(No Model.) 3 Sheets—Sheet 1.

# C. CHASE.

## ENDLESS CHAIN ELEVATOR.

No. 362,571. Patented May 10, 1887.

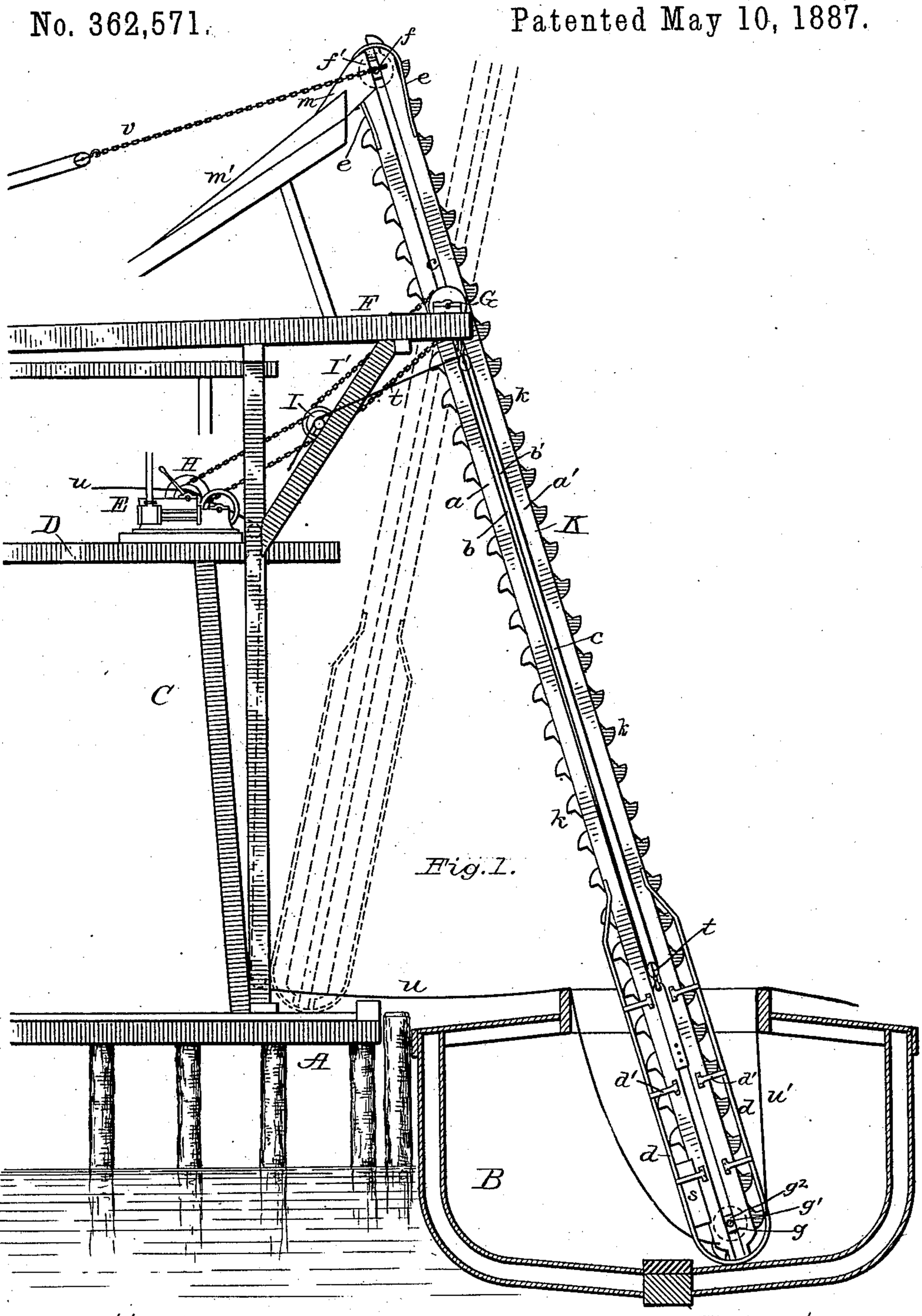


Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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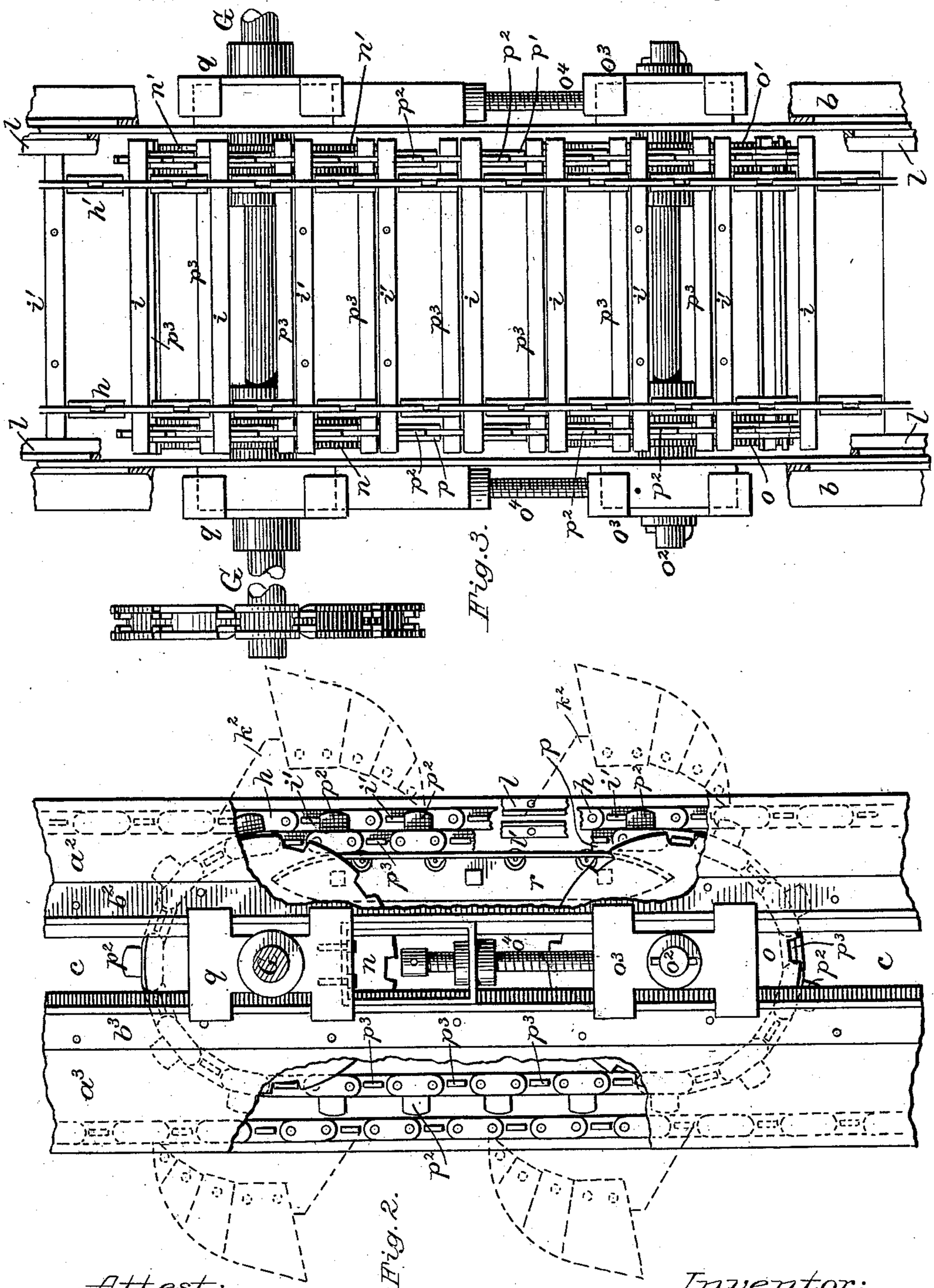

Fig. 3.



Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

# C. CHASE.

## ENDLESS CHAIN ELEVATOR.

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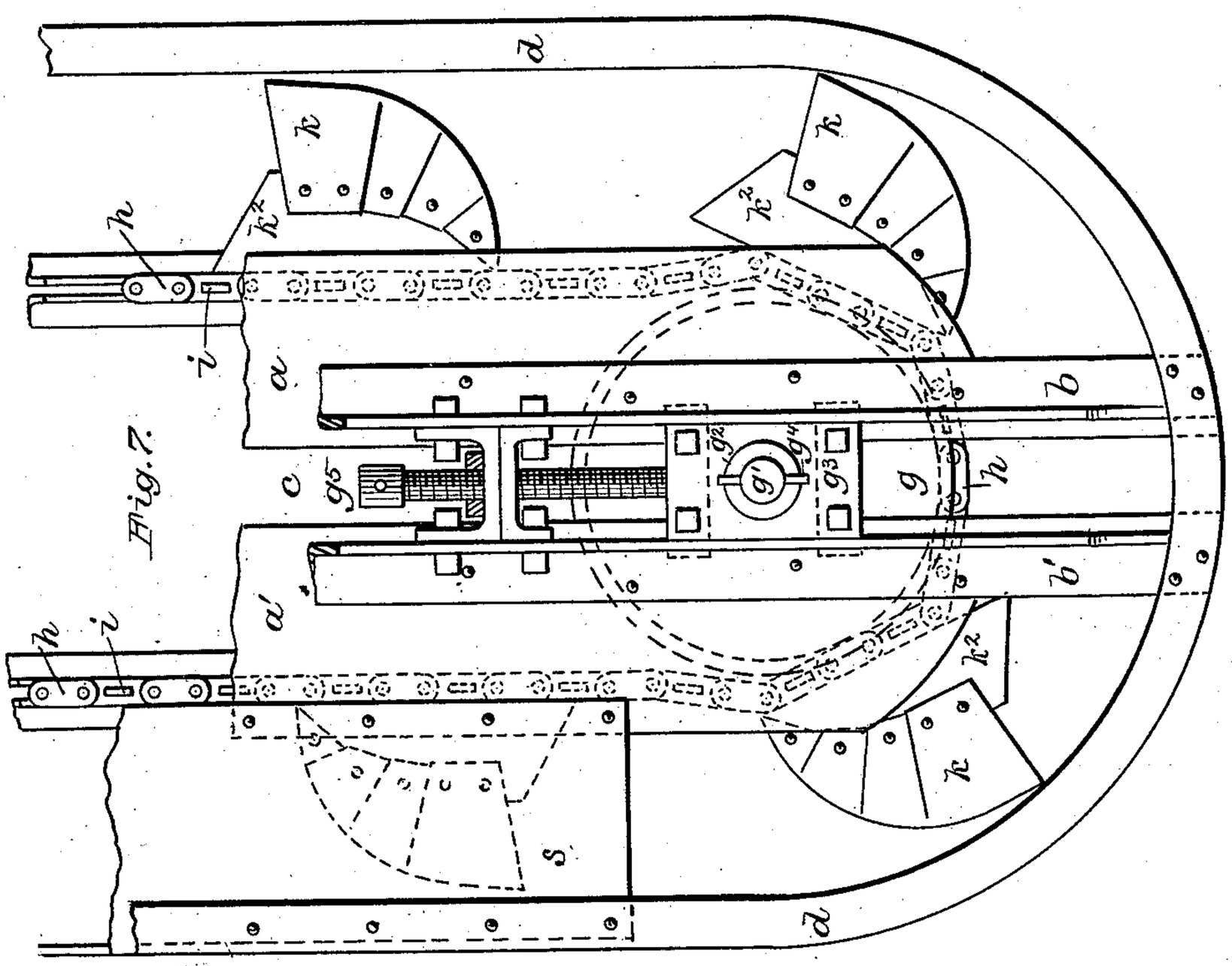

Fig. 7.

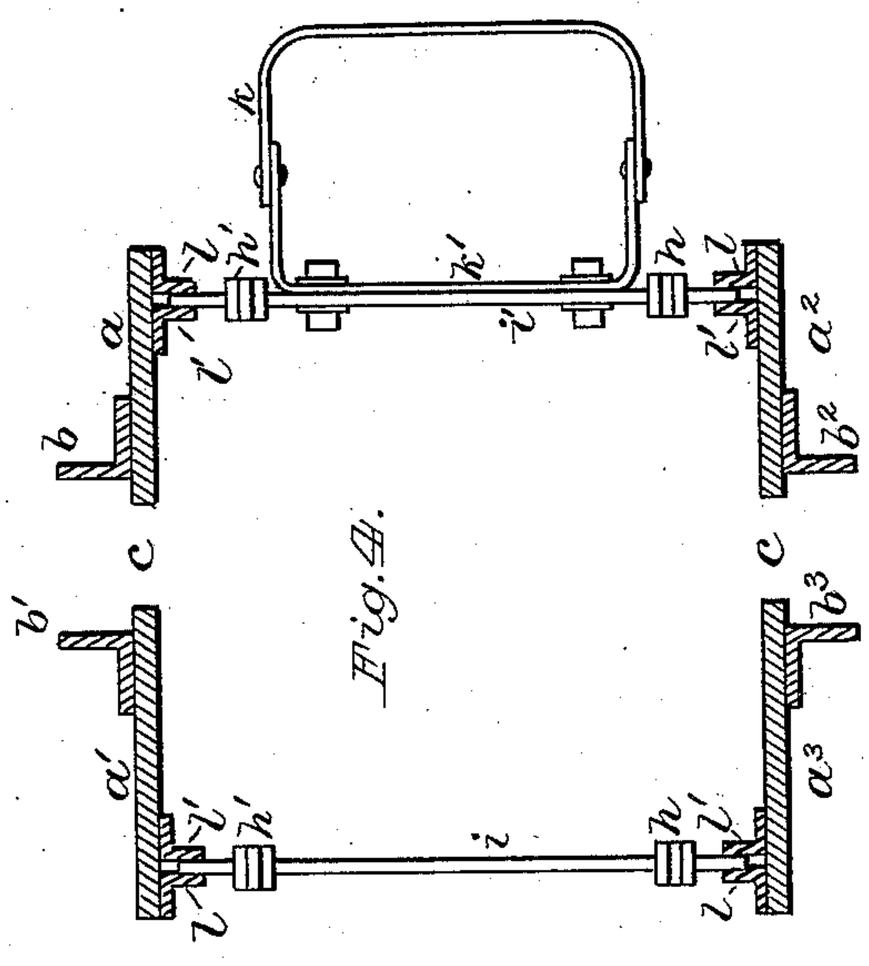

Fig. 4.

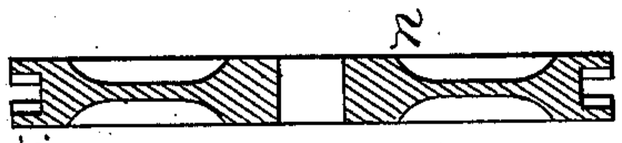

Fig. 5.

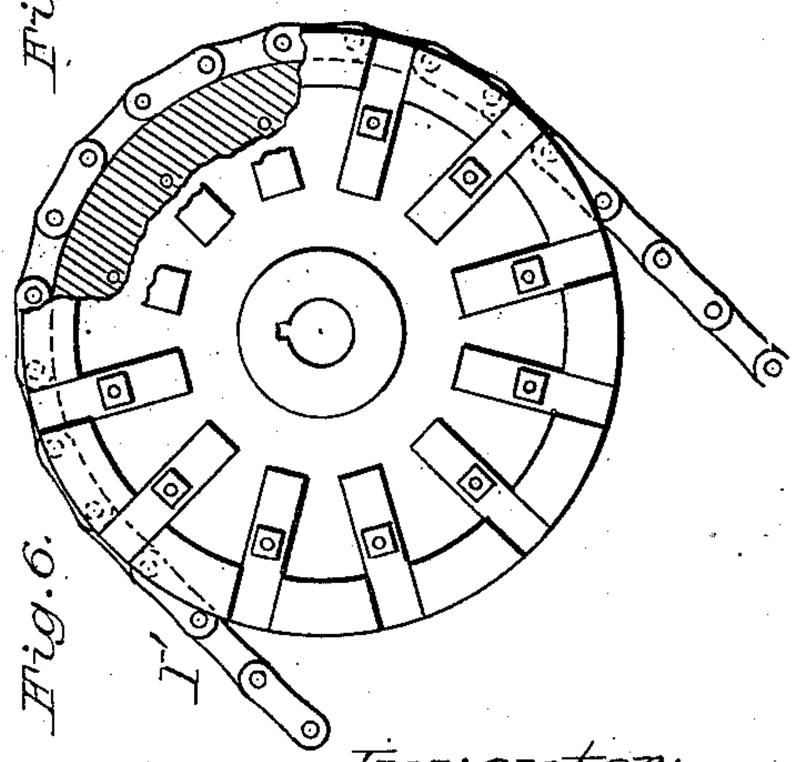

Fig. 6.

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# UNITED STATES PATENT OFFICE.

CLARK CHASE, OF FALL RIVER, MASSACHUSETTS.

## ENDLESS CHAIN ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 362,571, dated May 10, 1887.

Application filed November 10, 1886. Serial No. 218,490. (No model.)

*To all whom it may concern:*

Be it known that I, CLARK CHASE, of the city of Fall River, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Endless Chain Elevators for Unloading Vessels; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of my invention.

My said improvements have been devised with special reference to transferring coal from vessels to other vessels, or to storage-pockets, and they will be found of equal value in connection with transferring other heavy bulk freights, such as ores, molding-sand, or even grain, the latter, however, requiring mechanism of a somewhat lighter and less expensive character.

An apparatus embodying my invention essentially involves endless chains on which many buckets are mounted and are continuously carried, as in many other prior elevators; and the objects of the several features of my invention are to provide a highly effective and desirable apparatus which can be readily handled and adjusted, and which requires comparatively little power to operate it, and which can be economically constructed.

It is well known that it is generally desirable that coal should be lifted to a considerable height, in order to provide for gravity distribution by the way of chutes or conductors into each of a group of pockets, and that even if a single pocket is to be filled the height of lift would be such as to involve generally a considerable weight of coal in continuous vertical transit; and one feature of my invention consists in communicating power from the motor to the endless bucket-chains at a fixed point and by way of one or more endless driving-chains provided with lugs, and so operated in conjunction with the bucket-chains that several of said lugs will be at all times in lifting engagement with the bucket-chains, as distinguished from the use of sprocket-wheels which directly engage with bucket-chains, as heretofore. Said prior sprocket-wheels have heretofore been located at either the upper or the lower ends of the frame which carries the endless bucket-chains, or between such guide pulleys or rolls as have been used at the top and bottom of the elevator-frame. In this latter case it is impracticable to have the sprocket-wheel lugs engage with the bucket-chains at more than one point in their length and on one horizontal line, thus concentrating all the lifting strain at a single point on the bucket-chains. In such machines as have had the power applied to sprocket-wheels at either end of the bucket-chain frame many lugs can be made to simultaneously engage with the bucket-chains; but to apply power to any sprocket-wheel over and around which the bucket-chains are carried obviously involves certain complications and inconveniences in adjustment for service, which are wholly obviated by me.

My elevator is so organized and combined with its stationary outrigging frame-work on a wharf that, although the motive power and its connections directly communicate with the endless bucket-chain, no variation in the position of the driving mechanism is involved, while freely admitting of all the necessary variations in positions of adjustment on the part of the elevator proper, which includes the chain, the buckets thereon, and the frame on which they are operatively mounted. I have also devised many minor improvements in construction, and after a detailed description of the apparatus illustrated the features deemed novel will be specified in the several clauses of claim hereunto annexed.

Referring to the three sheets of drawings, Figure 1 illustrates, in side elevation, the framing for a coal-pocket front, an elevator embodying my improvements, and, in section, a coal-barge in position for unloading. Fig. 2 is an enlarged side view of portions of the elevator frame, chain, and buckets, with a portion of its driving-gear at the point of connection with the elevator-chain and with portions of the side plates broken away. Fig. 3 is a front view of the parts shown in Fig. 2. Fig. 4 illustrates the elevator-frame, its chains, and a bucket in horizontal or lateral section. Fig. 5 illustrates, in diametrical section, one of the sprocket-wheels on which the driving-chains are carried. Fig. 6 illustrates a portion of the sprocket-chain and the wheel from which power is communicated to the shaft on which the driving-chains are carried. Fig. 7

is a side view of the lower end of the elevator.

In Fig. 1 the wharf A is shown with a barge, B, alongside in position for unloading. On the wharf there is the coal-pocket C, with its front side properly located at the rear of the cap-log of the wharf, the heavy timbering of the pocket affording ample foundation for the platform D, on which the hoisting-engines E are mounted. Above said platform there are two heavy outrigging-beams, F, side by side, projecting beyond the face of the wharf, to afford a suitable foundation near their outer ends for the elevator driving-shaft G, which is mounted in fixed bearings. Power is communicated from the engines by gearing to a balance-wheel shaft, H, thence to a counter-shaft, I, by means of suitable sprocket wheels and chains, and thence by other sprocket-wheels and one or two chains, I′, to the shaft G.

None of the mechanism thus far described need ever be varied in position, having once been properly put up and adjusted, although, whenever deemed desirable, the outrigger-beams can be made so as to retire more or less when out of service without departure from my invention.

The elevator K embodies many novel features, and I will first describe the framing thereof, which can either be made of both wood and metal or wholly of metal. I have, with satisfactory results, used timber for the side beams or plates, $a$, $a'$, $a^2$, and $a^3$, as indicated in Fig. 4, but have strengthened them with parallel angle-irons $b$ $b'$ $b^2$ $b^3$. The relative proportions of thickness of the angle-irons and the side plates indicated in the drawings are such as would be substantially correct for a wholly metallic frame; but if the side plates were composed of wood they should of course be much thicker than when composed of iron or low-steel plates. Two of these side plates being edge to edge form one side of the frame, one plate being a little wider than the other, and the two being separated to afford at a little to the one side of the center a space or slot, $c$, extending mainly throughout the length of the frame. Said angle-irons are bolted upon the outer sides of said plates and near their coincident edges, (see Fig. 4,) and said irons not only serve to longitudinally brace and stiffen the frame, but they also serve as guides for certain movable portions of the mechanism, and they still further serve as co-operative means for locking each pair of side plates together, as will hereinafter be made fully apparent.

At the lower end of the elevator the two frame-plates of each side are firmly united by means of bent angle-iron, there being two of these irons, one at each edge, and they serve as guards, $d$, for the adjacent working portions of the elevator during the several adjusting movements toward, into, and from the hold of a vessel. Said guards are secured to the projecting ends of the pairs of outside angle-irons, which are in turn bolted upon the frame-plates, and they are also secured to said plates by means of the bolted arms or braces $d'$, as well as by being directly bolted at their upper ends to the outer edges of said plates.

At the top of the frame there are other bent iron straps, $e$, which securely bind each pair of frame-plates together at their upper ends, and the two pairs of side plates at the top of the frame are also bound together by a shaft, $f$, having its boxes or bearings rigidly secured to the angle-irons in the slot $c$, the shaft and boxes being so constructed and organized as to enable the shaft to serve as a lateral brace. On said shaft $f$ two interior sprocket-wheels, $f'$, are carried, and these, if coupled together, may revolve loosely on said shaft, or they may be keyed thereto and revolve therewith. At the bottom of the frame (clearly shown in Fig. 7) there is another pair of sprocket-wheels, $g$, mounted upon and keyed to a shaft, $g'$, having bearings in boxes $g^2$, which are wider than the slot $c$, but can freely slide between the adjacent angle-irons, and each box has straps $g^3$, which embrace the outer portions of both of said irons, so that the shaft, having heavy locking-pins $g^4$ at each end, serves as a lateral brace to the frame, regardless of the sliding capacity of its boxes. Above each box, and between the angle-irons, there is a cross-bar, made in one or two parts, firmly secured in position, and having therein a tapped hole occupied by a tightening screw, $g^5$, which at its lower end abuts against a seat at the top of the box. Upon these four sprocket-wheels $f'$ and $g$ two endless sprocket-chains, $h$ $h'$, are carried. These chains, both of which are shown in Fig. 3, are composed of a series of alternate double and single flat links, which should be as nearly counterparts as may be possible, and the rivet-pins should be of selected metal and carefully applied. The single links have a central lateral opening for the reception of a lateral bar, $i$, which couples the two chains $h$ $h'$, a portion of said bars, as at $i'$, serving as supports for the buckets $k$, and all of them serving as lifting-bars, when engaged by the driving mechanism, at their outer ends, and all of them serve, also, as tie-bars for maintaining the two chains $h$ $h'$ in their desired relative positions, and, in fact, uniting both chains, so as to constitute one complex endless bucket-chain. The laterally-projecting ends of these bars $i$ and $i'$ also serve as controlling-guides for the complex chain by co-operating with guide-grooves on the two side plates of the frame at their inner surfaces. Said grooves are conveniently provided by the use of parallel bars of angle-iron $l$ $l'$ on the inner sides of the side plates, as shown in Fig. 4, and, whether said side plates be composed of wood or of metal, said angle-bars $l$ $l'$ serve also to so stiffen and strengthen the frame as to enable the avoidance of undue weight in the structure, and by having the laterally-projected portions of said irons truly parallel and properly separated a groove is afforded which will not only serve as a general guide for the complex

chain, but it will also prevent the bars *i i'* from twisting or bending, especially if they be rectangular in cross-section and flat, as shown, although fairly good results would accrue if the lateral bars were round instead of flattened. The buckets *k* may be variously formed; but I prefer that they be flat at their backs and rounded at the front corners. They should be made of plate iron or steel, heavy enough for the service required, and the mode of constructing them indicated by the drawings has been proved to be practically valuable. Each bucket at its back *k'* is rigidly secured to two lateral chain-bars, *i'*, preferably by means of straight bolts and nuts, as shown in Fig. 4, although U-shaped clamping-bolts, with two nuts each, can be used to good advantage.

In machines heretofore organized for excavating and conveying earth, buckets on an endless chain have been employed in connection with an endless apron or belt, which served as a bottom or side for all of the buckets, the latter being mounted on the links of the bucket-chain by means of cross-bars, which also served as pivots for the links in each half of the chain, and they also projected beyond each side of the chain and served as lugs, with which a driving-wheel engaged. In my machine each half of the bucket-chain is a perfect chain, and my lateral bars are independent of the link-pivots and are carried by alternate links, thus affording desired flexibility in the chain between said bars, and each of my buckets is complete in itself and is fastened at its back to the bars, and my chain rivets or pivots, having only their proper duty to perform, are not liable to be unduly worn, strained, and weakened.

At the top of the elevator-frame, at its rear side, a short conducting-chute, *m*, is rigidly attached. At the bottom of said chute its inner end is provided with an opening, through which the emptied buckets pass on their downward path. It will be seen that the ends of the buckets at $k^2$ are extended beyond the line of the lip of the bucket, so that as a bucket passes over the upper sprockets its contents, in initially shifting their position, are well controlled against lateral spilling, and that when said contents begin to drop the inclination of the back of the bucket is such as to cause them to shoot beyond the preceding emptied bucket, and that the bottom of the latter serves as an outwardly-deflecting plate for such coal as may perchance be dropped thereon, and also that from the time coal commences to drop from a filled bucket the bucket next in advance occupies and fills the hole in the bottom of the chute *m*. As the coal passes from said chute *m* it is delivered into another chute, *m'*, which may be one of several, each leading to its own pocket; or one chute may obviously be made capable of adjustment for use with several pockets.

It will be seen that the elevator-frame is swiveled upon the fixed driving-shaft G, which transversely occupies the two slots *c* in the frame and serves as a pivot for the same during certain of its movements of adjustment. On said shaft G there are two sprocket-wheels, *n n'*, (shown in Fig. 3,) which are more widely separated than those at the top and bottom of the frame, so as to afford space between them for the two bucket-chains, and also so as to occupy a vertical plane corresponding with the path of the projecting ends of the lateral bars *i* and *i'*. These sprocket-wheels *n* and *n'* are smaller in diameter than those on which the bucket-chains travel, and they occupy a portion of the interior space vertically inclosed by said chains. Below the sprocket-wheels *n n'* there are two others, *o* and *o'*, which are their counterparts in form and dimensions and in their adjustment on their shaft $o^2$; but said shaft is mounted in sliding boxes $o^3$, and these are guided by the angle-irons, and, with the shaft and its locking-pins, co-operate in affording a lateral brace for the frame, as before described, in connection with the shaft at the foot of the frame. Upon these four sprocket-wheels two drive-chains, *p p'*, are carried, and for maintaining them at proper tension the boxes $o^3$ of the lower shaft, $o^2$, are provided with adjusting-screws $o^4$, each tapped through a cross-bar secured by straps to the under sides of an upper box, *q*, of the shaft G, each of said boxes *q* being also so engaged with angle-irons of the side frames as to enable said shaft to serve as a lateral brace to the frame, although the latter may freely slide longitudinally, while all of said boxes remain stationary.

The drive-chains *p p'* differ in construction from the bucket-chains in that the double links are each provided with a lug, $p^2$; but the single links have holes therein, as in the bucket-chains, for the reception of the lateral bars $p^3$, which couple the two driving-chains together into a wide complex driving-chain, all parts of which must obviously move in perfect unison.

The slot *c* being at one side of the longitudinal center of each side of the frame, said driving-chain is thus located in close proximity to the rear side of the bucket-chain in front, but removed therefrom at the rear side, so that when the lugs $p^2$ of the driving-chain are in front they engage with the under sides of the lateral bars *i i'* on the bucket-chain and at their projecting ends. For assuring the complete engagement of the lugs $p^2$ and said bucket-chain bars, I have secured to the adjacent inner sides of the frame a pair of guide-plates, *r*, (shown clearly in Fig. 2,) which are curved at their ends, but afford a long vertical bearing-surface, preferably provided with anti-friction rollers, for the back side of the front portion of the driving-chain, thus rendering it impossible for any of the lugs $p^2$ to not properly engage with a bucket-bar or for them to be disengaged therefrom during the performance of their lifting duty. With a driving-chain thus constructed and organized with the bucket-chain, a large number of separate lifting con-

tacts are afforded, and when the chains are all constructed with proper regard to uniformity the contact between each pair of lugs and a bucket-bar will not only be uniform, but so, also, will all the front lugs be engaged in uniformity with the bucket-chain. As shown in the drawings, twelve of the lugs are engaged with six of the bucket-chain bars during the operation of the elevator.

I have in Fig. 1 indicated a usual adjustment of the elevator, and with its lower end within a barge as when at work, and it is to be understood that at the outset and for a while thereafter the elevator will operate without the aid of trimmers in the hold, the guard-plate *s* near the bottom at the rear side of the frame preventing the buckets from clogging as they are passing downward below the surrounding level of the main portion of the coal in the hold. The vertical adjustment of the elevator is easily accomplished by means of blocks and the lifting-line *t*, which I pass with a turn or two around the counter-shaft I. In actual service the elevator can be permitted to rest upon the mass of coal until it is finally supported upon the floor of the vessel. For shifting the lower end to and fro, the shifting-line *u* and its blocks are employed, the balance-wheel shaft H serving as a winch therefor, and I also supplement said line by a supporting-line, *u'*, attached to the front foot of the frame and made fast at its outer end to some upper portion of the vessel. At the top of the frame I employ a guy, *v*, which is rendered adjustable by blocks and a line, as clearly indicated.

When the elevator is out of service, it is raised longitudinally and its lower end drawn inwardly and permitted to rest upon the wharf in a position as indicated in dotted lines in Fig. 1.

Of course the buckets may be varied in their capacities; but I find in practice that it is preferable that they should be able to surely carry about fifty pounds of coal, and with an elevator having a frame about sixty-four feet in length and operated by means of two six-by-seven cylinders upward of two hundred tons of coal per hour have been discharged, and that duty has been performed continuously for many hours day after day with no more (but generally less) trimmers in the hold than would have been required in ordinary bucket-hoisting, and without any tendencies to clogging or derangement from any cause.

With my complex bucket-chains and the buckets mounted upon the transverse bars and controlled by the bar-guides good results can be obtained if the sprocket-wheels on the driving-shaft be provided with lugs for engaging with the bucket-chain bars, and that arrangement may be made without departure from certain portions of my invention, although my apparatus in its best form essentially contains the complex driving-chain. It will be seen that the frame-guides for the ends of the lateral bars in the bucket-chain assure a proper carrying position for each bucket, prevent the undue vibration of the bucket-chain, and enable the driving mechanism to operate with certainty and uniformity by assuring good driving contacts, and that the elevator-frame can be made of comparatively light weight, considering the heavy duty it can be relied upon to perform.

While I prefer for obtaining the best results to employ in each elevator all of the several features of invention hereinafter enumerated, it will be obvious that many of said features may beseparately employed in connection with other well-known co-operating mechanism.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, substantially as hereinbefore described, of an endless chain, a series of elevator-buckets thereon, a driving-shaft, an endless sprocket-chain driven by said driving-shaft over a tightening-wheel, and provided with lugs for engaging with said bucket-chain.

2. The combination, substantially as hereinbefore described, of an endless bucket-chain, a series of elevator-buckets thereon, a driving-shaft, an endless sprocket-chain driven by said shaft and provided with lugs for engaging with said bucket-chain, and a guide-plate at the rear of the working portion of said driven chain for maintaining the lugs thereon in driving contact with the bucket-chain.

3. The combination, substantially as hereinbefore described, of the elevated outrigger-beams above the face of a wharf, a driving-shaft mounted on said beams, one or more sprocket-wheels on said shaft, one or more endless driving-chains supported on and driven by said sprocket-wheels, and an endless bucket-chain inclosing said driving-chain at front and rear and mounted in a frame swiveled upon said driving-shaft and vertically adjustable independently thereof.

4. In an elevator, the combination, substantially as described, of an endless bucket-chain embodying separate sprocket-chains coupled together at alternate links by a series of lateral bars, a series of buckets attached at their backs to a portion of said bars, and all of them serving as lifting-lugs for engagement by the operating mechanism.

5. In an elevator, the combination, substantially as hereinbefore described, of a complex endless bucket-chain embodying a series of lateral bars, a series of buckets attached to a portion of said bars, and an endless driving-chain provided with two series of lugs for progressively engaging in pairs with said lateral bars in operating the elevator.

6. In an elevator, the combination, substantially as hereinbefore described, of a complex bucket-chain embodying separate chains and lateral bars, and an interior complex driving-chain embodying separate chains, each provided with a series of lugs for engaging with the bars on the bucket-chain, and a se-

ries of lateral bars for maintaining said lugs in positions for properly engaging with the bars in the bucket-chain.

7. In a bucket-chain frame, the combination, substantially as hereinbefore described, of the four side plates, each pair separated at their inner edges to afford a longitudinal slot at each side of the frame, a pair of longitudinal angle-irons adjacent to said slot, and one or more sprocket-wheel shafts provided with boxes wider than said slot and between said angle-irons, and locking devices by which said boxes are confined longitudinally on said shaft.

8. The combination, in the slotted bucket-chain frame, of the angle-irons, in pairs, parallel with the sides of each slot, the sprocket-wheel shafts, and their boxes clamped against longitudinal movement and laterally embracing each pair of said angle-irons.

9. The combination, substantially as hereinbefore described, of a complex bucket-chain composed of two separate chains and a series of lateral bars connecting said chains and projecting laterally beyond both of them, a series of buckets mounted on said bars, and an elevator-frame in which said bucket-chain is mounted, and longitudinal guides on the inner sides of said frame for receiving the projecting ends of said bars.

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