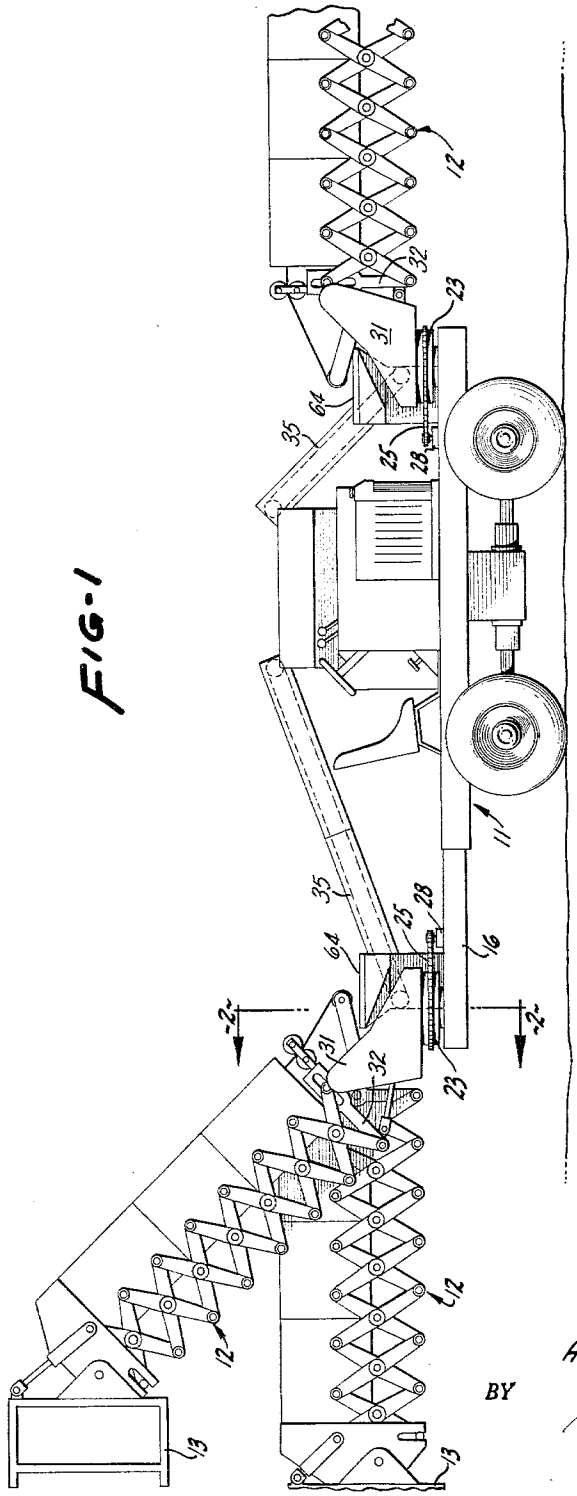
Feb. 22, 1966 A. L. GIRARDI 3,236,393

BOOM AND BOOM ACTUATING MECHANISM

Filed March 25, 1964 3 Sheets-Sheet 1

FIG. 1



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BOOM AND BOOM ACTUATING MECHANISM

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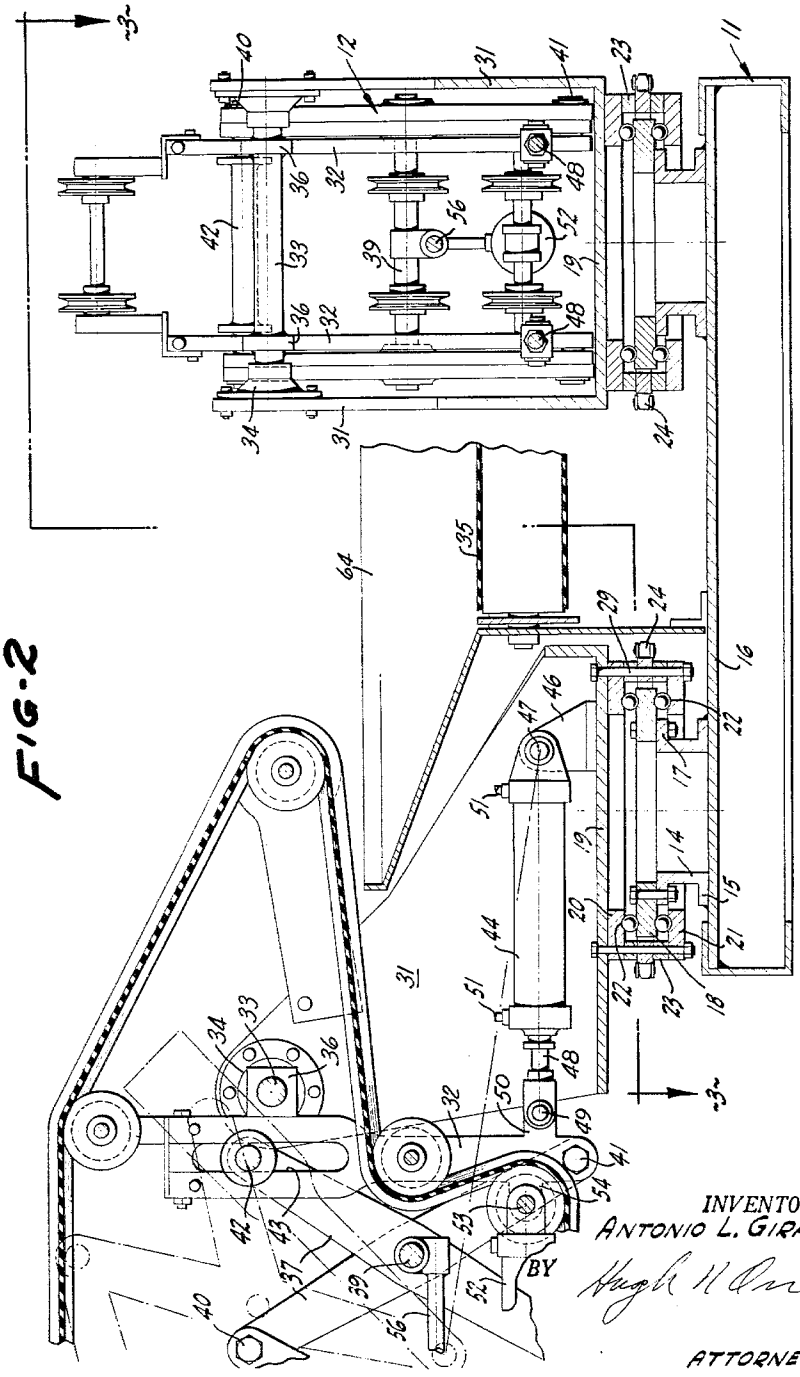


FIG. 2

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BOOM AND BOOM ACTUATING MECHANISM

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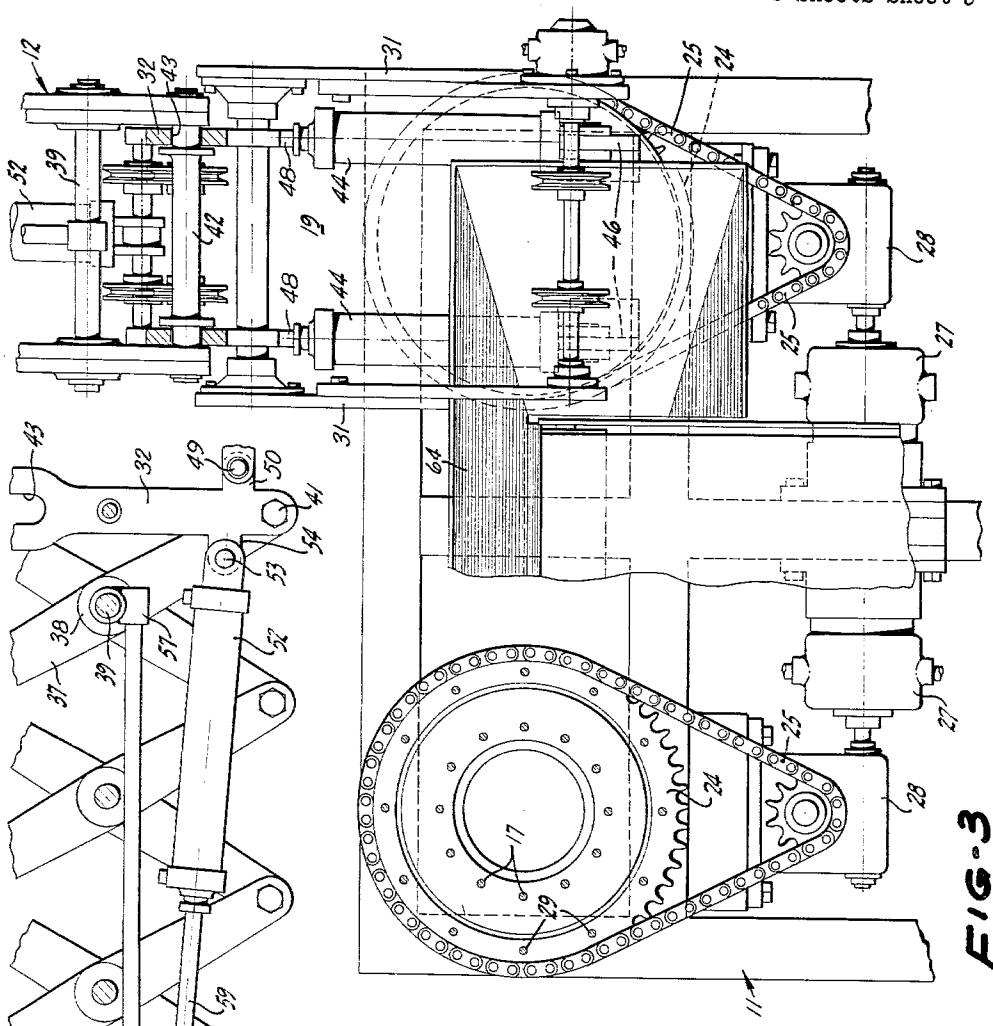


FIG-3

FIG-4

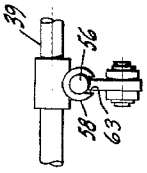


FIG-5

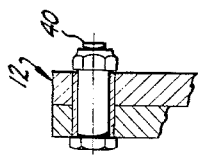


FIG-6

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3,236,393

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3,236,393

BOOM AND BOOM ACTUATING MECHANISM

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Substituted for abandoned application Ser. No. 794,545, Feb. 20, 1959. This application Mar. 25, 1964, Ser. No. 359,540

12 Claims. (Cl. 212—55)

This invention relates to boom supporting and actuating mechanism for orchard apparatus of the character disclosed in my prior Patent No. 2,927,705.

More particularly, the present invention relates to improvements in mechanism for mounting one or more booms upon a mobile carriage for angular adjustment about horizontal and vertical axes, and including an improved arrangement and structure of mechanism for extending and retarcting the boom along its longitudinal axis.

It is among the objects of this invention to provide an improved structure, arrangement, and cooperative relationship of parts and mechanisms for mounting one or more booms upon a carriage, and for effecting movement thereof through desired degrees of angular and axial adjustment, all designed to obtain economy in construction and efficiency in operation.

It is also an object of this invention to provide an improved boom and boom-supporting structure which will accommodate auxiliary mechanism in a compact manner, permitting a maximum utilization of space for the assembly and operation of primary and auxiliary parts, and which will improve the operative efficiency of the component parts separately and collectively in the assembly.

The invention has other objects and features of advantage, some of which, with the foregoing, will be hereinafter explained in connection with the illustrative embodiment of the invention shown in the accompanying drawings forming part of the present specification. It is to be understood that the invention is not limited to the sructural features shown in the drawings, as the invention may be embodied in other forms, and the structural details may be variously modified, within the scope of the appended claims.

In the drawings:

FIG. 1 is a side elevational view of an orchard apparatus embodying the improvements of the present invention, parts being broken away.

FIG. 2 is a fragmental sectional view showing the structure and arrangement of the boom supporting and actuating mechanism of the present invention with the booms at the right and left side of the carriage being shown in different positions, the plane of the section indicated by the line 2—2 of FIG. 1.

FIG. 3 is a plan view, partly in horizontal section, of the structure shown in FIG. 2, the parts being shown as viewed upon the planes indicated by the line 3—3 of FIG. 2.

FIG. 4 is a fragmental vertical sectional detail view showing the structure and arrangement of the boom extending mechanism.

FIG. 5 is a fragmental detail view showing the guide for the forward end of the boom extending rod.

FIG. 6 is a fragmental sectional detail showing the means for pivoting together the ends of the lazy tong levers which form the sides of the boom.

In terms of broad inclusion, the present invention is directed to orchard apparatus embodying improvements in the structure and operation of booms and the mounting and actuating mechanism therefor, including improved mechanism for adjusting the position of a boom through

desired angles of vertical and horizontal angular adjustment, and for extending and retracting the boom along its longitudinal axis in any position of vertical and horizontal angular adjustment. The invention also contemplates improvements in boom structure designed to minimize obstruction to the mounting and operation of conveying means and associated auxiliary apparatus by which improved operative efficiency may be obtained.

In the illustrative embodiment of the invention shown in the drawings, the numeral **11** designates a mobile carriage upon which booms **12** are mounted for angular and axial adjustment. The booms are provided with baskets **13** mounted upon the outer ends thereof, arranged to support a workman who, by suitable manipulation of the booms, may be moved to desired positions around adjacent trees to perform various operations, such as picking, thinning, pruning and the like. The functions and general structure and arrangement of these parts are similar to those of my copending application, Serial No. 570,165, above referred to, and to that extent a detailed description of the apparatus and its mode of operation is herein unnecessary. The invention now contemplated relates to improvements in the mechanism by which the boom is mounted and actuated through its range of angular and axial adjustment, and includes improved features of arrangement permitting auxiliary mechanisms and equipment to be mounted and operated with increased effectiveness.

More particularly, each boom **12** is mounted upon the carriage **11** by means of a supporting base **14** welded or otherwise secured to a frame portion **16** of the carriage. As illustrated, each base is a short, annular column having a lower flange **15**, which seats upon the frame **16**, and an upper flange **17** upon which is secured an annular bearing plate or ring **18**. A turntable **19** is mounted for rotative movement upon the plate **18** by means of an anti-friction bearing, preferably comprising upper and lower cage rings **20** and **21**. Bearing balls **22** are engaged between the plate **18** and the rings **20** and **21** to minimize friction and prevent binding under the eccentric loads, compressive and thrust, imposed by the boom. The rings **20** and **21** are joined at their outer peripheries by an annular spacing band **23**, and the bearing assembly is secured to the under side of the turntable **19** by bolts **29** or other suitable securing means extending through the rings **20** and **21**, the band **23** and the turntable **19**, as best shown in FIG. 2.

A sprocket ring **24** is secured to the band **23** to encircle the turntable bearing for each boom. A sprocket chain **25** extends over each sprocket ring **24** and a drive sprocket **26**, which in turn is driven at a very low speed by a motor **27** through a suitable reduction gear unit **28**. The sprocket ring **24**, as illustrated, is formed as an annulus gripped between upper and lower sections and held by bolts **29** which secure the turntable and the bearing assembly together. I prefer to use a separate reversible hydraulic motor **27** for each boom, such motor being arranged to serve as a brake for holding the turntable and boom in any adjusted position. Other types of power units may be substituted for the hydraulic motors **27**, and other flexible driving members, such as a belt or cable, may be substituted for the sprocket chain **25**, if desired.

Each turntable **19** is provided with a pair of boom mounting brackets **31** between which the base of a boom **12** is mounted for pivotal movement about a horizontal axis passing through the upper ends of the brackets. In the improved device of the present invention, the boom mounting comprises a pair of arms **32** pivotally mounted upon a shaft **33** suitably supported at its ends by bearing members **34** secured upon the inner sides of the brackets.

Preferably, each arm **32** is connected to the shaft in a slightly forwardly offset position by means of a lug **36** through which the shaft **33** extends.

Each boom **12** is of the lazy-tong type illustrated in my earlier filed application, Serial No. 570,165, above referred to, and is of the same general structure except that in the present device, the boom comprises a pair of lazy tongs composed of a plurality of pairs of levers **37** pivotally connected in crossing relationship, the matching pairs of the lazy-tong levers forming opposite sides of the boom being interconnected only at the crossing points midway between their ends. The levers of corresponding pairs of the matching lazy tongs are journaled upon bearing portions **38** formed upon the ends of cross braces **39** which extend transversely between the lazy tongs. The ends of the levers **37** of each pair are pivotally connected to the adjacent ends of the levers of adjacent pairs by pivot pins **40**, which engage only the two ends which they connect. No direct cross connection is provided between the pivotally connected ends of the levers of one lazy tong and the corresponding pivoted ends of levers of the other lazy tongs, so as to leave clear the space between the two lazy tongs above and below the cross braces **39**.

Each boom **12** is connected to its pair of mounting arms **32** by pivoting the ends of the innermost pair of levers **37** to the upper and lower ends of the arms **32**. The lower end of one lever **37** is pivoted to the lower end of the adjacent arm **32** by a pivot pin **41**. The upper end of the companion lever **37** is pivoted to the upper end of the adjacent arm **32** by a pivot pin **42**, which is slidably movable along a slot **43** formed in the upper half of the arm, as best shown in the left-hand portion of FIG. 2.

The mounting arms **32**, upon which each boom **12** is mounted, are swung about the mounting shaft **33** therefor by means of hydraulic rams **44**. Each ram **44** comprises a cylinder portion pivotally anchored to a bracket **46** secured to the turntable, upon which the boom is mounted, by a pivot pin **47**. Piston rods **48** operated by the rams are pivotally connected to the lower ends of the mounting arms **32** associated therewith, as, for example, by pins **49** connecting the pistons to lugs **50** carried by the arms. Hydraulic pressure is introduced into either end of the ram through suitable inlet and outlet connections **51** in conventional manner. Movement of the arms **32** about the horizontal shaft **33** causes the boom to be swung bodily in a vertical plane to a desired angle, the basket **31** at its outer end being thereby raised or lowered as desired. Since the ram **44** is anchored to the turntable **19**, the boom may be moved through a desired vertical angle in any position to which the boom may be moved as it is swung through a horizontal angle by rotation of the turntable upon the base **14**.

Each boom **12** is arranged to be extended and retracted along its longitudinal axis in any position of angular adjustment by a hydraulic ram **52** mounted for operation in a novel manner within the space between the lazy tongs, which form the sides of the boom, and below the cross pieces **39** by which the lazy tongs are connected and braced at the centers only of the crossing levers **37**. Thus, a hydraulic ram **52** is pivotally anchored upon a shaft **53** extending between the lower ends of the mounting arms **32** upon which the boom is mounted. The shaft **53** is supported by lugs **54** extending forwardly from the lower portions of the arms **32**, as best shown in FIG. 4.

Each boom **12** is provided with a rod **56** having its inner end secured to the innermost cross brace **39** by a suitable clamp fitting **57**. The rod **56** extends forwardly under a plurality of the cross braces **39** connecting successive matching pairs of the lazy tong links and through a guide **58** clamped to a cross brace **39** appropriately spaced from the base end of the boom. A piston rod **59** operated by the ram **52** is connected to the rod **56** by a pin **61** extending through a lug **62** projecting downwardly from the under side of the rod. The guide **58** is slotted as at **63** to permit the lug **62** and guide to pass as the boom is extended and retracted. Power exerted by the ram is applied through the rod **56** to move the rearward cross brace **39** and the center portions of the levers **37**. This movement is transmitted from each crossing pair of levers to the next in each of the two lazy tongs which form the sides of the boom. As the piston **59** is moved outwardly from the ram **52**, the lazy tongs are extended; and, as the piston is moved inwardly, the lazy tongs are retracted, thereby extending and retracting the boom along its longitudinal axis.

The mounting of the ram **52** and rod **56** below the cross braces **39** and between the lazy tong sides of each boom affords material advantages. Thus the mechanism is safely and compactly fitted within the boom, in a position accessible from the under side of the boom for adjustment, repair or replacement. More important, however, is the added space which is allowed for extending a conveyor belt to the outer end of the boom, regardless of the angular and axial adjustment of the boom. Such an extensible conveyor is disclosed in my copending application, Serial No. 763,653, filed September 26, 1958. In the present structure, however, the space above the cross braces is unobstructed along the full length of the boom, and take-up loops which are paid out and taken in as the boom is extended and retracted, may be of greater length and operate over guides of greater diameter, thereby obtaining increased range of adjustment and greater efficiency. Also, the mechanism of the present invention permits the conveyor to operate smoothly over the base of the boom, to deliver fruit to a receiver **64** positioned above the boom supporting base, rather than through the base itself, as shown in my application, Serial No. 570,165. This materially lessens the likelihood of damage to fruit, and facilitates the transfer of fruit to auxiliary conveyors **35** and thence to a sorting table, such as shown in my copending application above referred to.

Having thus described my invention, I claim:

1. A boom support for orchard apparatus and the like comprising a base provided with an annular flange, upper and lower bearing rings positioned above and below the flange, bearing balls engaged between each of said rings and the flange, an annular band connecting the rings along their peripheries, a turntable secured to the upper ring, boom mounting brackets upon the turntable, a flexible drive member mounted in driving engagement with the band, and power operated means for actuating the drive member to impart rotative movement to the turntable.

2. A boom support as defined by claim **1** wherein a sprocket is mounted upon the band and the flexible drive member is a chain extended around the sprocket for imparting rotative movement to the rings and turntable.

3. A boom support as defined by claim **1** wherein the band is provided with a sprocket secured in encircling engagement therewith, a drive chain mounted over the sprocket, a motor, and means connecting the motor to the chain for imparting rotative movement to the rings and turntable.

4. A boom support as defined by claim **1** wherein the band is provided with a sprocket ring secured in encirling engagement therewith, a motor, a drive sprocket actuated by the motor speed reduction gearing interposed between the motor and the drive sprocket for actuating the sprocket at reduced speed and for holding the turntable at a selected position, and a chain mounted over the drive sprocket and sprocket ring for imparting rotative movement to the rings and turntable.

5. In an orchard apparatus of the character described, a boom supporting and actuating mechanism comprising a base, a turntable rotatably mounted upon the base, power actuated means for imparting rotative movement to the turntable, boom mounting brackets upon the turntable, a pair of tilting arms pivoted to the brackets for movement about a horizontal axis near the upper ends

of the arms, an extensible boom mounted upon the arms, and hydraulic ram means connected to the arms near the lower ends thereof for imparting pivotal movement to the arms for raising and lowering the boom about the horizontal axis.

6. Apparatus as defined by claim 5 wherein the boom is of lazy-tong construction comprising a pair of spaced matching lazy tongs, each composed of a succession of pairs of levers pivotally connected in crossing relationship upon central pivot axes midway between the ends of the levers, cross rods connecting and bracing the lazy tongs in spaced relation, said cross rods connecting the lazy tongs only along the central pivot axes of corresponding pairs of lever, the ends of the levers of each pair being connected to the adjacent ends of adjacent pairs of levers by pivot pins extending through only the connected end of the levers of the respective lazy tongs, said boom being provided with hydraulic ram means for extending and retracting the boom along its longitudinal axis.

7. Apparatus as defined by claim 5 wherein the boom is of lazy-tong construction comprising a pair of spaced matching lazy tongs, each composed of a succession of pairs of levers pivotally connected in crossing relationship upon central pivot axes midway between the ends of the levers, cross rods connecting and bracing the lazy tongs in spaced relation, said cross rods connecting the lazy tongs only along the central pivot axes of corresponding pairs of levers, the ends of the levers of each pair being connected to the adjacent ends of adjacent pairs of levers by pivot pins extending through only the connected ends of the levers of the respective lazy tongs, said boom being provided with hydraulic ram means mounted and operating substantially wholly within the space between the lazy tongs and below the cross rods for extending and retracting the boom along its longitudinal axis.

8. Apparatus as defined by claim 5 wherein the boom is of lazy-tong construction comprising a pair of spaced matching lazy tongs, each composed of a succession of pairs of levers pivotally connected in crossing relationship upon central pivot axes midway between the ends of the levers, cross rods connecting and bracing the lazy tongs in spaced relation said cross rods connecting the lazy tongs only along the central pivot axes of corresponding pairs of levers, the ends of the levers of each pair being connected to the adjacent ends of adjacent pairs of levers by pivot pins extending through only the connected ends of the levers of the respective lazy tongs, said boom being provided with hydraulic ram means anchored to one of the tilting arms and extending outwardly along the boom between the lazy tongs and below the cross rods, a boom actuating rod anchored to the innermost cross rod and extending outwardly below the cross rods, a guide secured to a cross rod spaced outwardly from said innermost cross rod and arranged to slidably support the boom actuating rod, and means connecting the ram to the actuating rod for extending and retracting the boom along the longitudinal axis.

9. In an orchard apparatus of the character described, a boom comprising a pair of lazy tongs connected and braced in spaced relation only by cross shafts provided with bearing portions upon which the lever arms of the lazy tongs are journaled in crossing relationship at points

midway between their ends, pivot pins engaging and pivotally connecting only the adjacent ends of adjacent levers of the respective lazy tongs, a boom extending rod secured to the innermost cross shaft and slidably engaged by a guide secured to a cross shaft spaced outwardly along the boom from said innermost shaft, and a hydraulic ram positioned between the lazy tongs and connected to the rod at a point outwardly spaced from the base of the boom a distance embracing a plurality of pairs of lazy-tong forming links for exerting force through the rod at said outwardly spaced point to extend and retract the boom.

10. In an orchard apparatus of the character described having a boom of lazy-tong construction formed of spaced matching lazy tongs, each composed of a plurality of pivotally connected levers, boom supporting and actuating mechanism comprising a base, a turntable rotatable upon the base and provided with upwardly extending brackets, a pair of boom mounting arms pivotally mounted upon the inner sides of the brackets for movements about a horizontal pivot axis positioned near the upper ends of the arms, means pivotally connecting the lower ends of the innermost levers of the lazy tongs to the lower ends of the mounting arms, means slidably and pivotally connecting the upper ends of said innermost lazy-tong levers to the upper ends of the mounting arms, and hydraulic ram means anchored to the turntable and connected to the lower ends of the mounting arms for moving said arms and the boom supported thereon about their horizontal pivot axis.

11. Boom supporting and actuating mechanism as defined by claim 10 provided with a hydraulic ram anchored to one of the boom mounting arms and extending longitudinally outwardly within the boom, a boom actuating rod connected to the boom adjacent the innermost end of the boom, and means connecting the ram to the rod at a point spaced a substantial distance outward from the innermost end of the boom.

12. In an orchard apparatus of the character described wherein a boom of lazy tong construction formed of crossing pairs of pivotally connected lever arms is mounted upon a turntable having spaced upwardly extending brackets, a pair of boom mounting arms each having a longitudinally extending slot formed in its upper end, a mounting shaft supported by the brackets in a substantially horizontal position, a bearing upon the slotted end of each arm pivotally engaging the shaft for supporting the arms thereupon, a fixed pivot at the lower end of each arm pivotally connecting the same to the lower ends of the innermost lever arms of the boom, and movable pivots slidably and pivotally connecting the upper ends of the innermost lever arms to the slotted upper ends of the mounting arms.

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