(No Model.) 2 Sheets—Sheet 1.

W. D. EWART & J. M. DODGE.

ELEVATOR.

No. 480,659. Patented Aug. 9, 1892.

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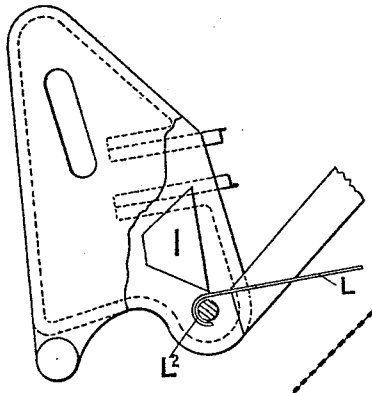

FIG. 2.

FIG. 1.

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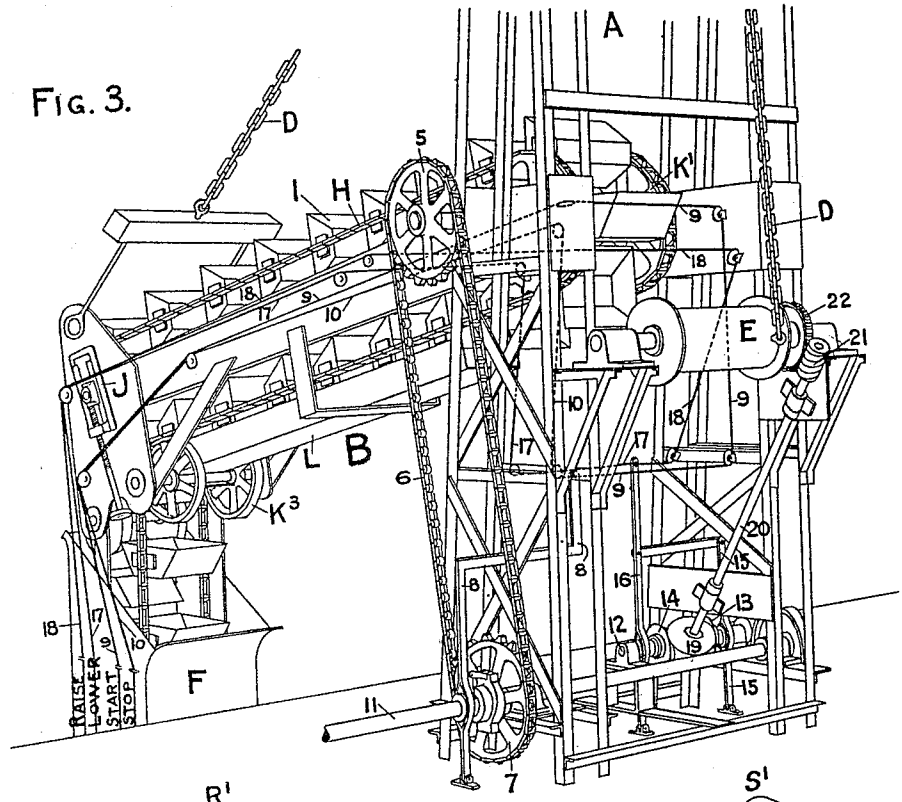
FIG. 3.



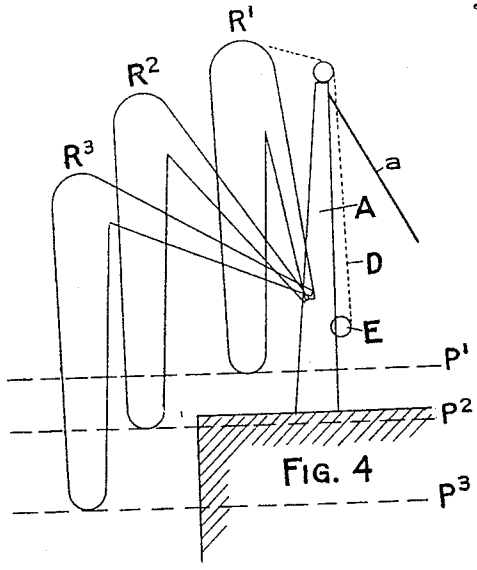


FIG. 4

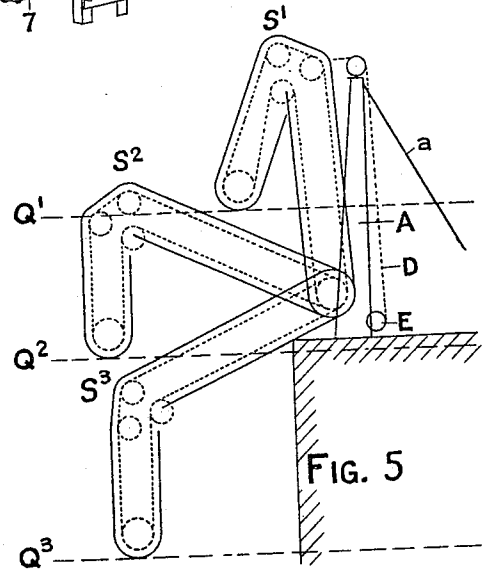


FIG. 5

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UNITED STATES PATENT OFFICE.

WILLIAM D. EWART, OF CHICAGO, ILLINOIS, AND JAMES M. DODGE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO THE LINK-BELT ENGINEERING COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 480,659, dated August 9, 1892.

Application filed November 24, 1890. Serial No. 372,419. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM D. EWART, of Chicago, Cook county, Illinois, and JAMES M. DODGE, of Philadelphia, Philadelphia county, Pennsylvania, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

Our invention relates particularly to what are known as "dock-leg" elevators. These as generally constructed, have been long, heavy, and cumbersome, requiring expensive framework for the leg and its supports and more or less complicated driving arrangements. It has been necessary to extend such elevators to a considerable height in order to let them down into the holds of vessels about vertically and at the same time give the discharge-spout (which reaches from head of elevator to bins or other places of deposit on the dock) a sufficient length and steepness to deliver the material readily at the varying stages of water, especially where it is necessary to provide for a large rise and fall, owing to tide or other causes. The required degree of steepness for free delivery through the discharge-spout varies with the kinds of material handled, and with some materials—such as coal—there is more or less trouble from too abrupt a fall and consequent breakage when elevator is at or near its highest position if the spout is made steep enough for the material to flow through it readily when elevator is at its lowest position. Furthermore, the ordinary form of elevator requires a comparatively high belt speed to obtain a satisfactory discharge over the head-wheels, and the consequent violence in picking up and discharging the load causes additional trouble from breakage.

The primary object of our invention is to overcome the above-mentioned difficulties and furnish an elevator which will operate satisfactorily under conditions of a greatly-increased range of vertical and horizontal movement of the foot of the elevator to suit varying heights of water, depths of holds in vessels, relative location of hatches, &c., a secondary object being to render the entire outfit easy of manipulation.

Our invention consists, mainly, in adapting to the uses of a combined elevator and conveyer a carrier employing two parallel strands of chain or cable with buckets rigidly secured between them, all being arranged as more fully described hereinafter, and as more specifically defined in the claims of this specification.

To enable those skilled in the art to which our improvements relate to understand and practice the same, we will now proceed to describe our invention more fully, referring to the accompanying drawings, which form part of this specification, and in which similar letters and numbers refer to similar parts throughout the several views.

Figure 1 is a side elevation of a dock-leg elevator constructed in accordance with our invention. Fig. 2 is an enlarged view of a portion of the outer end of the boom, shown partially in cross-section, illustrating particularly the curved end of the conveyer-trough bottom of the boom. Fig. 3 is an enlarged perspective view of the driving machinery, power appliances, shifting-levers, cables, &c., by which the outfit is operated. Fig. 4 is a diagram side view of an ordinary dock-leg elevator, drawn on a small scale, illustrating different positions, as more fully explained hereinafter; and Fig. 5 is a similar view of an elevator made in accordance with our invention, illustrating especially the greater range of movement permitted by its construction.

A is a framework shown as securely held in an upright position by guys, as at *a*, and serving as a tower or mast by which the boom B is supported. The latter is a framework pivoted at C in bearings preferably concentric with the head-shaft of the carrier, and its outer end is raised and lowered by a chain or cable D, which passes over the top of mast A down to winding-drum E. From the outer end of the boom is suspended an elevator-leg F, which is pivoted at G. Boom B and elevator-leg F are fitted to hold in working position the carrier-chains (or cables) H and buckets I, the lower portion of the boom being formed into a sort of conveyer-trough, along which the loads or charges of the buckets are moved in greater or less engagement with the buckets, depending on the angle at which the boom is standing.

K′ are the head-wheels, K^2 the foot-wheels, and K^3, K^4, and K^5 are idler wheels, over which the chains run at the junction of the elevating and conveying sections of the carrier. The slack in the carrier-chains is provided for by take-up bearings J, which carry the idler-shaft on which wheels K^4 are located. At its inner end the conveyer-trough bottom L of the boom B connects with a discharge-chute L^3, preferably through the medium of a hinged spout end L′, and at the outer end it extends between the wheels K^3, and is curved partially around the shaft at L^2 in such a manner as to form for the conveyer-trough (at whatever operative angle it may stand) a sort of receiving-spout to take care of such material as may drop from the buckets in turning, and feed it into the trough as the buckets move forward. The direction of motion of the chains and buckets is indicated by arrows above and below the boom, and shown by the positions of the buckets.

N is a barge or vessel from which the elevator is receiving its load, O being the hatch through which the elevator is let down into the hold.

R′, R^2, and R^3 in Fig. 4 are different positions of an ordinary dock-leg, and S′, S^2, and S^3 in Fig. 5 are different positions of our dock-leg corresponding somewhat with the preceding, but with differences to be more fully explained hereinafter. Dotted lines P′, P^2, and P^3 show the levels of the foot of ordinary elevator in positions R′, R^2, and R^3, respectively, and Q′, Q^2, and Q^3 show levels of the foot of our elevator in positions S′, S^2, nd S^3, respectively.

5 is the driving-wheel on the head-shaft of the carrier.

6 is the driving-belt connecting wheel 5 with outside driving-wheel 7, which latter is fitted with a clutch operated by bent lever 8, this lever in turn being moved in one direction by rope or cable 9 to throw the clutch into engagement and in the other direction by rope 10 to throw out of engagement. Wheel 7 is on shaft 11, which drives shaft 12 by spur-gearing arranged to increase the speed. On shaft 12 we locate two bevel-gears 13 and 14, provided with clutches operated by levers 15 and 16, respectively, so connecting the levers that one clutch cannot be thrown into engagement until after the other is thrown out. Ropes or cables 17 and 18 control the movements of levers 15 and 16. Bevel-gears 13 and 14 engage suitably with bevel-gear 19, forming a reversible drive for shaft 20, the latter carrying worm 21, which engages with worm-gear 22, driving the shaft on which drum E is located.

From the above description it will be seen that when the operator on the vessel wishes to raise the elevator he pulls on rope 18, which, working through lever 16, bevel-gears 14 and 19, shaft 20, and worm-gearing 21 and 22, starts drum E to revolving in such a direction as to wind up cable D and raise the end of the boom. To lower the elevator, he pulls on rope 17, which through intermediate mechanism corresponding to the above-described agencies revolves drum E in the opposite direction, paying out cable D and lowering the end of the boom. We arrange to have an intermediate position for levers 15 and 16 where the clutches on gears 13 and 14 are both out of engagement, so that no motion will be transmitted to the worm-shaft and drum when the elevator is at any desired stationary position. We also sometimes arrange to counterweight the boom and leg so as to render the above-described movements easier of effectuation and permit a certain degree of hand adjustment of the elevator-leg in the hold of the vessel. To start the operation of the elevator chains and buckets, rope 9 is pulled, throwing the clutch on wheel 7 into engagement through the medium of lever 8, thus connecting the main driving-shaft with the head shaft of the carrier through wheels 7 and 5 and belt 6. Pulling on rope 10 will stop the carrier by throwing the clutch out of engagement. The ropes or cables run out along the boom and down the elevator-leg within easy reach of the operator on the vessel.

It is evident that any style of clutches, friction-gearing, and plain or reversible driving mechanisms can be used in the above-described work without departing from the spirit of our invention, and we have merely shown the above as a simple and effective arrangement, which we have thus far successfully adopted.

In dock-leg elevators as usually constructed the framework of the discharge-spout serves as a boom, and the highest position which can be reached is shown by R′ in Fig. 4. The position R^2 represents the highest point at which the elevator is operative in handling such material as coal without such an abrupt fall as to cause excessive breakage, and the position R^3 is the lowest at which the coal will flow down the spout freely. The arc of the circle through which the boom moves in passing from R′ to R^2 and the corresponding change of level of the foot of the elevator from P′ to P^2 is generally utilized for getting the elevator over the side of the vessel into the hatch, and the remaining arc of the circle and change of level in passing from R^2 to R^3 and P^2 to P^3 is required for the variations in depths of holds, height of water, &c. With our form of elevator the angle of the boom in S^2 may correspond to that in R^3, leaving all the change of level from Q′ to Q^2 for adjustment of elevator over the side of the vessel, if desired, while the elevator by reason of our improvements is rendered operative at any position between S^2 and S^3, giving a change of level from Q^2 to Q^3 and more than doubling the range of adjustability for either purpose, at the same time not being limited to the position S^2 as the highest operative position or as the lowest adjustment for getting over the

side of the vessel. The range of movement of the foot of the elevator toward and away from the dock, as shown in dotted lines in Fig. 1, is a further advantage, saving much of the labor of "trimming" in the hold of the vessel, required in the use of the ordinary forms, which are necessarily so long as to make this adjustment inconvenient or impossible. The lightness of the outfit and ease of manipulation made possible by our improvements render the above-described large ranges of movement practical and very useful.

The comparatively high belt speed required in ordinary dock-leg elevators to obtain a discharge by centrifugal force is wholly unnecessary in our device, and we are enabled to run our elevator-belts at as slow a speed as may be found desirable, and thus prevent all violence in picking up and discharging the material.

As mentioned above, more or less trouble arises in the ordinary forms of dock-leg elevators from too steep a descent from the head of the elevator for the safe delivery of coal and analogous materials when elevator is at its highest point; but in our improved form the connection between head of elevator proper and the dock is the boom along which the carrier drags the load, so that a great height for obtaining a discharge is unnecessary, and even if the rise and fall of water should at times be excessive, requiring an unusual elevation of the outer end of the boom, the buckets would serve to retard the fall of the material enough to prevent injury to it.

If it is desired, the tower A can be arranged on wheels and tracks and made adjustable along the entire front of the dock, and this can be the more readily done because of the comparatively short and light framework of our device, which admits of the employment of lighter supports on the dock than would be required for the ordinary dock-leg elevators. If preferred, our device can of course be attached directly to a warehouse or other permanent structure on the dock, or it can be used in other locations—as, for instance, in the work of unloading cars instead of vessels—or various other modifications could be adopted to suit the circumstances without departing from the spirit of our invention.

In practical operation our carrier serves first as an elevator in lifting material from the hold of the vessel, and next as a conveyer, each bucket pushing its charge along the trough-bottom formed in the boom. The material is delivered at the inner end into the chutes or spouts L' and L^3 by a gradual descent and a natural and easy flowing or sliding motion, thus being "handled" but once in the passage from vessel to dock, and by a method which involves no abrupt fall to cause breakage, the material never being thrown from the buckets.

In order to make a permanent, substantial, and simple bootjack for the elevator-leg and confine the movements of the buckets at that point to a constant circular path, we use stationary journal-bearings for the foot-shaft instead of the adjustable bearings or "take-ups" usually employed there, and apply the take-ups to the upper idler-shaft, as shown at J, where the adjustment will not interfere with the carrying side of the elevator and will the more readily take care of the slack thrown into the chains as they pass off of the head-wheels.

Some of the advantages of our improvements might be obtained by arranging to have the elevator and conveyer formed separately, the former delivering directly into the latter, or a continuous carrier could be constructed on substantially the same plan as shown above, with the exception of a reversal of the motion of the belting and the utilization of the upper run of the conveyer-section instead of the lower; but either of these plans would involve a more or less forcible discharge of the material, and for this reason we have preferred to construct the device in the manner which we have shown in the drawings, and which we have described hereinbefore.

What we claim as new, and desire to secure by Letters Patent, is—

The combination of the following instrumentalities arranged and operating together in substantially the manner hereinbefore described, viz: a framework serving as a boom, provided with a conveyer-trough bottom, an elevator-leg pivotally suspended from said boom, and a continuous double-strand bucket-carrier running over suitable wheels mounted in the framework of said boom and elevator-leg, the buckets of which carrier lift the material bodily in the elevator-leg and then push or scrape it along the trough-bottom of the boom to a suitable place of discharge.

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