

May 28, 1963

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3,091,353

RETRACTABLE UNLOADER

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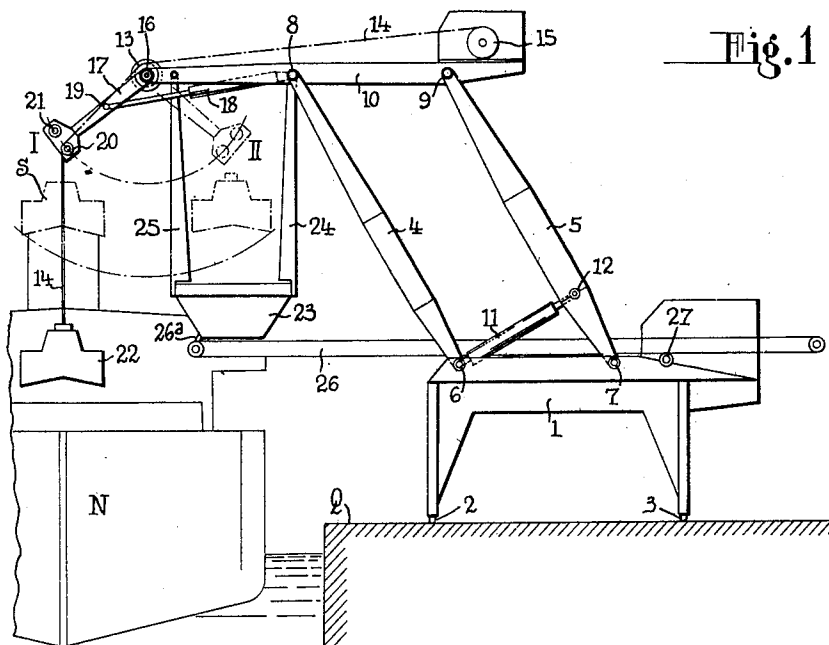
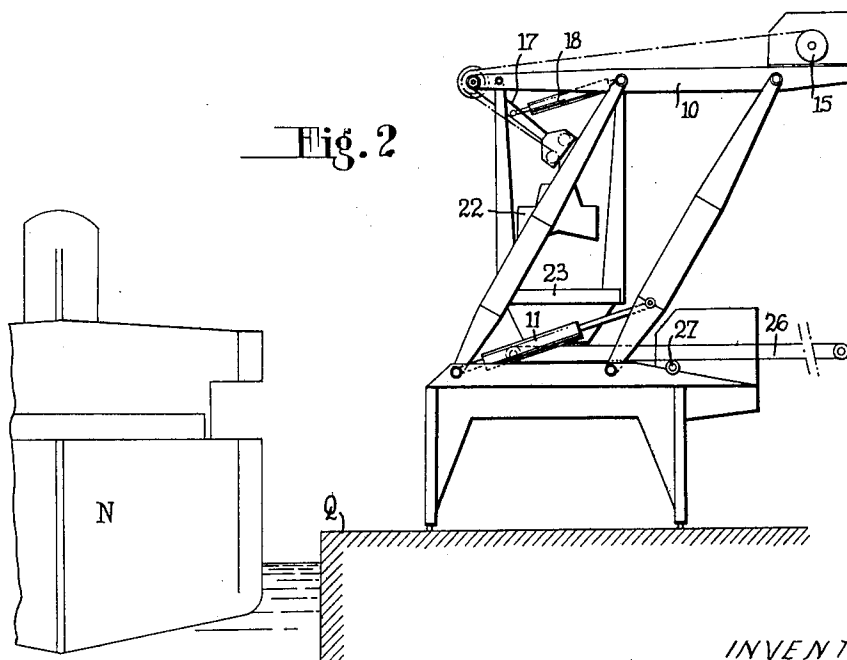


Fig. 2



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Fig. 3

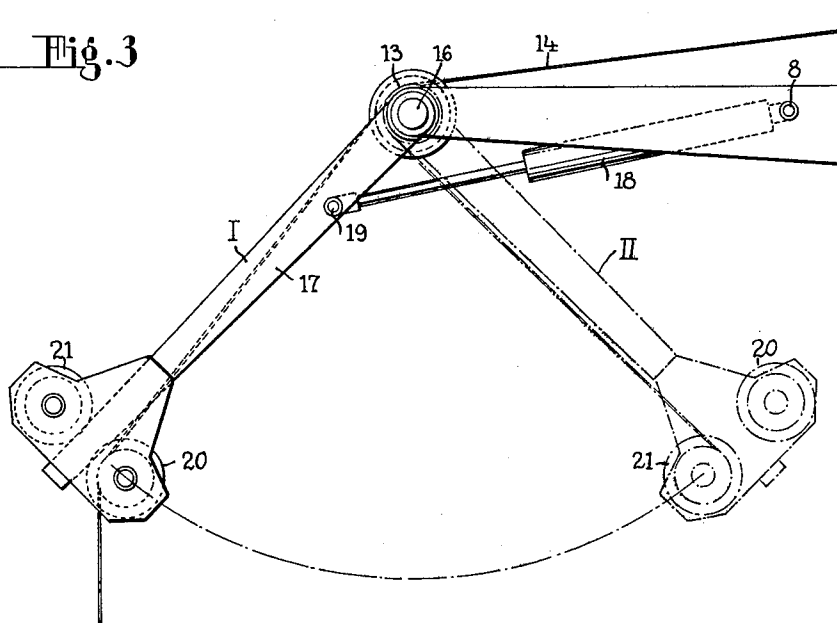


Fig. 4

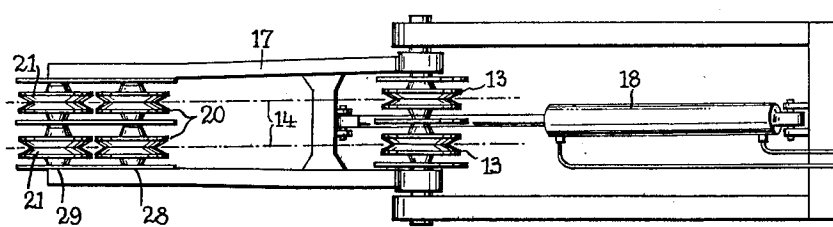
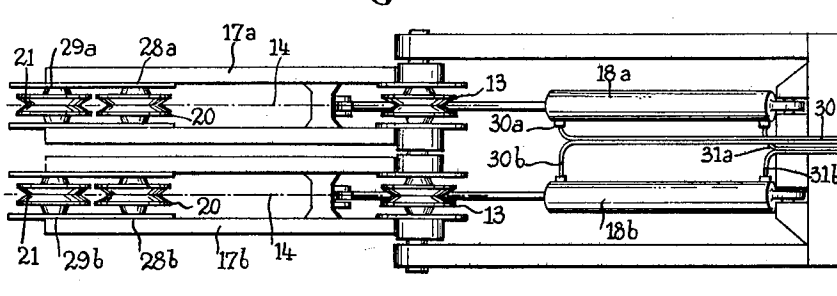


Fig. 5



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ATTY.

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3,091,353

RETRACTABLE UNLOADER

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8 Claims. (Cl. 214—89)

The present invention relates to unloaders and more particularly to apparatus of this type including a grab-bucket suspended from a pendulum arm together with parallelogram linkage means for simultaneously retracting the arm and grab-bucket so that the entire unloader may be moved lengthwise of a pier without interference with the superstructure of a ship to be unloaded which is docked at the pier.

In this type of apparatus, it is necessary for the grab-bucket to be made capable of operating both adjacent to the walls of the ship holds which are on the far side of the pier or quay, and adjacent to the hold-walls which are on the near side of the quay. Since on the other hand, most ships have some sort of superstructure, such as masts, decks and the like, it is necessary, in order to enable the unloading apparatus to be moved lengthwise of the ship, to provide some means whereby the grab-bucket supporting frame may be retracted in a plane perpendicular to the quay so as to clear such superstructure.

It is customary for such operations to use overhead travelling cranes, but such apparatus has the drawback of requiring very extensive manipulations making the operation thereof highly time-consuming.

The load picked by the grab-buckets in the hold must be transported over a great distance to be unloaded on trucks, lorries or to be stored.

Since the buckets are suspended on a carriage equipped with all handling means, such as winch, engine and the like, the whole structure is heavy and the inertia thereof leads to numerous difficulties both in the starting and stopping of the apparatus.

The object of the present invention lies in the provision of a simpler apparatus enabling the aforesaid drawbacks to be overcome.

The unloading apparatus, according to the invention, is essentially characterised in that it comprises in combination: a movable base or gantry arranged to be movable along a longitudinal path, which in practice is formed by rails extending parallel to the quay; a parallelogram link system of swingable beams connected to said base to be pivotally displaced in a vertical plane at right angles to the direction of travel of the base or gantry along the rails, and swingable means such as a pendulum arm member pivoted to the link system and arranged to swing in a vertical plane which is also perpendicular to the direction of travel of the base or gantry, said rocking arm supporting at the end thereof pulleys which guide cables having a grab-bucket suspended thereon, said arm being operated to move said bucket between a position directly above the grab point in the hold to be unloaded and an unloading station which can be reached by a simple swinging movement of said arm member, said unloading station consisting for example of a hopper adapted to supply a conveyor belt operatively connected with the aforesaid parallelogram link system of swingable beams.

The parallelogram beam system is pivotably mounted on the movable base such that the structural members of the lifting apparatus may be moved transversely toward or away from the ship, said members extending, when in operative position, above the ship, i.e. are laterally projecting in relation to the quay, and in particu-

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lar the frame members carrying the rocking arm as well as the hopper and the conveyor belt may be retracted, whereby the apparatus can be rapidly moved along the quay without being impeded by the ship's superstructures.

The rocking arm carrying the grab-bucket is controlled by a hydraulic jack or ram independently of the winch which controls the cables of the grab-bucket.

Further features of the invention will become apparent from the following specification, when read in connection with the accompanying drawings, in which:

FIG. 1 is an elevational showing of the apparatus in its unloading position extended over a ship;

FIG. 2 is a showing of the same apparatus but in retracted position enabling it to be moved longitudinally of the ship towards a hold located behind the ship's superstructures;

FIG. 3 shows one illustrative embodiment of the hydraulically actuated swingable means or cable guiding pendulum arm member;

FIG. 4 is a plan view of the rocking arm according to a first embodiment of the invention, and

FIG. 5 shows a second embodiment of said rocking arm.

In accordance with a first embodiment illustrated in FIGS. 1 to 3, the lifting apparatus forming the subject-matter of the invention is positioned on an unloading quay Q in order to effect the unloading of a ship N, and it comprises a movable base consisting of a gantry 1 arranged to travel along rails 2, 3 which are arranged generally parallel to the quay-side.

Two swingable beams 4 and 5 having the same length are pivotally connected at 6 and 7, respectively, by their bases or lower end portions to the gantry 1, and by their upper end portions, at 8 and 9 respectively, to a boom member or jib 10. The distance between the pivotal connections 8 and 9 is the same as between pivotal connections 6 and 7, whereby the system provides an articulated parallelogram structure or parallelogram link system, the upper horizontally displaceable element of which is comprised within the horizontally extending boom or jib 10 extending, perpendicularly to the edge of the quay, over the ship N.

Intermediate the beams 4 and 5, are positioned one or several hydraulically actuated cylinders or jacks, such as 11, which bear, on the one hand, on the pivot-pin 6 and, on the other hand, on a pin 12 provided in the upwardly extending beam 5.

The jib 10 carries at its end a pair of pulley sheaves 13 (FIGS. 1 and 3), which guide and support the cables 14 which are controlled by a winch 15 mounted on the jib 10. These pulleys 13 are mounted on a pivot pin 16 having a rocking pendulum arm 17 connected thereto (FIGS. 1 to 3), said arm being operated by means of a hydraulic ram or jack 18, connected, on the one hand, to an intermediate portion of the beam 10, by a pivot pin 8, and on the other hand to a pivot pin 19 located intermediate the ends of the rocking arm 17.

The latter arm carries at one end thereof two pairs of pulleys 20 and 21 which support and guide the cables 14 of a grab-bucket 22. This arm 17 is rocked between an outermost position (shown in full lines in FIGS. 1 and 3) and an innermost position (shown in chain or dot-dash lines), each of the cables 14 bearing in the former case on a pulley 20 and, in the latter case, on a pulley 21.

17 in all positions thereof. This first reach always extends longitudinally of the pendulum arm.

It will be observed that the cables 14 comprise a first tends over and is guided by the pulleys 13. The cables 14 also comprise a second reach which depends from the free end portion of the pendulum arm 17. The upper end of

the second reach passes over and is guided by the pulleys 20 with the arm 17 in position I and the pulleys 21 with the arm 17 in position II. The grab-bucket 22 is suspended from the lower end of the second reach.

With the pendulum arm 17 in its innermost position, the grab-bucket 22 is suspended directly above an unloading hopper 23. The hopper 23 is carried by the jib or boom 10, being supported by depending arms 24, 25. One end of a discharge conveyor belt system 26 is supported by the hopper 23 as indicated at 26a. Intermediate its ends, the conveyor belt system 26 rests on rollers or slides 27 mounted on the gantry 1.

The arm member 17 may be arranged either as a unitary single arm as shown in FIG. 4 or as two separate arms as illustrated in FIG. 5.

In the single arm arrangement of FIG. 4 one pair of pulleys, which consists of an inner pulley 20 and an outer pulley 21, is mounted on the same shafts 28, 29 as a second pair of pulleys 20, 21. The position of the unitary arm 17 is controlled by a single hydraulic cylinder or jack 18.

In the double arm embodiment of FIG. 5, each of the cables 14 is guided by an individually supported pair of pulleys 20, 21. One of the pairs of pulleys 20, 21 is freely revoluble on shafts 28a, 29a, respectively. The shafts 28a and 29a are mounted in an arm 17a the position of which is individually controlled by a separate hydraulic cylinder 18a. The other pair of pulleys 20, 21 is similarly freely revoluble on shafts 28b, 29b, respectively which are mounted in another separate arm 17b. The position of the arms 17b is individually controlled by a separate hydraulic cylinder or jack 18b.

In this case, the lines 30a, 30b and 31a, 31b adapted to supply the jacks 18a, 18b are so connected that the fluid supplied from the hydraulic mains simultaneously feeds the two corresponding faces of the jacks; this arrangement enables the load to be suitably distributed over the arms and the lifting cables.

Obviously, in the case of a four-cable bucket, similar means are provided for the controlling of the retaining or bucket-opening cables. The shown means are thus duplicated.

The disclosed apparatus operates as follows:

We will first assume that the apparatus is in the position shown in solid lines in FIG. 1.

By operating the pendulum arm 17, it is possible to adjust the position of the bucket to bring it above the opening of the hatchway; by unwinding the cable by means of the winch 15, the bucket can be then lowered into the hold.

Once the bucket is loaded, the positioning of the cable in relation to the axis of the hatchway can be adjusted, if necessary, by operating in a suitable manner the swingable arm 17; by actuating the winch 15, the bucket can be then lifted to its upper position at I, shown in dot-dash line in FIG. 1. By thereafter pivoting the arm 17 from its outer position indicated at I to its inner position indicated at II, the bucket is brought to a position directly above the hopper or load-receiving device 23 into which it is discharged. As shown in FIG. 1, this may be accomplished without operating the winch 15 except to the small extent required to open the grab bucket 22. The payed-out lengths of the cables 14 remain substantially unchanged except during the lowering and raising of the grab 22 into and out of the hold of the ship N.

After release by the opening the grab 22, the load passes through the hopper 23 to the conveyor system 26 by which it is transported inwardly and away from the ship N to a discharge station located beyond the gantry 1. The conveyor system 26 may include side chutes (not shown) located centrally of the gantry 1 which permit the loading of trucks which are driven between the legs of the gantry 1.

It will be appreciated that the bucket travels are very small, since the unloading or emptying thereof is effected

at a very short distance from the grabbing point thereof, enabling all operations to be carried out very rapidly, as such operations are effected by means of the jack 18 (or jacks 18a, 18b) controlling the swingable arm 17 (or the pair of swingable arms 17a, 17b).

The lifting or suspension cables 14 pass over the sheaves or pulleys 13 and 20 when the bucket is in position I and over the sheaves 13 and 21 when the bucket is in position II; the length of the cable is not substantially varied and the bucket is at all times suspended at the same distance from the pulleys during the generally horizontal movement thereof in the vertical plane of the swingable arm. When the unloading of one hold is completed and operations are to be transferred to another hold located behind the ship's superstructure members, the bucket is positioned in its open condition, i.e. directly above the hopper 23 (position II). The unit consisting of the linkage parallelogram is then actuated by means of the jack 11, and the assembly comprising the hopper 23, the horizontal jib 10, the swingable arm 17, the grab-bucket 22 and the winch 15 is then moved inwardly of the quay-side into the position shown in FIG. 2. During this movement, the conveyor system 29 travels over its supporting rollers or slides 27, as can be seen in FIG. 2; since the apparatus has no portion thereof overhanging the ship or extending beyond the edge of the quay Q, it can be moved on its rails parallel to the quay without interference with the superstructure or other portions of the ship, while the apparatus is thus shifted into a position adjacent to the next hold to be unloaded.

The machine is then returned to extended position shown in FIG. 1 and the previously described operations are repeated.

It will be seen that the grab-bucket can rapidly travel between the loading and the unloading stations, since it has to cover but a small distance and the masses set into motion are comparatively small, whereby the inertia forces to be overcome are rather low, so that the initiation of the load actuation can be effected very rapidly; moreover, in the manner of a pendulum the weight of the bucket located at the end of the swingable arm always acts to facilitate acceleration and deceleration in passing from position I to position II and vice versa.

It will be apparent to those skilled in the art that various changes and modifications may be made in the embodiments of the invention which have been shown and described without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim is:

1. An unloader for the unloading of ships, comprising: a movable base member displaceable longitudinally of a ship to be unloaded, a beam system including a plurality of beams pivotably mounted by the lower end portions thereof on said base member to be rocked in a transverse vertical plane, an upper structure carried by the upper end portions of the beams of said beam system for movement therewith to be extended and retracted thereby toward and away from said ship; pendulum arm means connected to said upper structure for swinging movement in the direction of said vertical plane between first and second positions; cable means including a first reach extending longitudinally of said arm means in all positions thereof and a second reach depending from the free end portion of said arm means; grab-bucket means suspended from said second reach, said grab-bucket means being adapted to be lowered into and raised from a hold of said ship with said upper structure extended and said arm means in said first position; load receiving means carried by said upper structure and positioned below the free end portion of said arm means in said second position thereof; winch means carried by said upper structure and connected to said cable means for operation of said grab-bucket means; power operated means connected to said arm means for moving said arm means selectively between said first and second positions;

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and further power operated means for selectively extending and retracting said upper structure.

2. A lifting apparatus, more specifically adapted for the unloading of ships, comprising: a movable base member displaceable in a longitudinal direction, a beam system including beams pivotally mounted by the lower end thereof on said base member to be rocked in a transverse vertical plane, and an upper structure carried by the upper ends of said beams, said upper structure projecting transversely relative to one of the sides of said system; swingable means mounted on said upper structure at the end thereof to be swung in a transverse vertical plane such that free end of said swingable means can take a first lateral location in a vertical plane remote of said base member and a second lateral location in a vertical plane less remote of said base member, cables guided by said free end of said swingable means, a grab-bucket suspended on these cables, winch means carried by said upper structure for controlling said cables, and load-receiving means adapted to receive a load from the bucket, said load-receiving means being arranged vertically beneath said second lateral location and co-operative with said beam system to be transversely movable therewith, winch means controlling said cables, said winch means being mounted on said upper structure, and actuating means to rock said beam system.

3. A lifting apparatus, more specifically adapted for the unloading of ships, comprising: a movable base member displaceable in a longitudinal direction with respect to a ship being unloaded, one of the longitudinal sides of the apparatus being the operative side; a beam system including beams pivotally mounted by the lower end thereof on said base member to be rocked in a transverse vertical plane and an upper structure carried by the upper end of said beam system, said upper structure projecting transversely relative to the operative side of said system; swingable means mounted on said upper structure at the end thereof to be swung in a transverse vertical plane such that a free end of said swingable means can take a first lateral location in a vertical plane remote of said base member and a second lateral location in a vertical plane less remote of said base member, cables guided by said free end of said swingable means, a grab-bucket suspended on these cables, winch means carried by said upper structure and operatively controlling said cables, load-receiving means adapted to receive a load from the bucket, said load receiving means being arranged vertically beneath said second lateral location and co-operative with said beam system to be transversely movable therewith, and actuating means to rock said beam system between an extended position in which said upper structure is transversely projecting from the base member on the operative side, and a retracted position in which said upper structure is withdrawn from projecting from the base on the operative side.

4. A lifting apparatus, more specifically adapted for the unloading of ships, comprising: a movable base member displaceable in a longitudinal direction with respect to a ship being unloaded, one of the longitudinal sides of the apparatus being the operative side; a pair of equal and parallel beams arranged in a transverse vertical plane and pivotably mounted by the lower ends thereof for pivotal movement about spaced parallel axes lying in a horizontal plane, said axes being perpendicular to said transverse vertical plane, a horizontal jib pivotably connected to the upper ends of said pair of beams to be horizontally displaced in said transverse vertical plane; swingable means mounted at the end of said horizontal jib, to be swung in said transverse vertical plane such that a free end of said swingable means can occupy a first lateral location in a vertical plane remote of said base member on the operative side and a second lateral location in a vertical plane, less remote from said base member, on the operative side; cables guided at said free end of said swingable means, a grab-bucket suspended on

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said cables, load-receiving means adapted to receive the load from said bucket, said load-receiving means being arranged vertically beneath said second lateral location and co-operative with said jib to be moved transversely of said longitudinal direction; actuating means to rock said beams, further actuating means to control the movements of said swingable means, and controlling means to control said cables.

5. A lifting apparatus, more specifically adapted for the unloading of ships, comprising: a movable base member displaceable in a longitudinal direction with respect to a ship being unloaded, one of the longitudinal sides of the apparatus being the operative side; a pair of equal and parallel beams arranged in a transverse vertical plane and pivotably mounted by the lower ends thereof on said base member to be rocked in said transverse vertical plane; a horizontal jib pivotably connected to the upper ends of said pair of beams to be horizontally rocked in said transverse vertical plane; a rockable arm pivotably mounted at the end of said horizontal jib, to be pivoted in said transverse vertical plane such that the free end of said arm can occupy a first lateral location in a vertical plane remote of said base member on the operative side and a second lateral location in a vertical plane, less remote from said base member, on the operative side; a plurality of pairs of parallel, rotatably mounted pulleys at the end of said arm, both pulleys of each pair being in the same plane; a plurality of cables each of said cables passing between the two pulleys of the same pair to bear against and be guided by either of said pulleys in accordance with the inclination of said arm; a grab-bucket suspended on said cables, load-receiving means adapted to receive a load from said bucket, said load-receiving means being arranged vertically beneath said second lateral location and co-operative with said jib to be moved transversely of said longitudinal direction; further actuating means to rock said beams, actuating means to control the movements of said arm, and means to control said cables.

6. A lifting apparatus, more specifically adapted for the unloading of ships, comprising: a movable base member displaceable in a longitudinal direction, one of the longitudinal sides of the apparatus being the operative side; a pair of equal and parallel beams arranged in a transverse vertical plane and pivotably mounted by the lower end thereof on said base member to be rocked in said transverse vertical plane; a horizontal jib pivotably connected to the upper ends of said pair of beams to be horizontally displaced in said transverse vertical plane; a pair of rockable arms pivotably mounted at the end of said horizontal jib to be pivoted in vertical planes parallel to said transverse vertical plane; at least one pulley carried by each arm, two cables passing respectively on the two said pulleys, a grab-bucket suspended by said cables, load-receiving means adapted to receive a load from said bucket, said load-receiving means being disposed vertically beneath the position of said bucket when unloading, said load receiving means being connected for movement with said jib, actuating means to cause said rocking beams to be rocked, hydraulic actuating means hydraulically interconnected to simultaneously control the movements of said two arms, and means controlling said cables.

7. An unloader for the unloading of ships, comprising: a movable base member displaceable longitudinally of a ship to be unloaded, one of the longitudinal sides of the base member being the operative side; a pair of equal and parallel beams arranged in a transverse vertical plane and pivotably mounted by the lower end portions thereof in a common horizontal plane on said base member to be rocked in said transverse vertical plane; a horizontal jib pivotably connected to the upper ends of said pair of beams to be horizontally displaced in said transverse vertical plane; pendulum arm means mounted at the free end of said horizontal jib, to be swung in said transverse

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vertical plane such that the end of said arm means can occupy a first lateral location in a vertical plane remote of said base member on the operative side and a second lateral location in a vertical plane, less remote from said base member, on the operative side; cables guided at the end of said arm means and depending therefrom, a grab-bucket suspended on said cables; hopper means adapted to receive the load from said bucket arranged vertically beneath said second lateral location and secured to said jib to be moved therewith; actuating means to rock said beams, further actuating means to control the movements of said arm means and winch means to control said cables.

8. An unloader for the unloading of ships, comprising: a movable base member displaceable longitudinally of a ship to be unloaded, one of the longitudinal sides of the base member being the operative side; a pair of equal and parallel beams arranged in a transverse vertical plane and pivotably mounted by the lower end thereof on said base member to be rocked in said transverse vertical plane about spaced parallel pivotal axes lying in a common horizontal plane; a horizontal jib pivotably connected to the upper ends of said pair of beams to be horizontally displaced in said transverse vertical plane; pendulum arm means mounted at the end of said horizontal jib, to be swung in said transverse vertical plane such that the free end of said arm means can occupy a first lateral location in a vertical plane re-

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mote of said base member on the operative side and a second lateral location in a vertical plane, less remote from said base member, on the operative side; cables guided at the free end of said arm means and depending therefrom; a grab-bucket suspended by said depending cables; load receiving means adapted to receive the load from said bucket, said load receiving means comprising hopper means arranged vertically beneath said second lateral location and secured to said jib for movement therewith; a conveyor system connected to and extending beneath said hopper means of said load receiving means for receiving material therefrom; means carried by said base member and slidably supporting said conveyor system; actuating means for rocking said parallel beams; further actuating means for moving said arm means between said first and second lateral locations; and winch means carried by said horizontal jib and connected to said cables for controlling said grab-bucket.

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