Oct. 12, 1943. J. H. LIENAU 2,331,613

MATERIAL HANDLING APPARATUS

Original Filed June 15, 1940 3 Sheets-Sheet 1

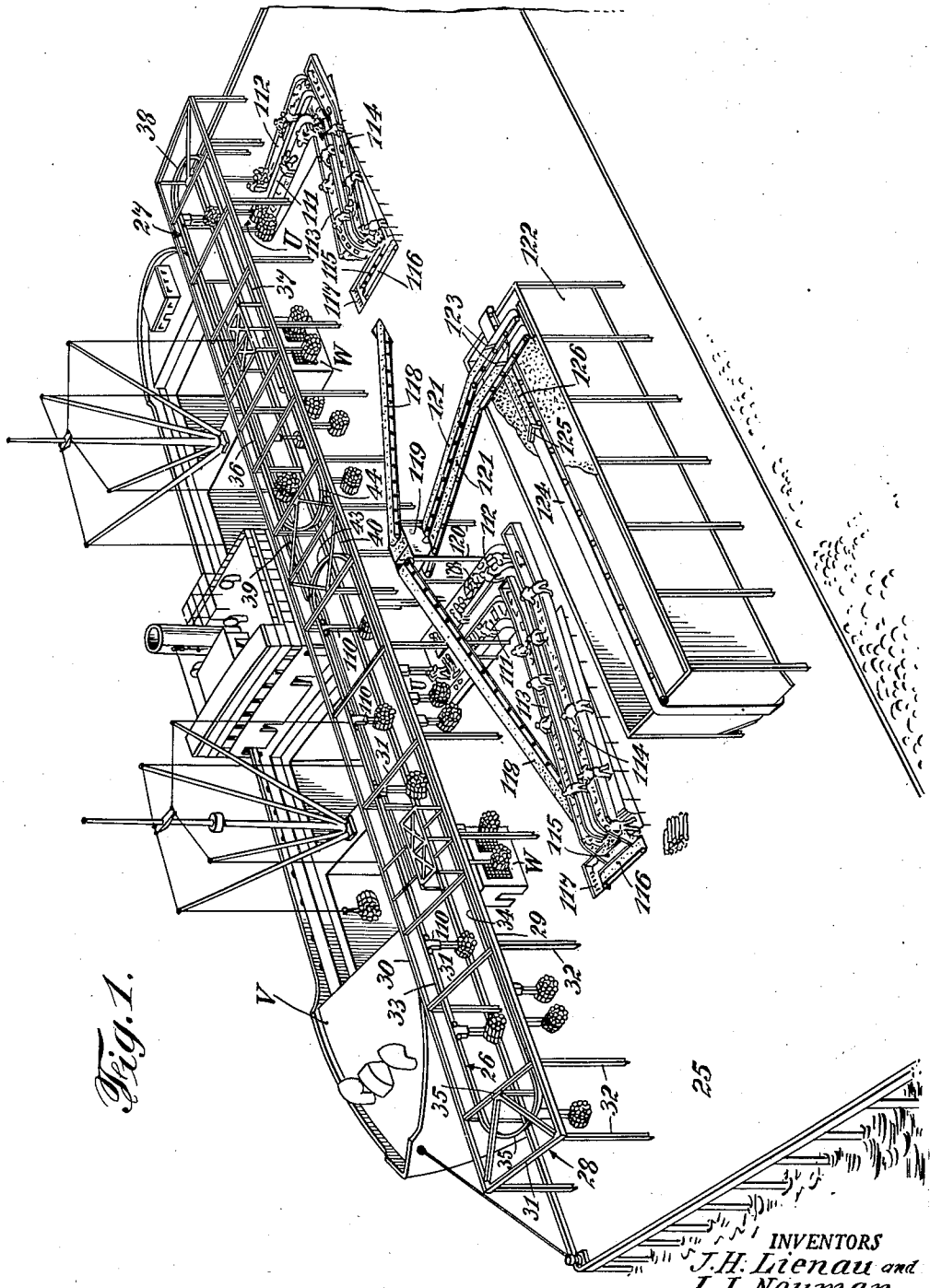


Fig. 1.

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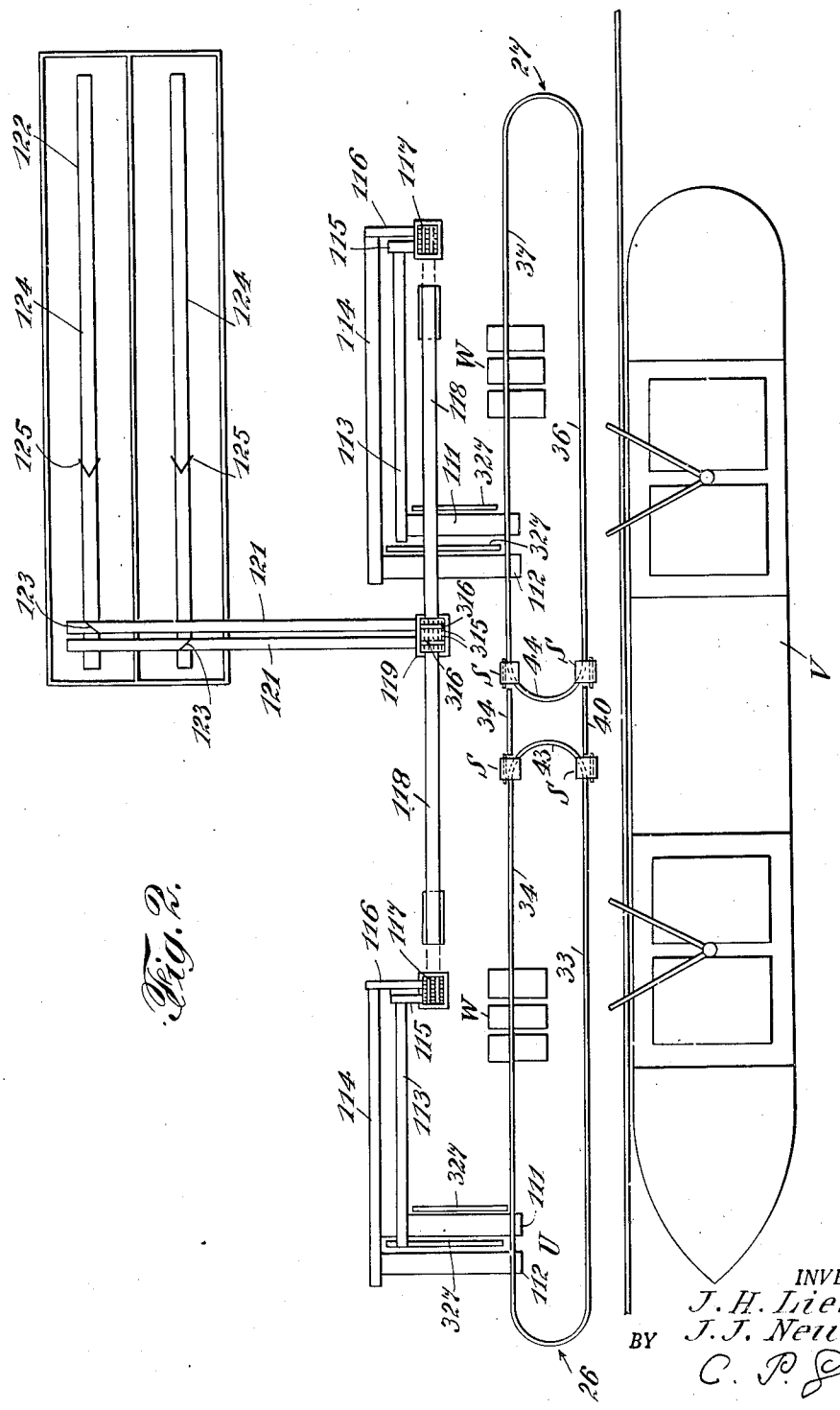


Fig. 2.

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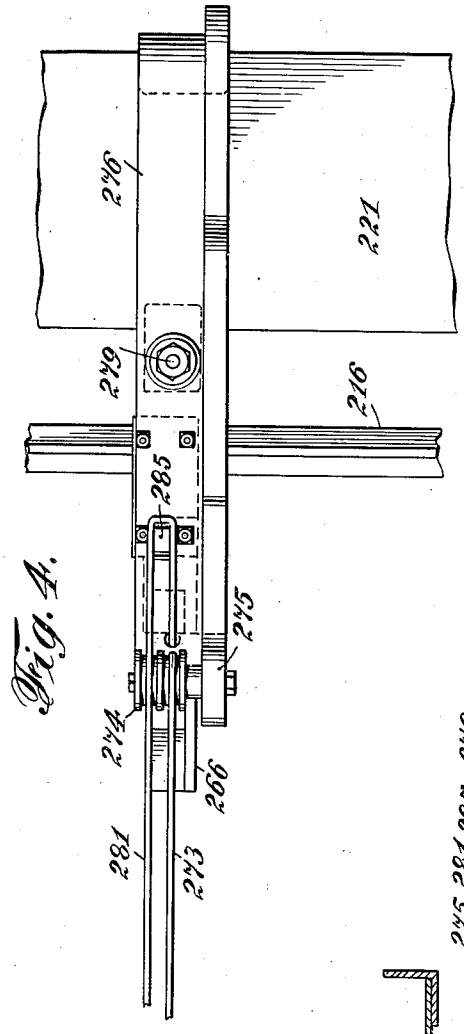


Fig. 4.

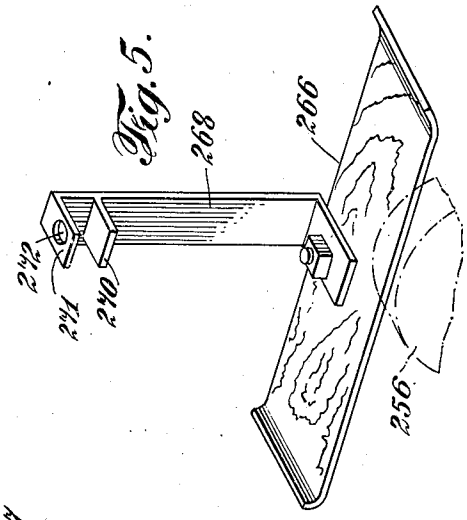


Fig. 5.

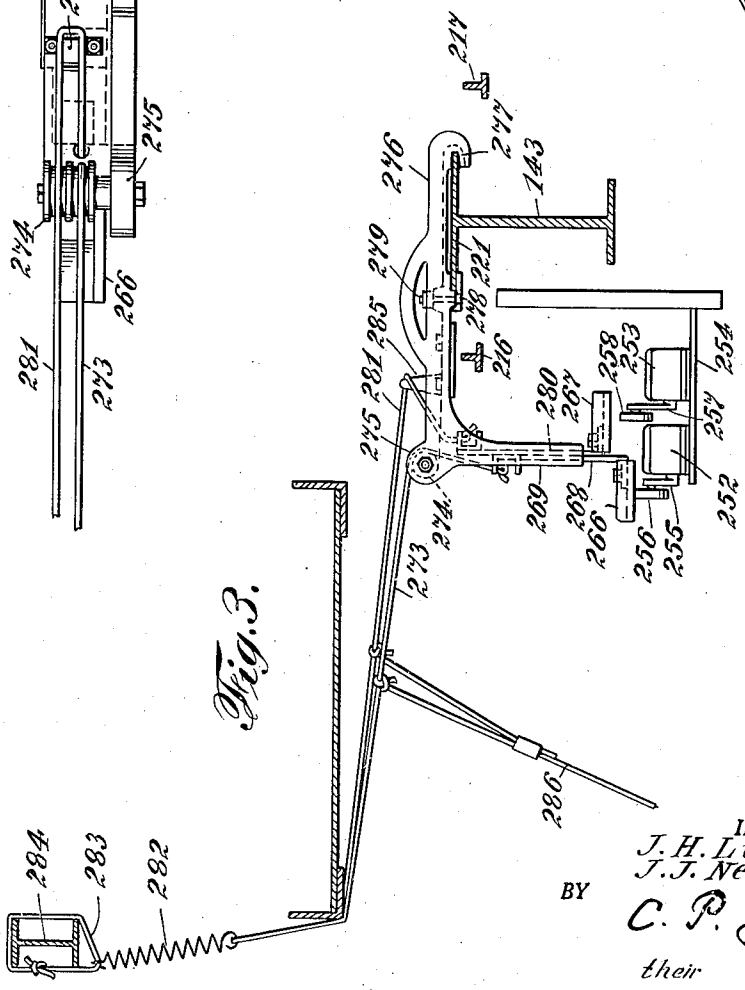


Fig. 3.

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2,331,613

UNITED STATES PATENT OFFICE

2,331,613

MATERIAL HANDLING APPARATUS

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Original application June 15, 1940, Serial No. 340,814. Divided and this application March 23, 1942, Serial No. 435,824

1 Claim. (Cl. 214—14)

This invention relates to material handling apparatus and more particularly to a means for handling material which is unloaded from a vessel or other carrier and conveyed to storage.

This invention is an improvement over the conveyor system and monorail hoist disclosed in a former patent, No. 1,988,855 and divisions thereof, the present application being a division of our co-pending application, Serial No. 340,814, filed June 15, 1940, now Patent No. 2,291,197, issued August 4, 1942.

An object of this invention is to provide a system of traveling hoists and conveyors associated therewith for handling materials in bags or other containers.

Another object of this invention is to provide a system of traveling hoists and conveyors which will facilitate the unloading of a vessel, and which may be installed in the present structure of a dock, warehouse, or shed.

A further object of the invention is to provide a system of traveling hoists to facilitate unloading of cargo vessels and adaptable to vessels of different sizes and construction and the different relative positioning of the hatches of respectively different vessels.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claim appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views—

Fig. 1 is a perspective view of the general conveyor arrangement or system embodying this invention;

Fig. 2 is a diagrammatic view of the material handling apparatus and system embodied in this invention;

Fig. 3 is a detail side elevation, partly in section, of the carrier stopping means;

Fig. 4 is a top plan view of the carrier stopping means, and

Fig. 5 is an enlarged detail of one of the stopping shoes.

Referring to the drawings and first to Fig. 1, a typical embodiment of the invention is shown in which a vessel V is moored alongside a pier 25 upon which is located an elevated monorail system consisting of two endless tracks 26 and 27 positioned substantially opposite the fore and aft holds, respectively, of the vessel V and around which tracks a plurality of electrically driven combined hoists and carriers 110 travel in counterclockwise direction. The tracks 26 and 27 are supported by means of a framework generally indicated as 28 and consisting of a pair of longitudinally extending frame members 29 and 30 connected by transverse beams 31 and supported above the surface of the pier 25 by a plurality of vertical posts 32. Each of the tracks 26 and 27 has a substantially straight section 33 and 36, respectively, on the vessel side of the pier 25, and a substantially straight section 34 and 37, respectively, parallel to the corresponding sections 33 and 36, but arranged on the shore side of the pier. The straight sections 33 and 34 of track 26 terminate at one end in a semi-circular section 35 and the straight sections 36 and 37 of the track 37 also terminate at one end in a semi-circular section 38. The other ends of each of the straight sections 33 and 34 and of sections 36 and 37 are adapted to cooperate by means of suitable switches S (Fig. 2), either with short straight sections 39 and 40 to combine the tracks 26 and 27 into a single loop, or the aforementioned straight sections 33, 34, 36 and 37 are adapted to cooperate with semi-circular sections 43 and 44 to form separate endless tracks 26 and 27. In this manner, the carriers 110 traveling along the monorail system may be shifted from one of the endless tracks 26 and 27 to the other for the purpose hereinafter set forth.

Along the path of travel of the carriers 110 on the shore side of the monorail system is a weighing station W where each load may be weighed before passing on to an unloading station U arranged beyond the weighing station. As clearly shown in Figs. 1 and 2, a separate weighing station W and a separate unloading station U are provided for each of the tracks 26 and 27. At each unloading station, there is provided a pair of endless conveyors 111 and 112 positioned at right angles to the straight sections 34 and 37 of the corresponding tracks 26 and 27, said endless conveyors receiving a load of bags from the carriers 110 and discharging the same on to conveyors 113 and 114, respectively. The last named conveyors may be of the self-discharging type as disclosed in a former patent, No. 1,911,525, or, as shown, may be adapted for semi-automatic dumping where a man stands at the discharging end and guides the bag while the contents is discharged and the empty bags cast aside. Alongside each of the conveyors 111 and 112 are provided sling conveyors 327 (Fig. 2) for conveying the empty slings to the monorail system to be returned by the empty carriers 110 to the loading stations on the vessel side of the tracks 26 and 27, as will later appear.

The material is discharged from each of the conveyors 113 onto separate lateral conveyors 115 and the material from each conveyor 114 is discharged onto a separate lateral conveyor 116 parallel with the adjacent one of the conveyors 115. The conveyors 115 and 116 associated with each of the tracks 26 and 27 discharge the loose material into separate crushing devices 117 from whence the crushed material drops downwardly therefrom onto elevating conveyors 118 which extend in opopsite directions from the respective crushing devices 117 to a double cracker mechanism 119 suitably supported by members 120.

The double cracker mechanism 119 is suitably constructed to provide two hoppers each adapted to receive the material from one of the elevating conveyors 118 and discharge the same through a discharge opening onto one of the conveyors 121 positioned at right angles to conveyors 118 and extending transversely over an open bin 122. Rotatably mounted in each hopper is a pair of rollers 316 (Fig. 2) provided with radial blades 315 for breaking up any remaining lumps in the material discharged in the double cracker mechanism 119 by the elevating conveyors 118.

The material may be discharged from either or both of the elevating conveyors 121 onto either or both of conveyors 124 which extend longitudinally of the bin 122 and from each of which conveyors the material is discharged into the bin by separate V-shaped ploughs 125 adjustable longitudinally of the conveyors by cables 126. In this manner, the material on each conveyor 124 may be discharged at any desired point along the length thereof into the storage bin 122.

Referring to Figs. 3, 4 and 5, electrical energy for the motor of each carrier 110 is supplied from trolley wires 216 and 217 by the usual trolley shoes supported by the carrier and connected to the controls for the motor. Each carrier has an outwardly extending bracket 254 on which are mounted switch members 252 and 253, the former including a switch arm 255 provided with a roller 256 and member 253 including a switch arm 257 also provided with a roller 258. The switch members 252 and 253 are electrically connected to the motor of the carrier, the arms 255 and 257 being normally held in circuit-making position and adapted to be shifted to circuit-breaking position by stop shoes 266 and 267, respectively, placed at predetermined points along the tracks 26 and 27, such, for example, as the loading, weighing and unloading stations.

The stop shoes 266 and 267 are secured to the lower ends of substantially L-shaped members 268 and 280, respectively, slidable in a vertical guide 269 which is secured at its upper end to a horizontal supporting arm 276 adapted to be clamped by means of hook portion 277 and clamping plate 278 and tightening bolt 279 to the upper flange 221 of the I-beam 143 forming the monorail system. The upper ends of the L-shaped members 268 and 280 are each provided with a pair of laterally projecting arms 270 and 271, the latter arm of each of the L-shaped members having an opening 272 as clearly shown is Fig. 5. Ropes 273 and 281, secured at one end to the upper ends of the members 278 and 280, respectively, extend over a pulley 274 supported as at 275 in the upper portion of the guide 269 and are connected at their other end to a tensioning spring 282 secured by a suitable fastening means 283 to a beam 284 or other stationary member. A downwardly extending pull cord 286 is connected at its upper end to each of the ropes 273 and 281 so that both stop shoes 266 and 267 may be raised simultaneously from operative to inoperative positions. One of the shoes 266 or 267 may be held in raised or inoperative position by looping the corresponding rope 273 or 281 about an upstanding lug 285 on the arm 276 disposed between the pulley 74 and the I-beam 143, as clearly shown in Fig. 3. Moreover, either one of the switch members 252 or 253 may be rendered inoperative by any suitable means so that when a carrier 110 comes to a station where the stop shoes 266 and 267 are as shown in Fig. 3 and switch member 252, for example, has been rendered inoperative, although switch arm 255 will be depressed, the carrier will not be stopped. However, should the stop shoe for the operative switch member be in lowered position, then the carrier will be stopped automatically when it reaches this point. Another advantage in the use of the double switch members and the stop shoes therefor, is that these operating parts or controlling devices may be set up in such a manner that certain of the carriers 110 will be stopped automatically at certain stations and pass by other stations, while certain other carriers will be stopped automatically at certain other stations and pass those stations at which the first carriers are made to stop.

It will thus be seen that by the use of the double switch arrangement and stop shoes therefor, the monorail system possesses a wide range of flexibility, and may readily be adapted to vessels of different sizes and construction especially since the travelling hoists or carriers 110 are individually controlled, and the operation of certain carriers selectively controlled with respect to certain others. Moreover, the stop shoes may be easily shifted along the monorail to accommodate any number of hatches and the varying positions of the hatches of different vessels.

Furthermore, as previously explained, the double track arrangement 26 and 27 may be combined into one large loop so that the carriers 110 may be shifted from one track to the other, thereby enabling the load taken from the hatch or hatches located aft of the vessel on the vessel side of one of the tracks 26 or 27, to be taken to the unloading station U of the shore side of the other track. In this manner, in the event of failure of one of the conveyors of the conveyor system cooperating with one of the tracks 26 or 27, substantially full production may be maintained by distributing the men from the disabled conveyor to the remaining conveyors and equally distributing the loads from the different hatches on to the remaining conveyors while the disabled conveyor is repaired.

In the use and operation of the conveying system above described, the ship is moored alongside the pier 25 so that the forward hatch is opposite the track 26 and the stern hatch opposite the track 27 of the monorail system. The track switches S in this instance are set so that the monorail system forms two independent circuits or loops and the stop shoes 266 and 267 for the switch members 252 and 254, respectively, adjusted to proper positions adjacent the different hatches on the vessel side of the tracks 26 and 27, and adjacent each of the scales at the weighing station W and each of the con-

veyors 111 and 112 at the unloading stations U on the shore side of the tracks.

Stevedores in the holds of the vessel pile the bags together to form a bundle or draft, the number of bags in each draft depending upon the weight of the individual bags and the lifting capacity of the combined hoists and carriers 110. The bags are laid on a sling in the form of a loop and one end of the loop threaded through the other end to hold the bags together and the derrick on the vessel then lifts the draft to the deck of the vessel from whence it is transferred to the pier along the path of travel of the carriers 110 on the vessel side of the monorail system. As the empty carriers 110 arrive at this point, each is stopped and the hoisting gear thereof lowered by any suitable mechanism (not shown). A stevedore stationed at this point ties a draft to the lowered hoisting gear after which the latter is operated to raise the draft and the carrier 110 started to move along the monorail until the weighing station W is reached on the shore side of the monorail. At this point, each carrier is stopped for weighing of the draft.

When the weighing operation has been completed, the carrier is again started to proceed along the monorail until the unloading station U is reached and the carrier stopped adjacent either conveyor 111 or conveyor 112. The hoisting gear is then operated to lower the draft onto one of the conveyors and the draft is disengaged from the carrier. The sling is removed from the bags as the draft of bags is carried along the conveyor and is placed onto one of the sling conveyor 327 for returning the empty slings to a position beneath the monorail where they may be loaded onto the empty carriers.

The bags moving along the conveyor 111 are discharged into the higher speed conveyor 113 and the bags moving along conveyor 112 are discharged into the higher speed conveyor 114. As the bags move along the conveyors 113 and 114, they are opened by workmen stationed along the sides of the conveyors. At the discharge end of each of the conveyors 113 and 114, the bags are emptied of their material onto sharply inclined conveyors 115 and 116, respectively, and the empty bags cast aside. The material falling out of the bags is often very lumpy and the conveyors 115 and 116 discharge it into the crusher 117 where the lumps are broken up. The material now falls onto the elevating conveyor 118 and is taken up to the secondary crusher 119 where the rotating blades 315 break up any remaining lumps before discharging the material to the second elevating conveyor 121 which terminates above the bin 122. The plow 123 pushes the material from the conveyor 121 onto the conveyor 124 from whence it is discharged at the desired point in the bin 122 by the plow 125.

The empty slings returned by the sling conveyors 327 are hooked to the empty carriers 110 and the latter started to proceed along the monorail system to the loading point on the vessel side of the tracks 26 and 27 and a new load or draft hooked onto the hoisting gear of the carrier to repeat the cycle just described until the ship V has been emptied of its cargo.

From the foregoing it is believed that the operation and advantages of our material handling and conveying system may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details disclosed without departing from the spirit of the invention as set out in the following claim.

What we claim is:

In combination with a straight-line wharf having material handling stations parallel with the straight-line wharf, including a series of loading and a series of unloading stations, each arranged at spaced predetermined points along the vessel side of the wharf, and said unloading station series being spaced therefrom along the shore side of the wharf, of an elevated monorail system disposed longitudinally between the series of elongated loading and unloading stations including a pair of endless tracks arranged in end-to-end relation and each including a pair of parallel straight sections disposed on the vessel side and shore side, respectively, of the wharf, switch means for connecting said pair of endless tracks together to form a single endless loop extending along the wharf, and a plurality of spaced travelling hoists movable along each of said tracks and each adapted to receive a load of material from a loading station and deliver it to an unloading station, to accommodate either or both fore and aft holds of a cargo vessel moored along the wharf and extending either the length of one pair of endless tracks or both of them when switched together.

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