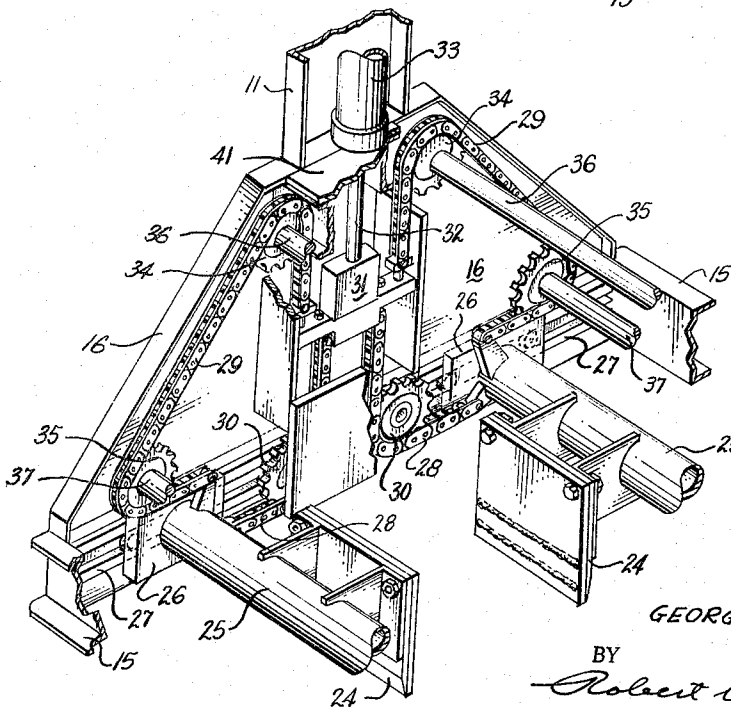


Fig. 7

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TIMBER-CARRYING GRAB FOR
OVERHEAD CRANEGeorge T. Dexter, Seattle, Wash., assignor to Puget Sound
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WashingtonFiled Jan. 6, 1964, Ser. No. 335,839
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This invention relates to a gantry crane particularly useful for transporting timbers to stack them in storage piles, unstack them from such piles, load them onto carrier blocks or trucks for transportation, and otherwise handle timbers which may be of considerable length and size of cross section.

While the timber-carrying gantry crane can be used in various types of installations, a typical installation would be in a timber storage yard at a sawmill. Large timbers may or may not be cut to order but even if they are cut for a special order timbers frequently are being cut for more than one order at the same time. It therefore becomes necessary either to store such timbers as stock or to accumulate the timbers for a particular order. In either case it is usually necessary to store the timbers for a greater or lesser length of time, either as stock or while particular orders are being accumulated. Timbers are thus moved from the mill to the storage yard usually by timber carrier, are then stored in the yard and when ready for shipment may be removed from the storage yard either by carrier or by forklift truck. The crane of the present invention is useful for shifting timbers from a receiving area into suitable stacks in a storage area, and from such storage area to a delivery area.

A crane capable of handling timber for such purposes must be able to pick up individual timbers of different cross-sectional sizes and lengths from different elevations, and shift them elevationally sidewise and lengthwise to different locations. Such a device to be most practical must also be capable of handling long timbers preferably up to as much as 40 feet in length, timbers which are of large cross section at least up to 2 feet in width and timbers which are heavy, such as being of large cross section of considerable length and of green wood. Such a crane must also be capable of operating in a large area in order to be of greatest utility. It may also be desirable to enable two or more of such cranes to be able to operate simultaneously generally in the same area.

A principal object of the present invention is to provide a timber-carrying gantry crane which will clamp a heavy timber securely to be lifted and transported without marring the surface of the timber appreciably where it is gripped.

A further object is to provide such a timber-carrying crane which can be operated quickly to shift a timber elevationally, sidewise and/or lengthwise in a controlled fashion so that the timber can be placed gently and accurately in the position desired. More specifically it is an object to hold a timber against sidewise swaying and lengthwise tilting during such movement, even though the timber is not gripped precisely symmetrically about its center of gravity.

It is also an object to provide such a timber-carrying crane with versatile control mechanism which can be operated quickly and accurately to effect the desired shifting of a timber, to enable it to be picked up and set down, as may be desired, completely under the control of the operator with safety and accuracy, even by an operator who is not particularly skillful. In this connection it is an object to provide good visibility for the operator.

An additional object is to provide a timber-carrying

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crane having the capabilities discussed above, which can be constructed relatively economically even though its structure is rugged and which can be installed at a particular location quickly and at a comparatively small cost.

The foregoing objects can be accomplished by a gantry type of crane, the trolley of which carries a vertically reciprocable timber gripping frame. Such frame is guided for vertical movement so that it cannot sway or tilt appreciably, and its elevation can be adjusted as desired by a long fluid piston and cylinder jack or actuator. Timber clamping plates are mounted on clamping strongbacks which are moved along guideways by chain, sprocket and shaft synchronizing mechanism driven by coordinated clamp-actuating jacks mounted on the vertically reciprocable frame.

FIGURE 1 is a perspective of the timber-carrying gantry crane.

FIGURE 2 is an enlarged side elevation of the crane trolley and vertically reciprocable frame carried by it, with parts broken away.

FIGURE 3 is a horizontal section through the vertically reciprocable frame taken on line 3—3 of FIGURE 2.

FIGURE 4 is an end elevation of the lower portion of the vertically reciprocable frame with parts broken away and with parts being shown in one operative position, and FIGURE 5 is a similar view with parts shown in a different operative position.

FIGURE 6 is a horizontal section through the vertically reciprocable frame taken on line 6—6 of FIGURE 2, parts being broken away.

FIGURE 7 is a top perspective of an end of the lower portion of the vertically reciprocable frame.

The principal structure of the gantry crane can be conventional, including the bridge formed by the horizontal parallel beams 1 having their opposite ends supported by the trestles 2. The wheels 3 mounted on the lower ends of such trestles travel along parallel tracks 4 laid on the ground and spaced apart so that the crane bridge straddles a timber-receiving area, a timber-storage area and a timber-delivery area. The bridge constitutes craneways along which the trolley 5 travels from one end of the bridge to the other. Preferably the span of the bridge between the trestles 2 is approximately 42 feet, so that timbers 40 feet in length can be received lengthwise between the two trestles. The tracks 4 along which the crane can move may be of any desired length.

The trolley 5 is driven along the craneways by a hydraulic motor 6 connected by chain 7 to a wheel 8 of the trolley. Hydraulic liquid under pressure is supplied to such a motor by a pump 9 from a reservoir 10. The hoisting operation is accomplished by a vertically reciprocable frame including two parallel upright arms 11 slidably received in guide channels 12, which are mounted on the trolley. Such guide channels are connected above the trolley by lower spreader beams 13 and the trolley frame so that the guide channels will be maintained rigidly in accurately spaced parallel relationship. Spreaders 14 connect arms 11.

The lower ends of the slidable arms 11 carry a rectangular box formed by two parallel elongated side beams 15, parallel to the bridge beams 1, and ends 16 including two elongated members connecting the ends of side beams 15 and disposed perpendicular to such beams but parallel to each other. Such box ends 16 are of generally triangular shape, as shown best in FIGURES 1, 4 and 5. Such box houses clamping mechanism operable to grip timbers so that they can be lifted and transported by the crane.

The timber-clamping mechanism carried by the box 15, 16 is operable simply to engage and grip timbers to hold

them immobile relative to the box. Elevational movement of a timber thus gripped is effected by moving upward arms 11 and the box carried by them. When thus elevated the timber can be moved lengthwise by traversing the trolley 5 along the bridge craneways and the timber can be moved transversely of its length by propelling the gantry crane as a whole along the rails 4. It is preferred that all of such movement be effected by hydraulic motors controlled from the console 17 of the operator's control platform 18 mounted on one of the trestles 2. Such location of the operator's platform enables the operator to have a good view of all operating components of the crane at all times, while being easily accessible.

The particular hydraulic drive mechanism for traversing the trolley 5 along the craneways and for propelling the gantry along the tracks 4 is not part of the present invention. In general, however, a reservoir 20 can be mounted on a trestle 2 from which hydraulic liquid can be supplied by a pump driven by electric motor 19 to synchronized hydraulic motors 21 mounted on the trestles forming opposite ends of the gantry. These hydraulic motors can drive chains 22 connected to rotate wheels 3 supporting opposite ends of the gantry so that its two ends will be propelled along the two tracks 4 at equal speeds to maintain the crane bridge in a position precisely perpendicular to the rails.

The pump 9 supplying hydraulic liquid under pressure to the trolley-traversing hydraulic motor 6 can be driven by an electric motor to which electricity can be supplied by an electric cable wound on reel 23. This reel is movable along the crane bridge with the trolley 5 and is arranged to take in or pay out the cable so as to hold the cable up out of the area beneath the crane bridge when the trolley is moved into different locations along such bridge. Also, the pump 9 can supply hydraulic liquid under pressure to the mechanism for actuating the timber clamp, and for effecting elevational movement of the upright arms 11 along the ways 12.

The clamp mechanism is shown best in FIGURES 2 to 7. In order to enable a timber to be gripped by engagement of portions of its opposite sides offset considerably from the center of the timber, it is desirable for the timber sides to be engaged over a considerable distance lengthwise of the timber. The desired clamping effectiveness can be obtained, however, by engaging opposite sides of the timber locally at locations spaced lengthwise of the timber by pairs of clamping plates 24 which are movable in unison. The corresponding plates of each pair at one side of a timber are mounted on a strongback 25.

In FIGURE 6 the plates 24 of each pair are shown as being mounted directly opposite each other at opposite sides of the timber, and the strongbacks 25 are shown as being disposed in parallel relationship. Opposite ends of the strongbacks 25 are supported by blocks 26 slidably engaged in horizontal ways 27 extending along the lower portions of the clamp box ends 16. Clamp-actuating mechanism is secured to such blocks to effect equal synchronized movement of all of such blocks so that the strongbacks 25 will be moved through equal distances toward or away from each other while always being maintained in parallel relationship, so that the spacing between the respective clamp plates of all the clamp plate pairs will always be equal.

Such movement of the clamp plates is effected by connecting to each sliding block 26 a pulling line in the form of chain 28 and a haulback line in the form of chain 29 extending in opposite directions from each block. The pulling chains 28 connected to the opposite blocks 26 at one end 16 of the box extend from such blocks toward each other around guide sprockets 30 mounted on the box end, and then upward, to be connected to a head 31 mounted on the piston rod 32 of a fluid-pressure clamp-actuating jack 33. From such head the haulback chains 29 extend upward over guide sprockets 34 and then downward and outward, as shown in FIGURES 4, 5 and 7,

around lower guide sprockets 35 and finally inward toward each other and are connected to the blocks 26. Thus pulling chain 28 and haulback chain 29 connected to each block 26 and the head 31 constitute, in effect, an endless line.

By connecting both pulling chains 28 to the same head 31 equal travel of the two blocks 26, to which such chains are connected, is assured. Correspondingly, connection of both haulback chains 29 to the same head insures that the two blocks 26 are pulled away from each other equal distances as the head 31 is moved downward. Moreover, connection of the pulling chains 28 and the haulback chains 29 to the same head insures that the two sets of chains will be moved in synchronism in whichever direction the head 31 is driven by the clamp-actuating jack 33. Synchronization of the travel of blocks 26 along the ways 27 at opposite ends of the clamp box is assured by interconnecting guide sprockets 34 by shafts 36 and guide sprockets 35 by shafts 37. Because of such interconnection of the guide sprockets 34 and 35 it would be possible theoretically to actuate the clamping mechanism by utilizing only a single clamp-actuating jack 33 at one end of the clamp box. The various components are subjected to less stress, however, by providing a clamp-actuating jack 33 at each end of the clamp box.

Elevational movement of the clamp mechanism is effected by a hoisting jack including a hydraulic cylinder 38 and piston rod 39. In order to apply the lifting force as directly as possible to the clamping mechanism such piston rod is connected to the spreader 40 bridging across the top of the clamp box. The cylinder 38 is mounted stationarily on a spreader 41 bridging between the guide spreaders 13, which connect the guide channels 12, as shown in FIGURES 2 and 3. The vertical travel of the clamp mechanism will depend on the length of the hoisting jack 38, 39. Hydraulic liquid under pressure can be supplied both to the hoisting jack and to the clamp jacks 33 by the pump 9 on the trolley 5. Supply of hydraulic liquid to these jacks and return of liquid from them to the reservoir 10 will be controllable separately by the operator from the console 17. Valve mechanism 42 mounted on spreader 40 of the solenoid type can control supply of hydraulic liquid to the respective clamp jacks 33, and return of liquid from them. Both the jacks 38, 39 and the jacks 33 are of the double-acting type.

In use, a pile of timbers can be transported from a mill such as by a timber carrier of the straddle-frame type and deposited in a timber-receiving area, as shown in FIGURE 1. Such timbers may be of random size and length. The crane operator by manipulation of controls at the console 17 may then maneuver the gantry into a position over the pile of timbers, traverse the trolley 5 along the bridge craneways until the clamp plates 24 are approximately centered over a timber to be relocated and the jack 38, 39 then actuated to lower the clamp box 15, 16 until the two parallel elongated members of the ends in its lower rim rest on the timber. The jacks 33 can then be actuated to raise the heads 31 for pulling the blocks 26 toward each other until the clamp plates 24 grip opposite sides of the timber firmly. During such movement of the clamping plates one plate of a pair may engage one side of the timber before the other plate of such pair, which may result in the timber being shifted somewhat transversely of its length or swung to some extent. Such movement of the timber is not detrimental to the operation of the crane. It should be noted that it is not necessary for any element to be engaged beneath the timber. In order to assure that each plate engages the timber with a sufficiently firm grip with negligible marring of the timber surfaces the clamp plates may have one or more horizontal beads of welding metal applied to them.

As soon as the clamping jacks 33 have thus been actuated to effect secure clamping of a timber with a rim of the clamp box 15, 16 resting on top of the timber, hydraulic liquid can be supplied to the lower end of the

hoisting jack cylinder 38 by manipulation of the operator's controls to hoist the clamp box and the timber carried by the clamping mechanism. When the timber has been raised clear of its support the trolley 5 can be traversed along the crane bridge to move the timber endwise, and the gantry can be propelled along the rails 4 simultaneously or sequentially, as may be preferred, to transport the timber to a desired storage location. The stiffness of the clamp box supporting arms 11 will prevent the timber from swaying sidewise, despite rapid acceleration or deceleration of the gantry along the tracks, virtually irrespective of the elevational position of the timber.

When the timber has thus been transported to the location desired hydraulic liquid can be returned from the lower end of the hoisting jack cylinder 38 so that the timber will be lowered onto an appropriate support. Hydraulic liquid can then be returned from the lower ends of the clamping jacks 33 and supplied to the upper ends of these jacks for effecting positive separating movement of the strongbacks 25 and clamp plates 24 of each pair. The clamp box 15, 16 can then be raised again by the hoisting jack 38, 39 and the crane maneuvered to handle another timber. Use of hydraulic liquid to power the hoisting jack 38, 39 and the clamping jacks 33 enables such jacks to be locked positively in any elevational or clamping position simply by confining the hydraulic liquid within the jack cylinders because of the virtual incompressibility of such hydraulic liquid.

I claim as my invention:

1. Grab mechanism for a bridge crane, comprising two clamping members, means supporting and guiding said two clamping members for relative substantially horizontal movement toward and away from each other, two pulling line means extending, respectively, from each of said two clamping members toward the other clamping member, actuator means connected to both of said pulling line means and operable to pull said two pulling line means simultaneously for moving said two clamping members toward each other, and two haulback line means extending respectively, from the side of each clamping member remote from the other clamping member and connected to said actuator means to be pulled thereby simultaneously to effect movement of said clamping members away from each other.

2. The grab mechanism defined in claim 1, in which the actuator means includes fluid-pressure jack means operatively connected both to the pulling line means and to the haulback line means.

3. The grab mechanism defined in claim 2, in which the pressure-fluid jack means is reciprocable in a direction extending transversely of the directions of movement of the clamping members.

4. The grab mechanism defined in claim 1, in which the pulling line means and the haulback line means connected to each clamping member cooperate to form in effect an endless line.

5. The grab mechanism defined in claim 4, in which the actuator means includes fluid-pressure jack means having an elongated piston rod disposed with its length upright and connected to both endless lines to effect simultaneous movement thereof.

6. Grab mechanism for a bridge crane, comprising clamping means including two elongated members, means supporting said elongated members in substantially horizontal, parallel relationship and guiding them for relative movement transversely of their lengths, four pulling line means, first two of said pulling line means being connected to a first one of said elongated members at respective locations spaced lengthwise thereof and extending therefrom toward the other elongated member and the second two of said pulling line means being connected to the other of said elongated members at respective locations spaced lengthwise thereof and extending therefrom toward said

first elongated member, two haulback line means extending respectively from the side of each of said elongated members remote from the other elongated member, and synchronizing means connecting said first two pulling line means, said second two pulling line means and said haulback line means for coordinating movement thereof and including actuator means operatively connected to pulling line means connected to said two elongated members and operable to pull simultaneously at least one of said pulling line means connected to each of said elongated members, respectively, for moving said two elongated members toward each other.

7. The grab mechanism defined in claim 6, in which the actuator means includes fluid pressure jack means connected to one of the pulling line means connected to the first elongated member and one of the pulling line means connected to the other elongated member.

8. The grab mechanism defined in claim 7, in which the actuator means includes second fluid pressure jack means connecting the other pulling line means connected to the first elongated member and the other pulling line means connected to the other elongated member.

9. The grab mechanism defined in claim 6, in which the synchronizing means includes a shaft having its length extending parallel to the lengths of the elongated members, engaging the first two pulling line means and operable to coordinate movement thereof for insuring equal displacement of opposite ends of the first elongated member during movement thereof.

10. Grab mechanism for a bridge crane, comprising clamping means including two elongated members, means supporting said elongated members in substantially horizontal parallel relationship and guiding them for relative movement transversely of their lengths, four pulling line means, four haulback lines means, first two of said pulling line means being connected to a first one of said elongated members at respective locations spaced lengthwise thereof and extending therefrom toward the other elongated member and first two of said haulback line means being connected to said first elongated member at respective locations spaced lengthwise thereof corresponding to the locations of said first two pulling line means and extending respectively from the side of said first elongated member remote from the other elongated member, the corresponding pulling line means and haulback line means connected to said first elongated member cooperating respectively to form endless lines, the second two of said pulling line means being connected to the other of said elongated members at respective locations spaced lengthwise thereof and extending therefrom toward said first elongated member and the second two of said haulback line means being connected to such other of said elongated members at respective locations spaced lengthwise thereof corresponding to the locations of said second two pulling line means and extending respectively from the side of said other elongated member remote from said first elongated member, the corresponding pulling line means and haulback line means connected to said other elongated member cooperating respectively to form endless lines, synchronizing means including a shaft having its length extending parallel to the lengths of said elongated members and engaging the endless line loops connected to said first elongated members for coordinating movement of such two loops to insure equal displacement of opposite ends of said first elongated member during movement thereof, and actuator means including two fluid-pressure jack means, each connected to two of said endless lines connected, respectively, to said two elongated members.

11. In a bridge crane, the combination which comprises a trolley movable along the crane's bridge, upright guide means carried by said trolley, vertically elongated rigid means fitted in said guide means and reciprocable vertically relative to said trolley, means operatively connecting said rigid means and said trolley and operable to effect

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vertical reciprocation of said vertically elongated rigid means, first two parallel elongated members mounted rigidly on the lower portion of said vertically elongated rigid means, second two parallel elongated members extending transversely of said first two elongated members, supported therefrom and guided thereby for movement toward and away from each other relative to said rigid means, a plurality of pairs of clamping plates spaced lengthwise along said second two elongated members, the plates of each pair being mounted respectively on said second two elongated members with portions of said plates depending below said first two elongated members and being clampingly engageable with an elongated object extending transversely of said first two elongated members and engaged thereby, and clamp-operating means operatively connected to said second two elongated members and operable to effect approach and separating movement thereof to open and close said clamping plates.

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