June 18, 1957 B. A. ROSE 2,796,180

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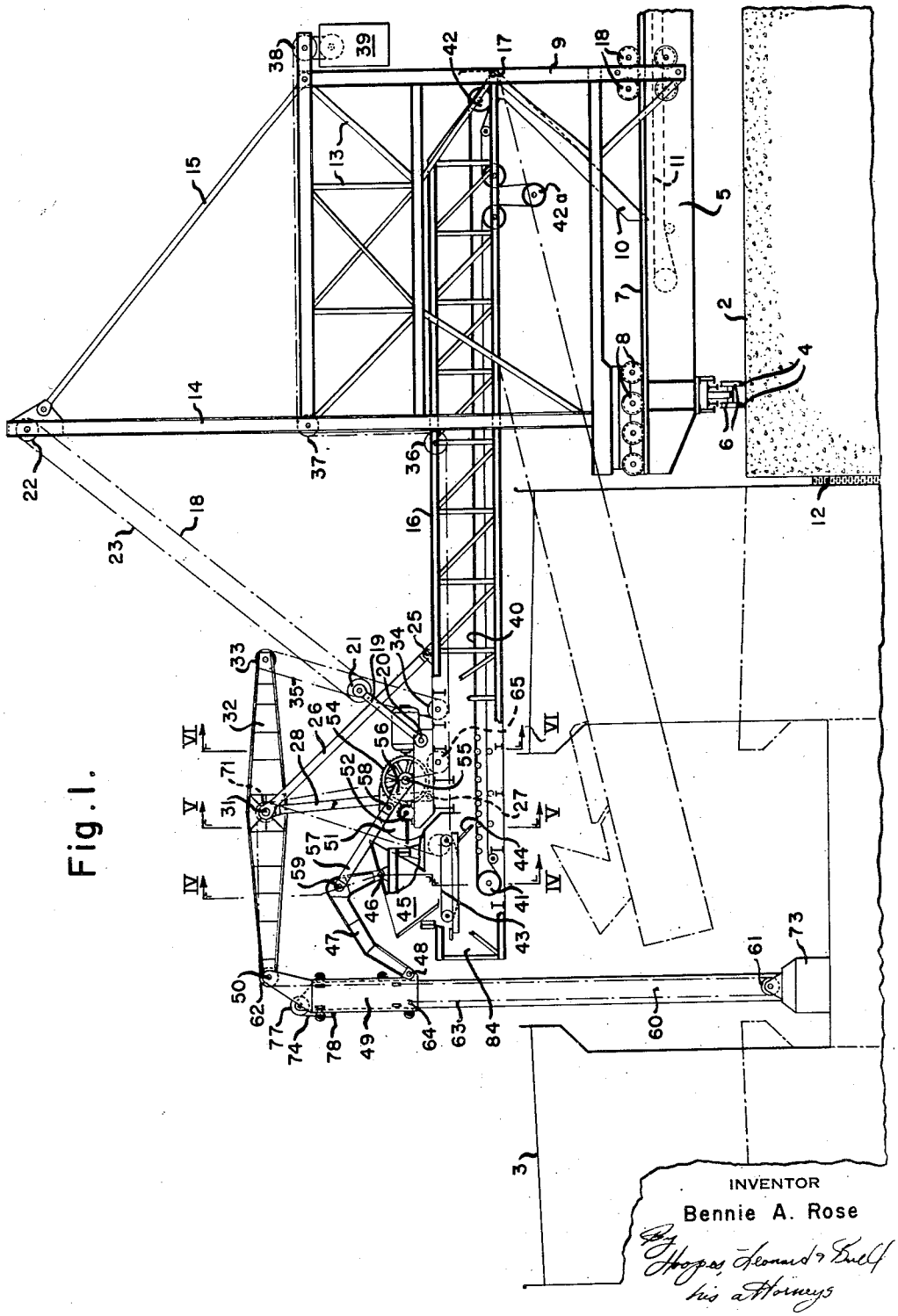


Fig. 1.

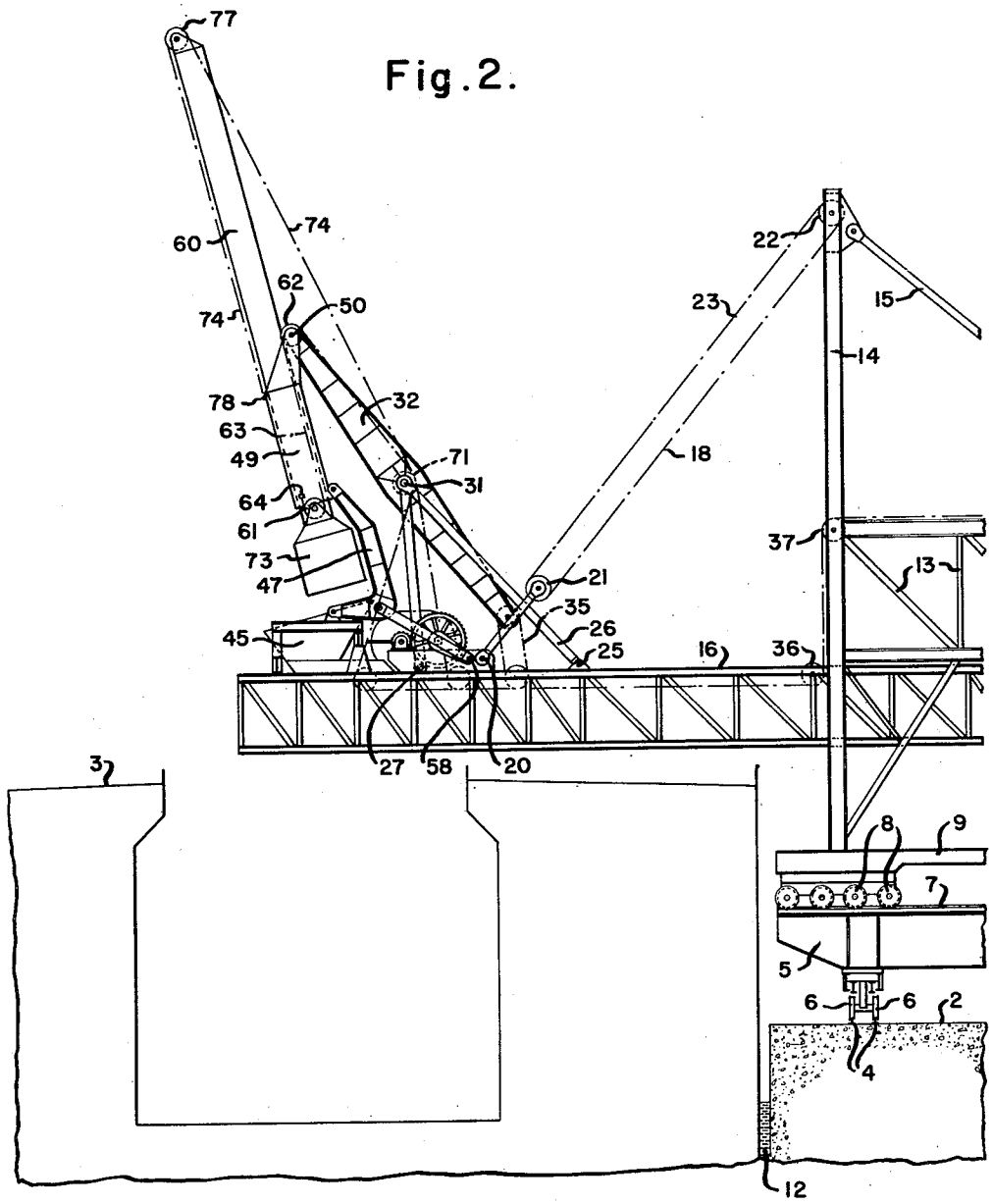
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Fig. 2.



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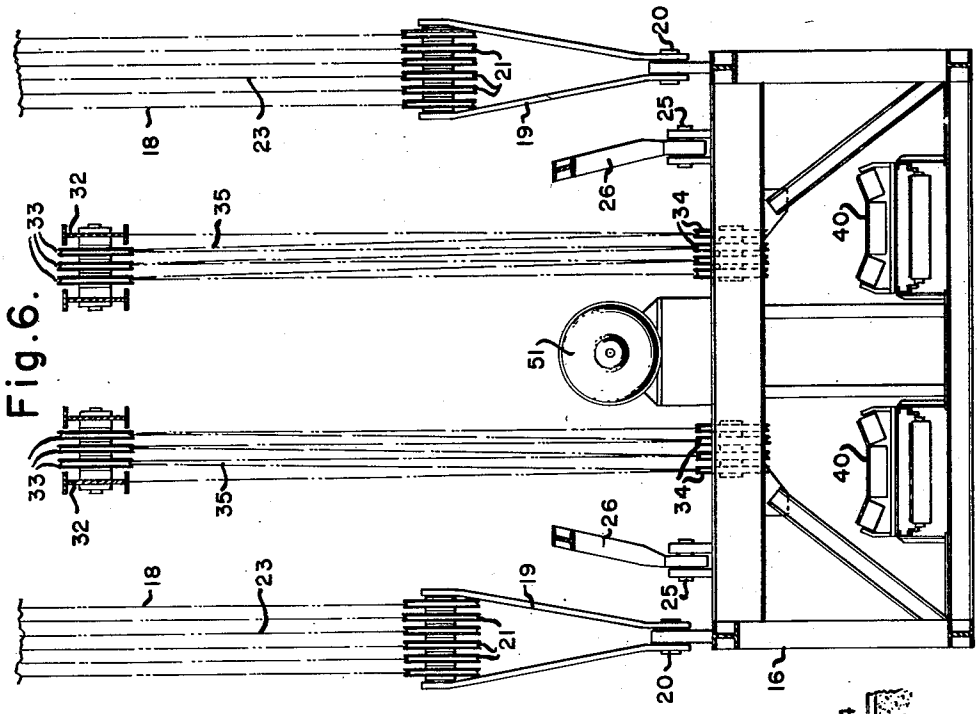


Fig. 6.

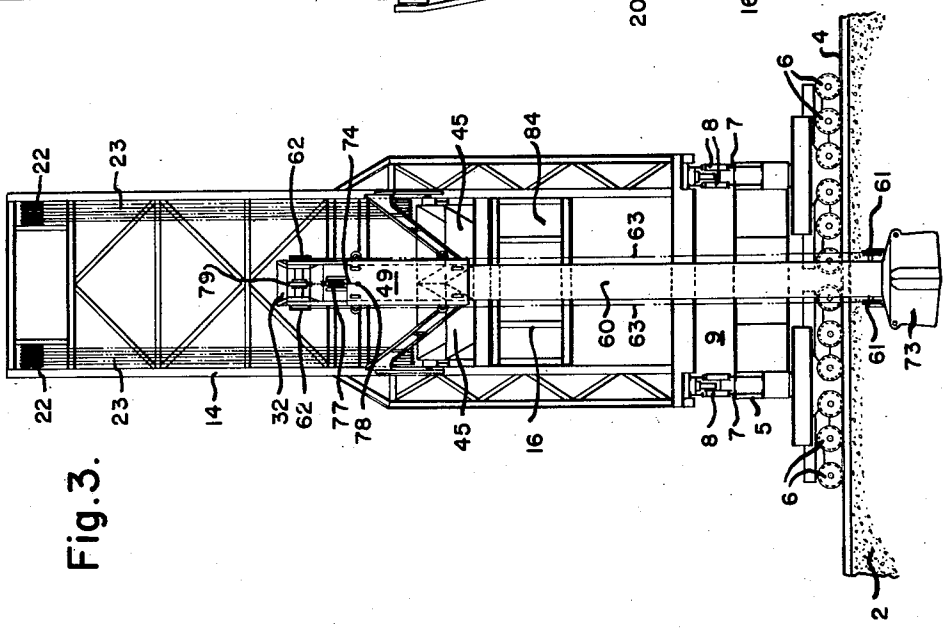


Fig. 3.

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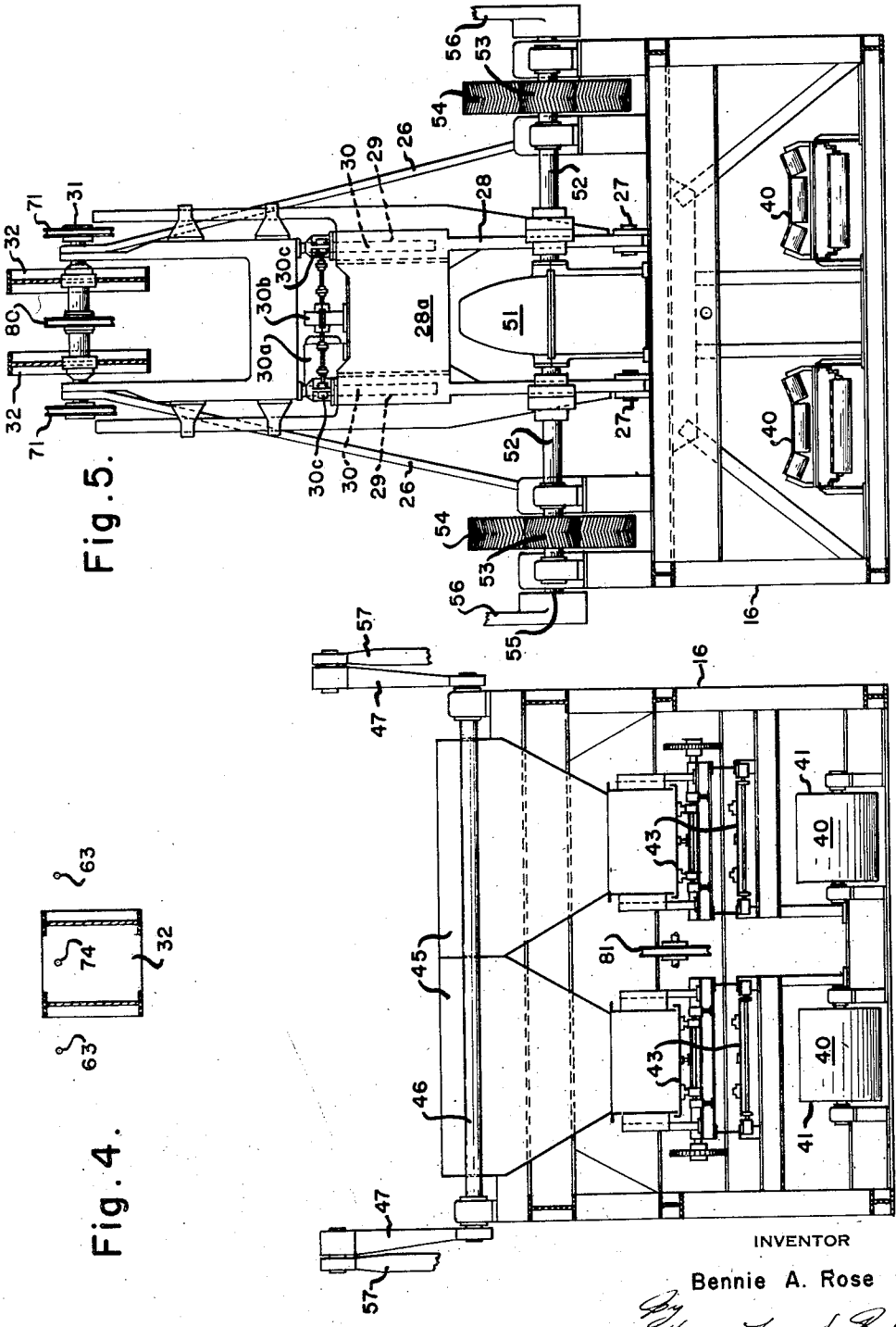


Fig. 5.

Fig. 4.

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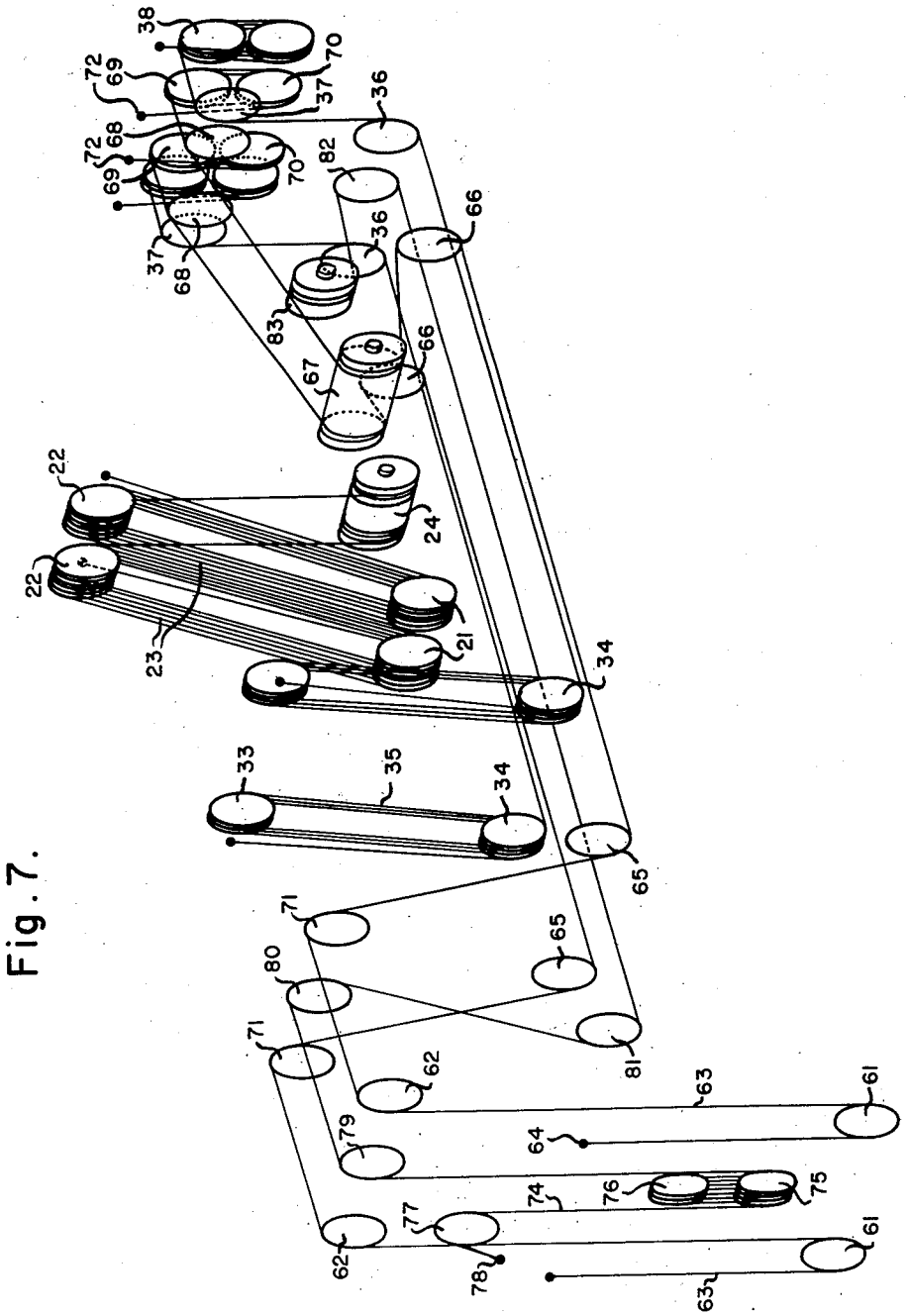


Fig. 7.

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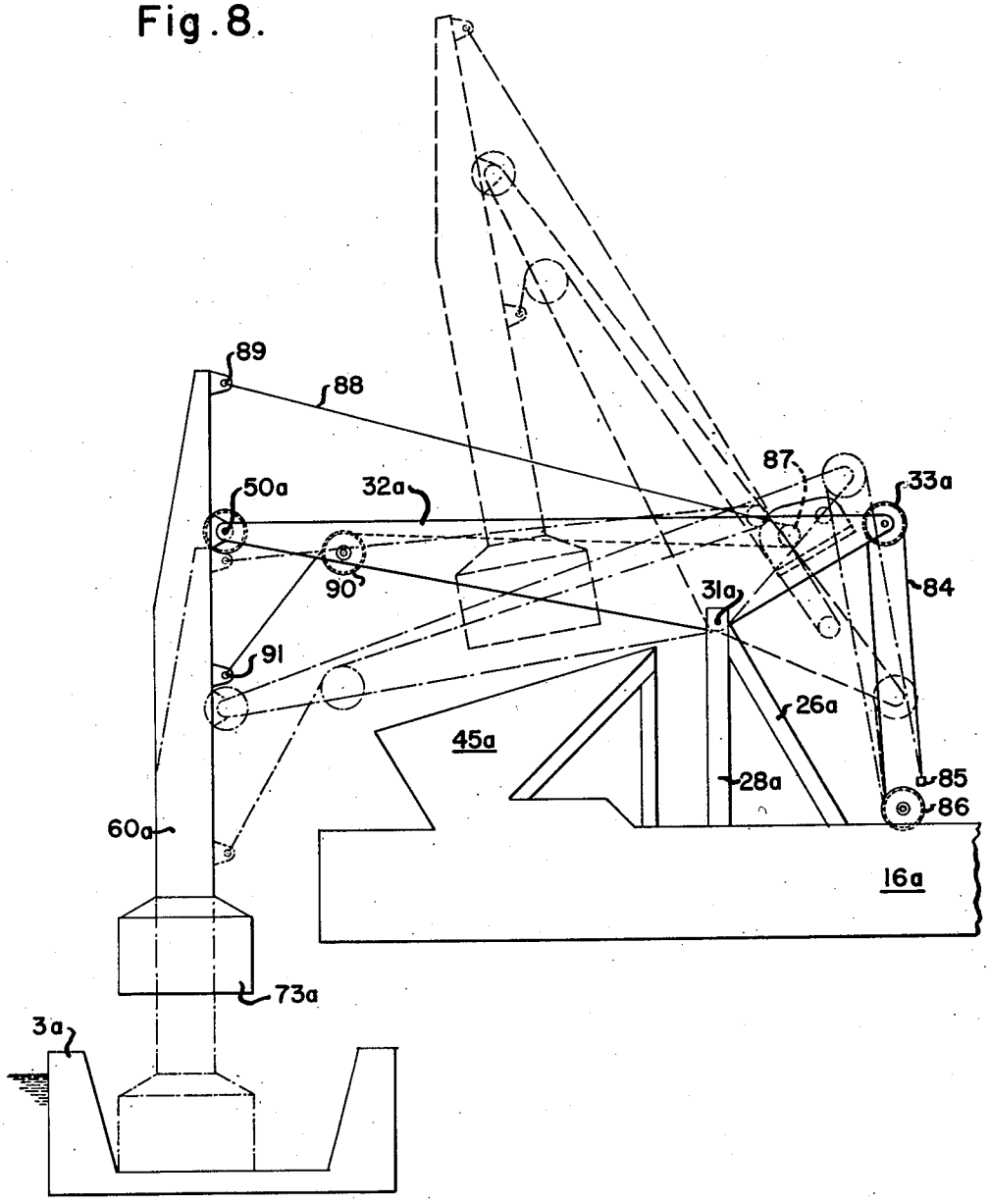
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Fig. 8.



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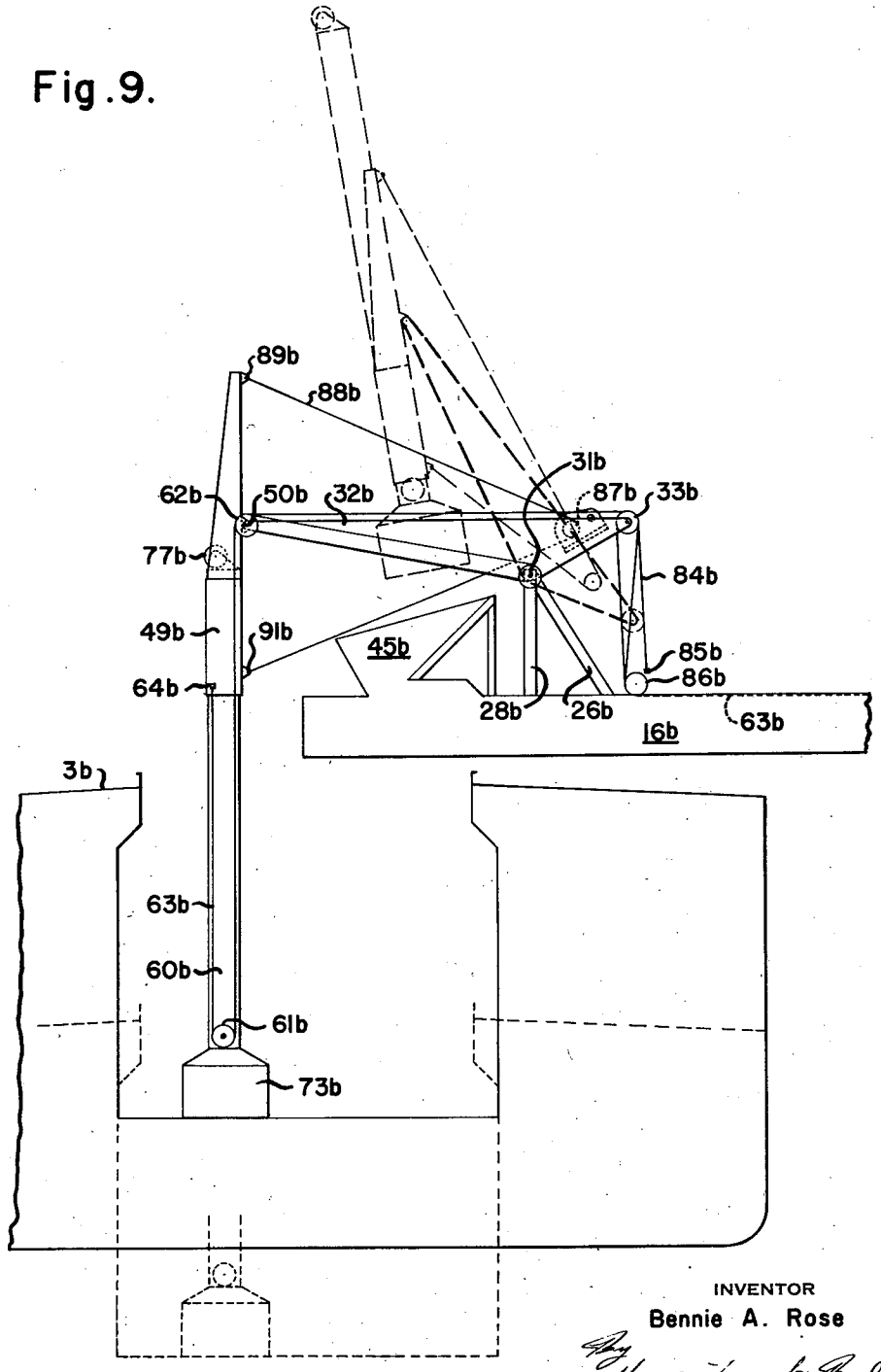
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Fig. 9.



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United States Patent Office 2,796,180 Patented June 18, 1957

2,796,180

UNLOADER

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Application February 9, 1955, Serial No. 487,084

4 Claims. (Cl. 214—14)

This invention relates to an unloader, particularly an unloader for removing bulk material from receptacles such as the holds of vessels, railway cars, trucks, etc. My unloader has especial utility in unloading bulk cargo from the holds of vessels and for purposes of explanation and illustration will be described as so embodied.

A cargo vessel tends to rise in the water as it is unloaded. The extent of rise depends on the capacity of the vessel and whether holds which have been emptied are filled with water ballast during the emptying of the remaining holds. A vessel may rise in the water as much as thirty feet or more during unloading. Also due to tides the level of the water in the ocean and in streams and lakes affected by the tides rises and falls. The level of the surface of the water between high tide and low tide may change as much as twenty feet or more. Further, as a hold of a vessel is unloaded the level of the material in the hold becomes progressively lower relatively to the bottom of the hold. The hold of a vessel may be thirty or more feet deep. Consequently during an unloading operation there may be a wide variation between the level of the material being unloaded and the level to which the unloaded material is being delivered.

In unloading bulk material from a cargo vessel the material is delivered by material handling mechanism to a delivery zone and provision must be made for such delivery of the material despite variation between the level of the material being unloaded and the level to which the unloaded material is being delivered. Also provision must be made for removing material throughout as much of the area of each hold as the size of the hatch permits. Consequently the unloader must in some cases at least be designed to remove bulk material from a vessel throughout a very substantial vertical height range as well as a substantial horizontal range both parallel and perpendicular to the shore or the edge of the unloading dock.

I provide an unloader having great flexibility in operation and which rapidly and efficiently unloads cargo from the holds of vessels under all conditions of change of elevation of the material being unloaded relatively to the unloading dock.

My unloader preferably comprises a generally horizontally shiftable carriage with means thereon for receiving unloaded material together with a generally vertically oriented stem, connections between the stem and the carriage through which the stem is carried by the carriage, means for shifting said connections to move the stem between an outward and downward position and an inward and upward position generally above the receiving means, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means. By "outward" I mean generally in a direction away from the unloading dock toward the vessel being unloaded and by "inward" I mean the converse. The generally horizontally shiftable carriage may through its shifting be projected to a position in which a portion of it is generally above but slightly laterally offset from a hold of a vessel to be unloaded.

The means on the carriage for receiving unloaded material may be a hopper or hoppers, and the hopper or hoppers may discharge onto a conveyor or conveyors which may deliver the unloaded material at a delivery zone where it may be delivered or loaded either directly into receptacles such as railroad cars or trucks or onto another conveyor mounted on the unloading dock. The material handling means carried by the stem at the lower portion thereof may be a bucket. By manipulation of the stem-carried bucket I may unload material from a vessel and deliver the unloaded material onto the same carriage upon which the stem-carried bucket is mounted. The means on the carriage for receiving the unloaded material such as the hopper or hoppers above mentioned may be positioned close to the hatch and the stem-carried bucket may be operated to take material from the hold and deposit it in the hopper or hoppers in a single efficient smooth motion which can be accomplished in a minimum of time. Thus the unloading operation may be accomplished with unprecedented rapidity and efficiency.

The stem may be mounted for generally vertical movement on a generally vertically oriented guide, in which case connections are provided between the guide and the carriage through which the guide is carried by the carriage and means are provided for shifting the connections to move the guide between an outward and downward position and an inward and upward position generally above the receiving means. Mounting of the stem for generally vertical movement on the guide increases the vertical field of operation of the unloader.

A support may be provided on the generally horizontally shiftable carriage together with means for moving the support to different elevations, and the means for receiving unloaded material may be carried by the support and also the stem-carried material handling means may be carried by the support. The support may be a boom pivoted at its end remote from the vessel being unloaded so that the boom may swing in a generally vertical plane to change the elevation of the end thereof which is relatively near the vessel.

Features of my unloader have utility whether carried by a generally horizontally shiftable carriage or not. My unloader may comprise a support, which may be other than a generally horizontally shiftable carriage, together with a generally vertically oriented stem, connections between the stem and the support through which the stem is carried by the support, means for shifting the connections to move the stem between an outward and downward position and an inward and upward position, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means. The support may, for example, be a support movable to different elevations either through rectilinear movement or through pivotal movement. For example, it may be a pivoted boom mounted as above referred to but not necessarily on a generally horizontally shiftable carriage.

My unloader preferably comprises pivoted element means between the stem and the support through which the stem is carried by the support together with means for pivotally moving the pivoted element means to move the stem between an outward and downward position and an inward and upward position, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means. The stem may be pivoted to a member which in turn is pivoted

to the support and means may be provided for controllably changing the angularity between the stem and the member. Means may also be provided for moving the member about its pivot whereby the stem may be moved between an outward and downward position and an inward and upward position. Instead of the stem being pivoted to said member a generally vertically oriented guide may be pivoted thereto and the stem may be mounted on the guide for generally vertical movement relatively to the guide. In either case material handling means are carried by the stem at the lower portion thereof and means are provided for operating the material handling means.

In another aspect my unloader may comprise a support, a generally vertically oriented guide, connections between the guide and the support through which the guide is carried by the support, means for shifting said connections to move the guide between an outward and downward position and an inward and upward position, a stem mounted on the guide for generally vertical movement relatively to the guide, means for so moving the stem relatively to the guide, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means.

I prefer to provide connections including pivoted element means between the guide and the support through which the guide is carried by the support together with means for pivotally moving the pivoted element means to move the guide between an outward and downward position and an inward and upward position. More specifically I may provide an element pivotally connected with the support about a generally horizontal axis, the guide being pivoted at its upper portion to said element about a generally horizontal axis, a second element pivotally connected to the lower portion of the guide and to the support and means for swinging the elements about their pivotal connections with the support to move the guide between an outward and downward position and an inward and upward position, the elements during such movement of the guide determining the orientation of the guide and causing the lower end of the guide to be tilted somewhat inwardly when the guide is in the inward and upward position. The end of the second element connected with the guide may during movement of the guide toward the inward and upward position be moved across the line joining the end of the second element connected with the support and the pivotal connection between the first mentioned element and the guide to cause the lower end of the guide to move inwardly to an optimum extent.

I desirably provide my unloader with means including an adjustable member carried by the support and projecting generally upwardly therefrom providing an adjustably positionable pivot together with a generally horizontally oriented element pivoted thereto, a generally vertically oriented guide, a generally horizontal pivotal connection between said element and the guide so that as said element is turned about its pivotal connection with the support the guide is moved between an outward and downward position and an inward and upward position and means maintaining the orientation of the guide generally vertical during such movement. In such an unloader the orientation of the guide is not maintained exactly vertical as it is somewhat tilted when the material handling means at the lower portion of the stem is brought to discharge position but the amount of tilting is not sufficient to result in spilling a substantial amount of material from the material handling means. The material handling means is desirably an openable and closable bucket.

I may employ in my unloader connections including an element pivoted intermediate its ends to the support and pivoted at one end to the generally vertically oriented guide through which the guide is carried by the support together with counterweight means acting on the other end of said element to counteract the weight of the guide and means mounted thereon and means for moving the connections to move the guide between an outward and downward position and an inward and upward position.

I find it desirable to utilize connections including an element of angular shape pivoted to the support at one end of the element and pivoted to the guide at the other end of the element through which the guide is carried by the support together with motive means connected with said element intermediate the ends thereof to turn the same about its pivotal connection with the support to move the guide between an outward and downward position and an inward and upward position, the guide during such movement being maintained substantially vertically oriented. The support may carry a material receptacle, for example, as a hopper, delivering onto an endless belt or other conveyor and the element of angular shape may be pivoted to the support at the side of the receptacle at one end of the element and pivoted to the guide at the other end of the element, and a second element may be provided which is pivoted to the support and to the guide, motive means being connected with the first mentioned element intermediate the ends thereof to turn the same about its pivotal connection with the support to move the guide between an outward and downward position and an inward and upward position generally above the receptacle, the second element cooperating with the first mentioned element during such movement to maintain the guide substantially vertically oriented.

In a preferred construction I employ two elements each pivoted to the support and to the guide through which the guide is carried by the support, motive means carried by the support, a connection between the motive means and one of said elements for moving the same, together with the other element and the guide, between a position in which the guide is disposed outwardly and downwardly and a position in which the guide is disposed inwardly and upwardly while maintaining the guide generally vertically oriented. The motive means may include a crank connected with one of said elements so that when the crank is in one position the guide is disposed outwardly and downwardly and when the crank is moved to a generally opposite position the guide is moved inwardly and upwardly, said elements maintaining the guide substantially vertically oriented during such movement.

Other details, objects and advantages of the invention will become apparent as the following description of certain present preferred embodiments thereof proceeds.

In the accompanying drawings I have shown certain present preferred embodiments of the invention in which:

Figure 1 is a fragmentary side elevational view of an unloader mounted on an unloading dock for removing bulk material from the holds of vessels, the unloader being shown in position with its bucket disposed at the bottom of a hold of a vessel to remove material therefrom;

Figure 2 is a fragmentary side elevational view similar to Figure 1 but showing the bucket in position to discharge material removed from the hold of the vessel to means for conveying the material to a delivery zone;

Figure 3 is an end elevational view of the unloader in the position shown in Figure 1 as viewed from the left in Figure 1, the vessel being omitted in Figure 3;

Figure 4 is a fragmentary vertical transverse cross sectional view to enlarged scale taken on the line IV—IV of Figure 1;

Figure 5 is a fragmentary vertical transverse cross sectional view to enlarge scale taken on the line V—V of Figure 1;

Figure 6 is a fragmentary vertical transverse cross sectional view to enlarged scale taken on the line VI—VI of Figure 1;

Figure 7 is a schematic diagram showing the reeving of the unloader;

Figure 8 is a fragmentary diagrammatic side elevational view of an unloader of modified structure; and

Figure 9 is a fragmentary diagrammatic side elevational view of an unloader of further modified structure.

Referring now more particularly to the drawings, there is shown at 2 an unloading dock alongside water 12 in which floats a cargo vessel 3. The water may be the ocean or a river, lake, canal or other body of water. The water may be influenced by the tides or not, but my invention has especial utility in the unloading of vessels whose elevation relatively to the unloading dock changes substantially due to change in the tide or rising of the vessel due to decreased displacement as it is being unloaded or for both reasons. The vessel 3 is shown in Figure 1 in solid lines at a relatively high elevation and in chain lines at a relatively low elevation in relation to the unloading dock 2. My unloader, as will appear from the following description, is adapted for efficiently unloading the vessel at all elevations in relation to the dock.

Mounted upon the dock 2 and extending generally parallel to the edge of the dock against which the vessel lies are parallel sets of rails 4 upon which a gantry 5 is mounted through wheels 6. Only one of the parallel sets of rails is shown because of the fragmentary nature of the drawings but it will be understood that there is another set to the right of the structure shown in Figures 1 and 2. The gantry is movable parallel to the length of the vessel on the rails 4 so that all of the holds of the vessel from bow to stern may be unloaded. The gantry 5 carries rails 7 disposed substantially at right angles to the rails 4, i. e. crosswise of the vessel, providing for unloading of each hold throughout the entire width of its hatch or hatches. Mounted on the rails 7 through wheels 8 is a carriage 9. The carriage is movable to selected positions crosswise of the vessel so that by correlated movements of the gantry and carriage all portions of all holds in the vessel can be reached.

The carriage is provided with a delivery chute 10 adapted to receive material which has been unloaded from the vessel as will presently be described and to deliver that material generally downwardly. That material is received by an endless belt conveyor 11 carried by the gantry and extending parallel to the rails 7 so that in all positions of the carriage 9 the chute 10 delivers unloaded material onto the conveyor 11. The conveyor 11 is driven so that the upper or active reach thereof moves toward the right viewing Figure 1. It discharges the unloaded material received from the chute 10 through another chute (not shown) which delivers the material at a delivery zone either directly into receptacles such as railroad cars or trucks or onto another conveyor mounted on the dock and extending parallel to the rails 4.

The carriage 9 includes structural framework 13 and a tower 14. Since the tower 14 is to resist stresses acting on its upper portion toward the left as will presently appear the tower is guyed from the right to the structural framework of the carriage by links 15.

A boom 16 is mounted on the carriage, being pivoted to the carriage at 17 for turning movement relatively to the carriage about a horizontal axis parallel to the rails 4. The boom is elongated in the direction crosswise of the vessel and is adapted to be swung in a vertical plane about the axis 17 to raise and lower its left-hand end which carries the primary unloading mechanism as will presently be described. The position of the boom is determined by reeving 18 extending between the top of the tower 14 and links 19 connected with the boom at 20. The reeving 18 includes sheaves 21 at the upper ends of the links 19, sheaves 22 at the top of the tower 14 and lines 23 extending about the sheaves 21 and 22 and to a drum 24 (Figure 7) mounted in the carriage. When the left-hand end of the boom 16 viewing Figure 1 is to be lowered the drum 24 is turned in the clockwise direction viewing Figure 7 to pay off the lines 23 and the left-hand end of the boom moves downwardly due to gravity. When the left-hand end of the boom is to be raised the drum is turned in the counterclockwise direction to wind up the lines 23 and hence shorten the distance between the sheaves 21 and the sheaves 22 and elevate the end of the boom.

Pivoted to the boom at 25 are opposed identical parallel links 26. The links 26 are pivoted at 31 to a guide arm 32 which is carried by the pivot for swinging movement about the axis thereof. Pivoted to the boom at 27 are opposed identical parallel adjustable links or columns 28. The adjustable links or columns 28 are united at their upper portions by a structure 28*a* which has parallel internally threaded bores 29 (Figure 5). Also pivoted to the links 26 and the guide arm 32 at 31 are two identical generally downwardly extending screw jacks 30 which screw into the internally threaded bores 29. By turning the screws 30 in the bores 29 the adjustable links or columns 28 may be adjusted in length. A reversing electric motor 30*a* is mounted on the structure 28*a* and through a speed reducer 30*b* and connections 30*c* the motor is adapted to turn the screws 30 in either direction to adjust the length of the links 28.

The length of the adjustable links 28 determines the location of the pivot 31 as the links 26 are of fixed length. As the adjustable links 28 are lengthened the pivot 31 moves upwardly relatively to the boom and also somewhat to the right viewing Figure 1. For each posion of the boom 16 there is an optimum position of the pivot 31. As the left-hand end of the boom 16, viewing Figure 1, is lowered the pivot 31 should be raised. The optimum position of the pivot 31 for each position of the boom 16 is that position which results in the stem presently to be described being oriented substantially vertically when the stem is positioned to remove material from a hold of a vessel. Thus the lower the position of the left-hand end of the boom the longer should be the adjustable columns 28 whereby to maintain the stem substantially vertical when it is positioned to remove material from a hold of a vessel.

As will presently appear, only the portion of the guide arm 32 to the left of the pivot 31 viewing Figure 1 functions in operation of the unloader, but since a heavy load is carried by the left-hand end of the guide arm that arm is extended to the right from the pivot 31 and provided with sheaves 33. Cooperating sheaves 34 are carried by the boom and lines 35 extend about the sheaves 33 and 34 and thence about sheaves 36, 37 and 38 to counterweights 39. The counterweights 39 exert downward force on the right-hand end of the guide arm 32 to counteract at least a substantial part of the downward force exerted on the left-hand end of the guide arm.

The boom carries two parallel endless conveyors 40 for conveying material to the chute 10. The conveyors 40 are trained about sheaves 41 and 42, the latter being driven, and a slack take-up 42*a* is provided for each conveyor. The conveyors 40 discharge into the chute 10 in any position of the boom. Material is delivered to the conveyors 40 by two parallel feeder conveyors 43. Each of the feeder conveyors 43 delivers the material through one of a pair of parallel chutes 44 onto the corresponding conveyor 40. Two side-by-side hoppers 45 receive material unloaded from the vessel by the means now to be described and direct that material to the feeder conveyors 43 whence it passes through the chutes 44 onto the conveyors 40, through the chute 10 onto the conveyor 11 and to the delivery zone.

At opposite sides of the hoppers 45 are drive arms 47 of generally L shape as shown in Figure 1. Each of the drive arms 47 has a relatively short leg and a relatively long leg. The two drive arms 47 are identical, each being pivoted to the boom at 46 at the end of its short leg. The ends of the long legs of the drive arms 47 are pivoted at 48 to a guide 49. Also, the left-hand end of the guide arm 32 is pivoted to the guide 49 at 50. Thus the guide arm 32 and the drive arms 47 carry and control the movement of the guide 49.

The boom 16 carries a motive unit 51, which may, for example, be an electric motor with a speed reducer, driving a shaft 52 to which are fixed two driving herringbone pinions 53. The pinions 53 respectively mesh with driven herringbone gears 54 fixed to a shaft 55. Also fixed to the shaft 55 are opposed cranks 56 each of which is connected through a link 57 with the corresponding drive arm 47. Each link 57 is pivoted to the corresponding crank 56 at 58 and to the corresponding drive arm 47 at 59.

The cranks 56 determine the positions of the drive arms 47 and also of the guide arm 32 and the guide 49. The cranks 56 are shown in Figure 1 fully extended toward and in alignment with the links 57 so that the pivot 59 is at the maximum distance from the shaft 55. With the cranks 56 so positioned the guide 49 is in its extreme left-hand position viewing Figure 1 and is oriented with its axis substantially vertical. When the cranks 56 are turned through 180° the drive arms 47 are moved to the position shown in Figure 2 and the guide 49 is moved somewhat upwardly and toward the right and tilted with its lower extremity extending somewhat toward the right and substantially directly above the hoppers 45.

A stem 60 is carried by the guide 49 and is movable up and down relatively thereto, being guided in such movement by the guide. The stem carries near its lower end sheaves 61 and the guide carries at its upper end sheaves 62 coaxial with the pivot 50. Lines 63 are dead-ended to the guide 49 at 64 and pass downwardly and about the sheaves 61 and thence upwardly through the guide and about the sheaves 62. The lines 63 then pass about sheaves 71 carried by the pivot 31 and thence generally downwardly and about sheaves 65 carried by the boom and thence about sheaves 66. From the sheaves 66 the lines 63 pass to and make several turns about the stem hoisting drum 67 and thence extend about sheaves 68 and 69 and about sheaves 70 carrying counterweights (not shown), the lines 63 being dead-ended to the carriage at 72. Thus when the drum 67 is turned in the clockwise direction viewing Figure 7 the stem 60 is raised in the guide 49 while when the drum 67 is turned in the counterclockwise direction the stem 60 is allowed to move downwardly in the guide 49 through the action of gravity.

The stem 60 carries at its lower end a bucket which may for example be a conventional clamshell bucket and which is designated generally by reference numeral 73. The bucket is adapted to be opened and closed in conventional manner by a line 74 passing about bucket dome sheaves 75 and bucket crosshead sheaves 76, one end of the line extending about a sheave 77 carried by the guide 49 and being dead-ended to the guide 49 at 78. The other end of the line 74 passes about sheaves 79, 80, 81 and 82 to a bucket closing drum 83 mounted in the carriage.

There is shown in Figure 1 an operator's station 84 where the operator may observe the unloading operation as it progresses and manipulate controls for moving the gantry along the dock, for moving the carriage in and out on the rails 7 mounted on the gantry, for raising and lowering the boom, for lengthening and shortening the adjustable links 28, for operating the cranks 56 to move the guide 49, for raising and lowering the stem and for opening and closing bucket.

As above explained, the boom is positioned consonantly with the level of the material being unloaded and for each position of the boom the adjustable links 28 are adjusted so that when the stem 60 projects into the hold as shown in Figure 1 it will be substantially vertical. With the cranks 56 in the position of Figure 1 and hence with the guide 49 in the position of that figure, being positioned relatively outwardly and downwardly and with its axis substantially vertical, the stem 60 is lowered into the hold with the bucket 73 open. The bucket is closed to fill it with material whereupon the stem is raised to withdraw the bucket filled with material from the hold. As soon as the stem has reached a sufficient height to allow the guide 49 to be swung upwardly and inwardly without the stem or bucket striking against any portion of the apparatus the cranks 56 are turned 180° and the guide 49 is swung upwardly and inwardly to position the closed bucket filled with material above the hoppers 45. That position of the bucket is shown in Figure 2. With the bucket thus positioned the bucket is opened and the material is discharged into the hoppers 45 whence it passes out to the feeder conveyors 43, through the chutes 44 onto the conveyors 40, through the chute 10 onto the conveyor 11 and to the delivery zone. The cranks 56 are then turned through 180° to the position shown in Figure 1, returning the guide 49 to the position of that figure whereupon the stem 60 is again lowered for repetition of the cycle.

Figure 8 shows an unloader of modified structure in which parts corresponding to parts shown in Figure 1 are designated by the same reference numerals each with the letter *a* appended. The stem 60*a* of Figure 8 is pivoted directly to the guide arm 32*a* at 50*a*. In Figure 8 there is no guide corresponding to the guide 49 of Figure 1 and there is no drive arm corresponding to the drive arm 47 of Figure 1. The guide arm 32*a* is moved about its horizontal pivot 31*a* by lines 84 each dead-ended at 85 to a part of the support 16*a* and passing upwardly and about sheaves 33*a* and thence downwardly and about a drum 86. Turning of the drum 86 in the counterclockwise direction winds up the lines 84 and turns the guide arm 32*a* in the clockwise direction about its pivot 31*a*. Turning of the drum 86 in the clockwise direction pays out the lines 84 and allows the guide arm 32*a* to turn in the counterclockwise direction about its pivot 31*a* due to gravity since the left-hand end of the guide arm 32*a* viewing Figure 8 and the parts carried thereby overbalance the right-hand end of the guide arm. Thus the drum 86 performs the function of the cranks 56 of Figure 1. It moves the guide arm 32*a* between its lowermost position shown in chain lines in Figure 8 through its intermediate position shown in solid lines and to its uppermost position shown in dash lines.

Means are provided for controllably changing the angularity between the stem 60*a* and the guide arm 32*a*. Such means include a drum 87 and means for driving it carried by the guide arm 32*a* and a line 88. The line 88 is dead-ended at 89 to the top of the stem 60*a*, takes several turns around the drum 87 and thence passes about a guide pulley 90 and is dead-ended at 91 to the stem below the pivot 50*a*. When the drum 87 is not rotating the line 88 maintains the stem 60*a* in fixed angularity relatively to the guide arm 32*a*. When the drum 87 is turned in the counterclockwise direction viewing Figure 8 it draws in the lower reach and pays out the upper reach of the line 88, drawing the bucket 73*a* toward the right and thus tilting the stem 60*a*. The opposite result is achieved by turning the drum 87 in the clockwise direction.

The unloader of Figure 8 is adapted for use when there is not a great change in the elevation of the material being unloaded during the unloading operation.

Figure 9 shows an unloader of the general character of the unloader of Figure 8 but incorporating a guide and mounting the stem on the guide for generally vertical movement relatively thereto. In Figure 9 parts corresponding to parts shown in Figures 1 and/or 8 are designated by the same reference numerals each with the letter *b* appended.

In Figure 9 the guide 49*b* is pivoted directly to the guide arm 32*b* at 50*b*. The guide arm 32*b* is moved about its horizontal pivot 31*b* in the same manner as the guide arm 32*a* of Figure 8 is moved as above described.

The stem 60*b* is carried by the guide 49*b* and is movable up and down relatively thereto, being guided in such movement by the guide. The stem carries near its lower

end sheaves **61***b* and the guide carries at its upper end sheaves **62***b* coaxial with the pivot **50***b*. Lines **63***b* are dead-ended to the guide **49***b* at **64***b* and pass downwardly and about the sheaves **61***b* and thence upwardly through the guide and about the sheaves **62***b*. The lines **63***b* then pass about sheaves coaxial with the sheaves **33***b* and about sheaves coaxial with the drum **86***b* to a drum, not shown, which upon being turned in one direction raises the stem and upon being turned in the opposite direction permits the stem to move downwardly by gravity.

I have not shown the bucket operating means in Figures 8 and 9 as they may be similar to the bucket operating means of the structure of Figures 1–7.

The support **16***a* of Figure 8 and the support **16***b* of Figure 9 may be a stationary support or it may be a generally horizontally shiftable carriage shiftable from right to left and vice versa viewing Figures 8 and 9, or it may be a boom pivoted to such a carriage as in the structure of Figures 1–7. In all of the structures shown in the drawings the unloaded material is deposited in hoppers carried by the same support which carries the stem-carried bucket.

While I have shown and described certain present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. An unloader comprising a base, a generally horizontally oriented boom connected with the base for movement of at least an end of the boom to different elevations, said end of the boom projecting outwardly away from the base and being free of undersupport so as to be adapted to extend over a ship, a material receiving hopper connected directly with the boom at the outwardly projecting portion thereof so as to form in effect a part of the boom, conveying means carried by the boom for conveying material from the hopper to a delivery point, a generally vertically oriented stem, connections between the stem and the boom through which the stem is carried by the boom, means for shifting said connections to move the stem between an outward and downward position and an inward and upward position generally above the hopper, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means.

2. An unloader comprising a base, a generally horizontally oriented boom carried by the base and connected therewith for movement of at least an end of the boom to different elevations, said end of the boom projecting outwardly away from the base and being free of undersupport so as to be adapted to extend over a ship, a material receiving hopper connected directly with the boom at the outwardly projecting portion thereof so as to form in effect a part of the boom, conveying means carried by the boom for conveying material from the hopper to a delivery point, a generally vertically oriented stem, connections between the stem and the boom through which the stem is carried by the boom, means for shifting said connections to move the stem between an outward and downward position and an inward and upward position generally above the hopper, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means.

3. An unloader comprising a base, a generally horizontally oriented boom pivoted to the base about a generally horizontal axis so that an end of the boom is movable to different elevations, a material receiving hopper connected directly with the boom so as to form in effect a part of the boom, conveying means carried by the boom for conveying material from the hopper to a delivery point, supporting means shiftably carried by the boom, an arm pivoted to the supporting means, another arm pivoted to the boom, a generally vertically oriented stem carried by said arms, means for shifting said arms to move the stem between an outward and downward position and an inward and upward position generally above the hopper, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means, the supporting means being shiftable relatively to the boom to shift the position of the pivotal connection therewith of the first mentioned arm to maintain the stem in generally vertical orientation despite turning of the boom to different positions about its pivotal connection with the base.

4. An unloader comprising a base, a generally horizontally oriented boom connected with the base for movement of at least an end of the boom to different elevations, said end of the boom projecting outwardly away from the base and being free of undersupport so as to be adapted to extend over a ship, a material receiving hopper connected directly with the boom at the outwardly projecting portion thereof so as to form in effect a part of the boom, conveying means carried by the boom for conveying material from the hopper to a delivery point, a generally vertically oriented guide, connections between the guide and the boom through which the guide is carried by the boom, means for shifting said connections to move the guide between an outward and downward position and an inward and upward position generally above the hopper, a stem mounted on the guide for generally vertical movement relatively to the guide, means for so moving the stem relatively to the guide, material handling means carried by the stem at the lower portion thereof and means for operating the material handling means.

References Cited in the file of this patent

UNITED STATES PATENTS

606,720	Hulett	July 5, 1898
652,313	Hulett	June 26, 1900
677,718	Titcomb	July 2, 1901
1,007,762	Wright	Nov. 7, 1911
1,281,379	Hudson	Oct. 15, 1918
1,547,533	Thomas	July 28, 1925
1,929,004	Pugh	Oct. 3, 1933
2,425,342	Palmer	Aug. 12, 1947

FOREIGN PATENTS

2,264	Netherlands	Dec. 7, 1917
363,053	Germany	Nov. 3, 1922
876,595	Germany	May 15, 1953