D. S. ANDREWS.

HOISTING AND CONVEYING MACHINE.

APPLICATION FILED FEB. 28, 1921.

1,417,013.

Patented May 23, 1922.

5 SHEETS—SHEET 1.

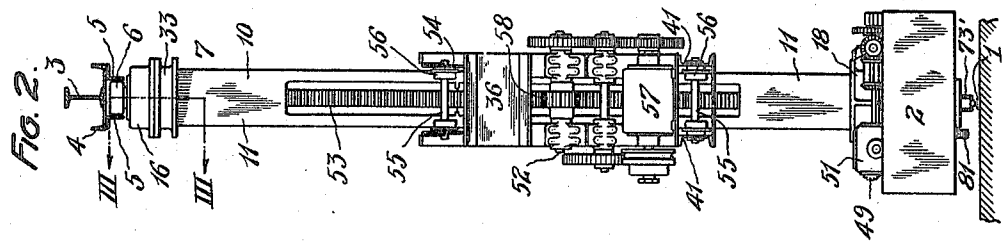


FIG. 2.

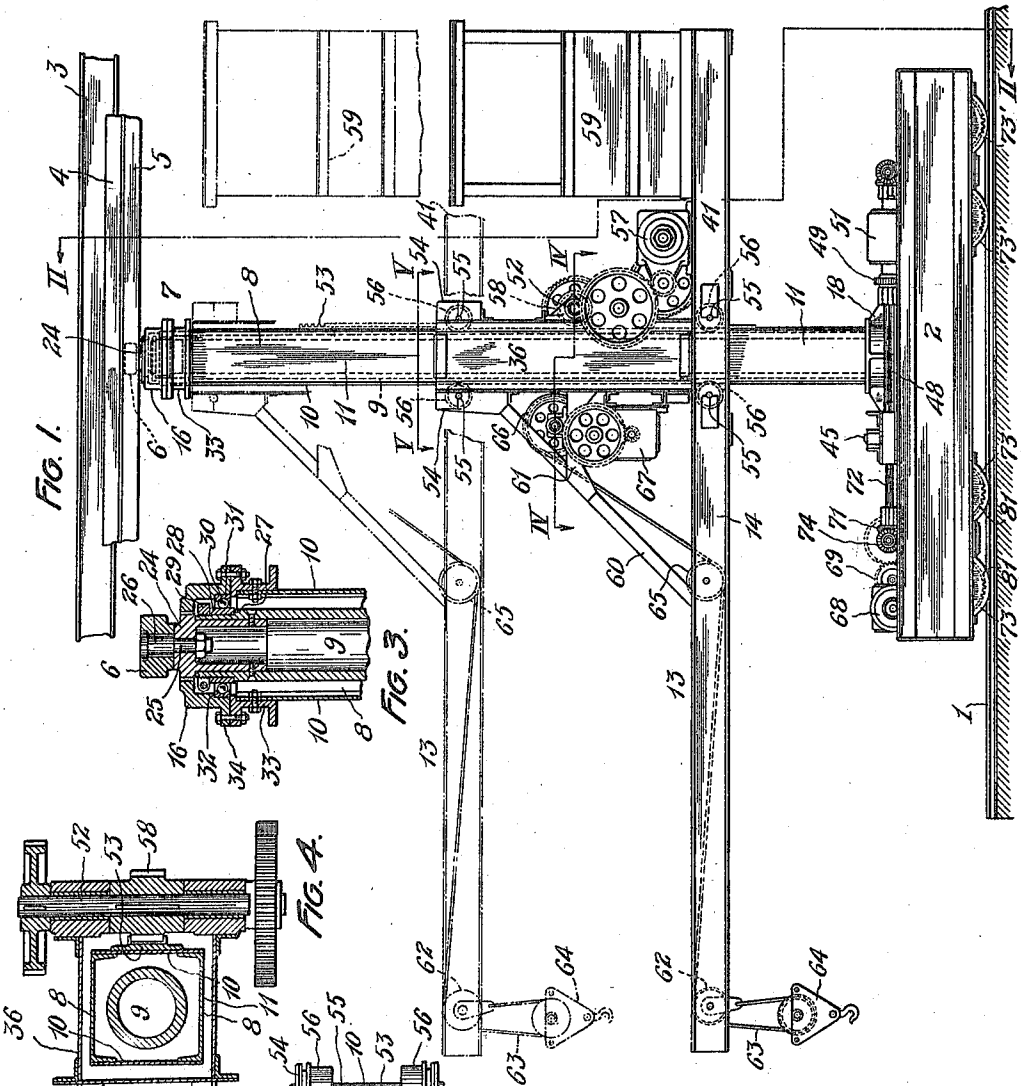


FIG. 1.

FIG. 3.

FIG. 4.

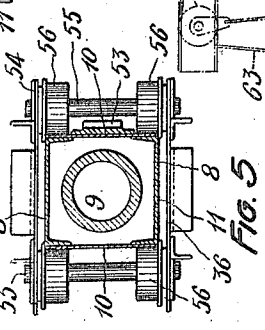


FIG. 5.

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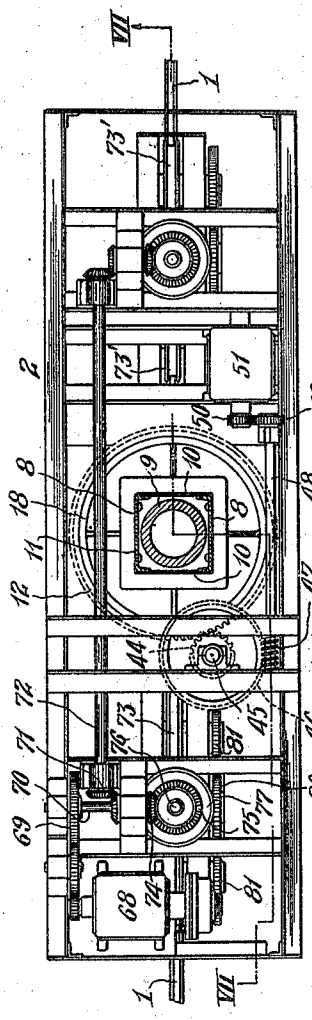


FIG. 6.

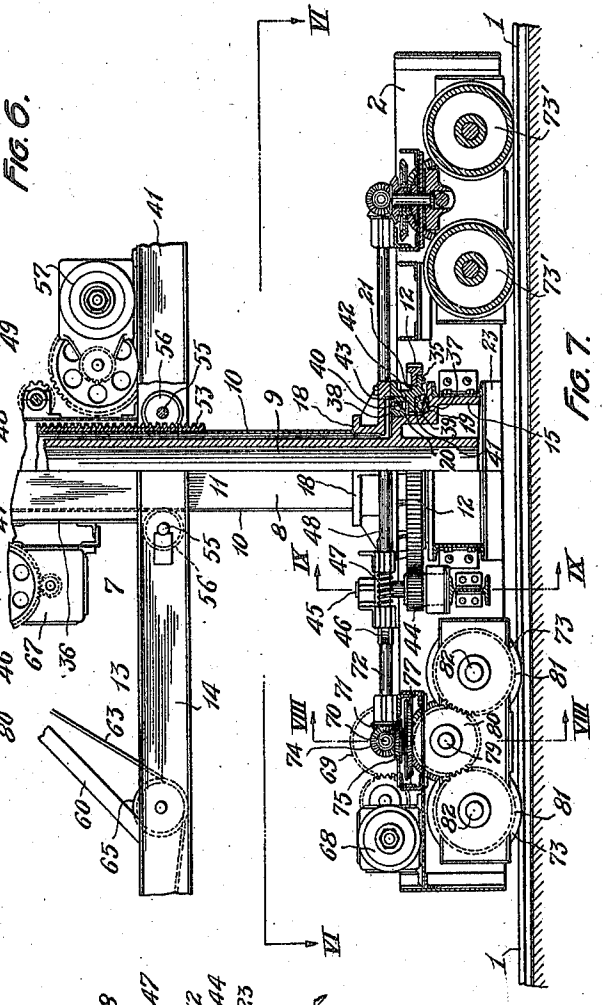


FIG. 7.

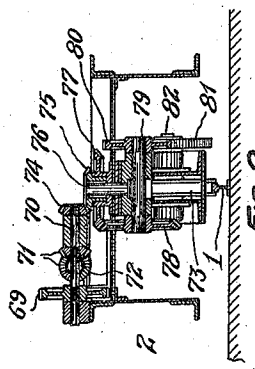


FIG. 8.

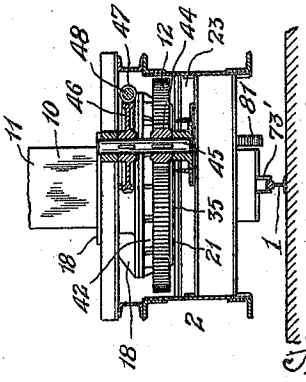


FIG. 9.

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5 SHEETS—SHEET 3.

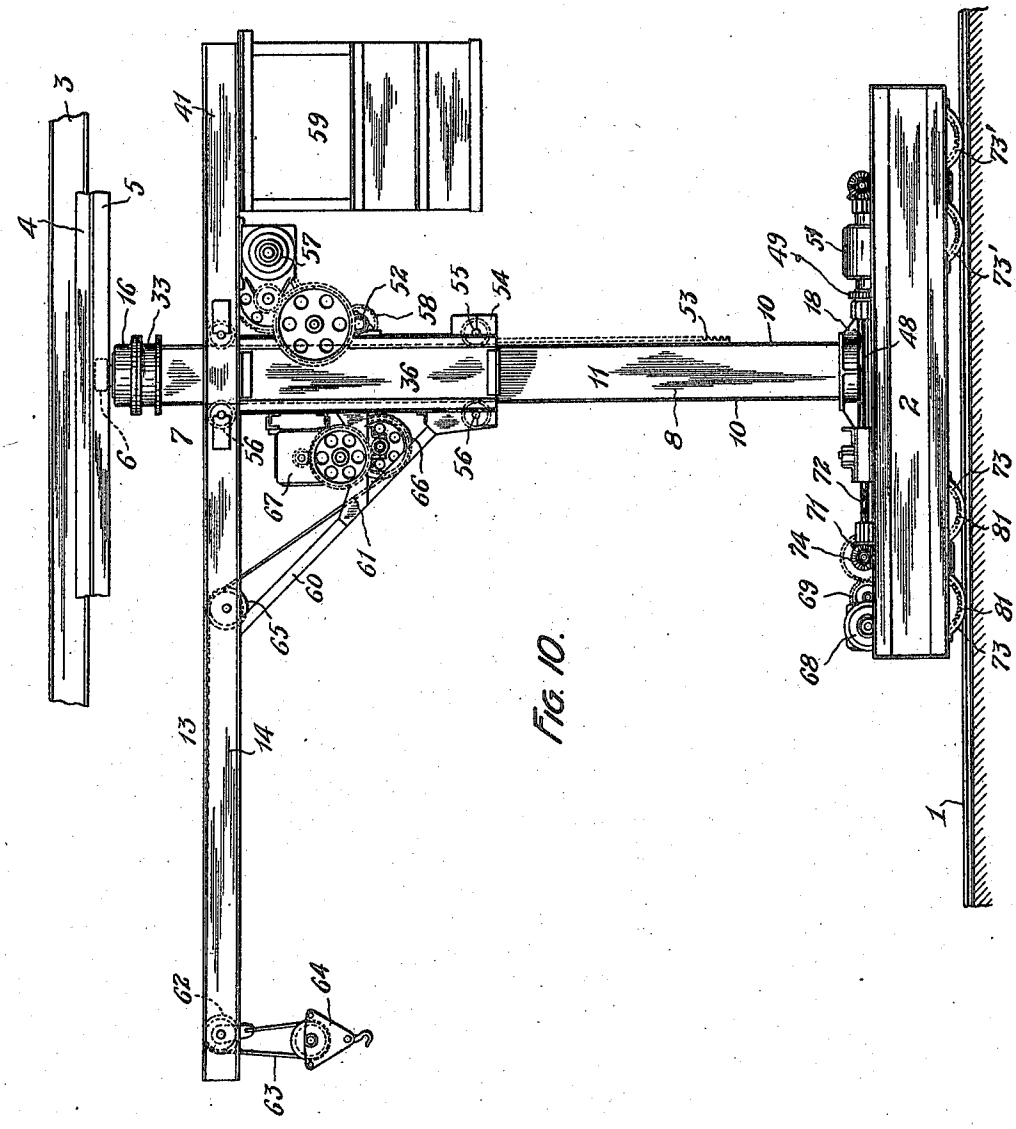


FIG. 10.

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5 SHEETS—SHEET 4.

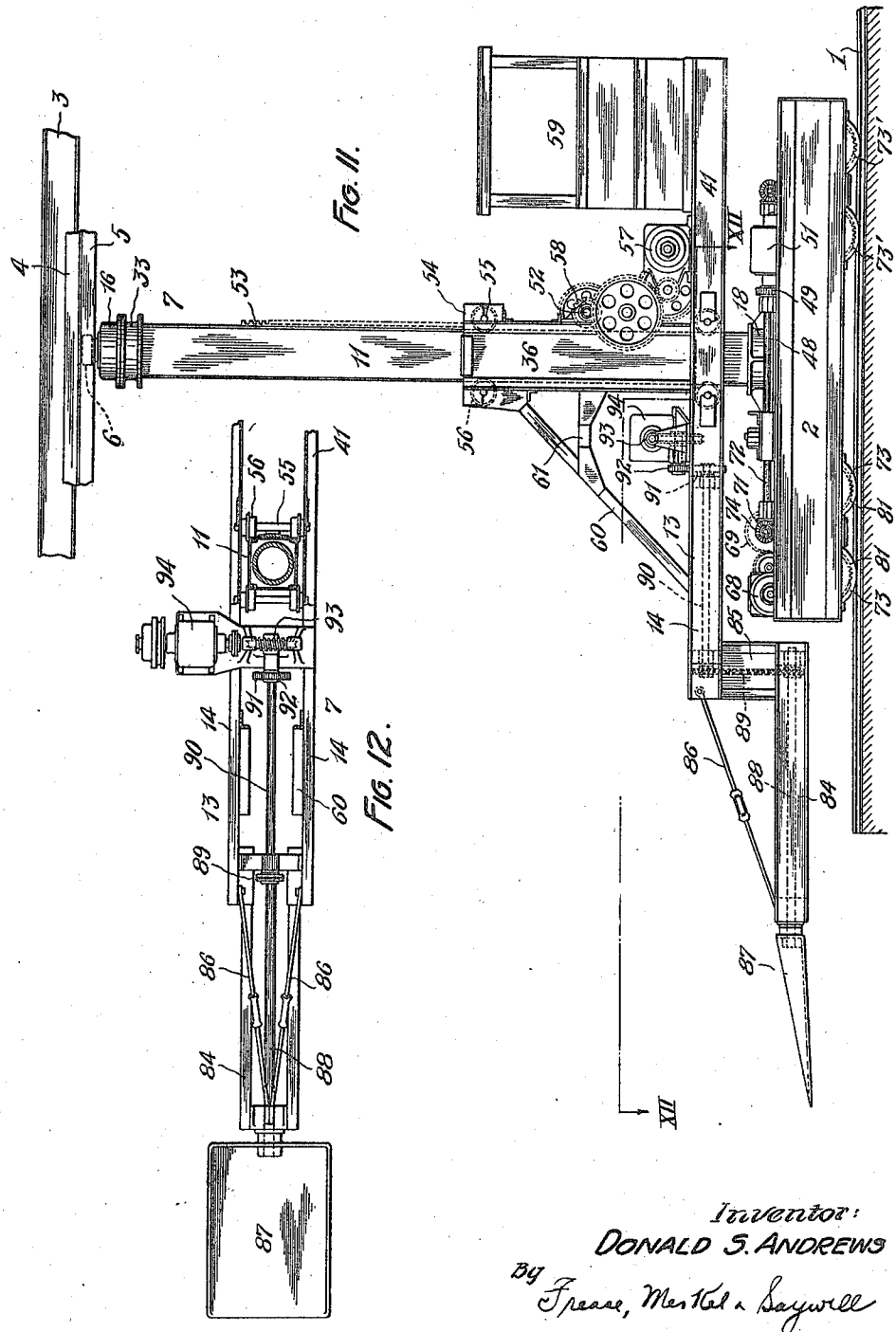


FIG. 11.

FIG. 12.

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1,417,013.

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5 SHEETS—SHEET 5.

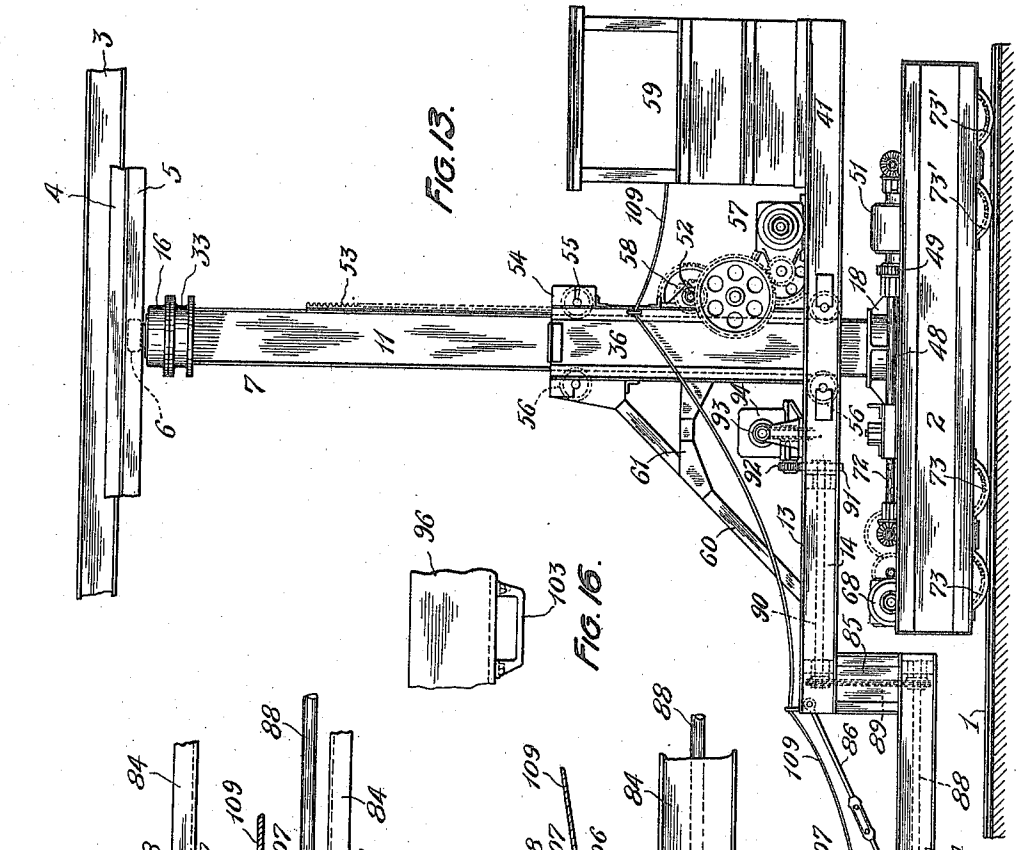


FIG. 13.

FIG. 16.

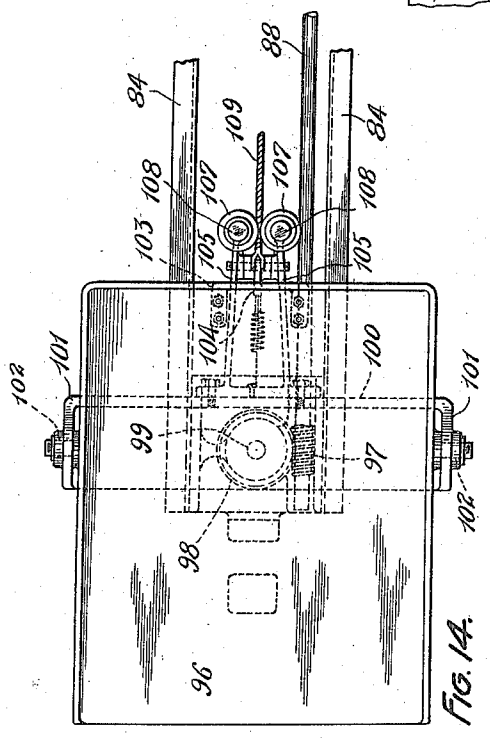


FIG. 14.

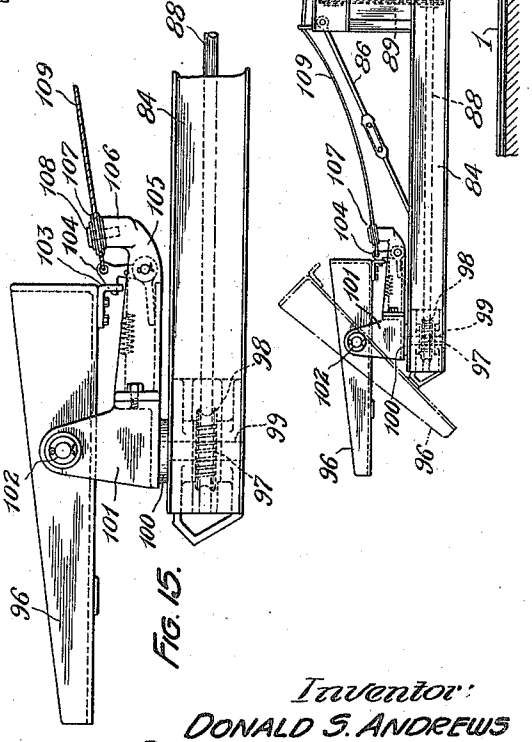


FIG. 15.

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HOISTING AND CONVEYING MACHINE.

1,417,013. Specification of Letters Patent. Patented May 23, 1922.

Application filed February 28, 1921. Serial No. 448,437.

To all whom it may concern:

Be it known that I, DONALD S. ANDREWS, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented new and useful Improvements in Hoisting and Conveying Machines, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to hoisting and conveying machines and particularly to that class of such machines which are supported and run upon a ground track. This invention is characterized by the use of a tractor upon which is mounted a hoisting device having the general characteristics of the device shown, described and claimed in U. S. Letters Patent No. 1,367,907 issued to me February 8th, 1921. The invention has a particular field of operation in transferring articles or material from one portion of a building or dock to another. Particularly, as illustrated in the accompanying drawings, the invention is used for loading or unloading railway cars, although not limited to such field of operations.

The object of my invention is to provide a hoisting and conveying machine, of the general character noted, which will embody simplicity of structure with economy of operation, a specific object of the illustrated form being to provide a construction and support such that a very narrow space will serve for a working floor.

My said invention consists of means exemplified by the accompanying drawings, hereinafter described, and particularly set forth in the claims.

The annexed drawings, and the following description set forth in detail, certain means embodying my invention, the disclosed means, however, constituting but one of the various mechanical forms in which the principle of the invention may be applied.

In said annexed drawings:

Figure 1 represents a side elevation of my improved hoisting and conveying machine;

Figure 2 represents an end elevation, taken upon the plane indicated by the line II—II, Figure 1;

Figure 3 represents, upon an enlarged scale, a fragmentary vertical section, taken upon the plane indicated by the line III—III, Figure 2;

Figures 4 and 5 represent respectively, on an enlarged scale, horizontal sections, taken upon the planes indicated by the lines IV—IV and V—V, respectively, Figure 1;

Figure 6 represents, upon an enlarged scale, a plan section, taken upon the plane indicated by the line VI—VI, Figure 7, and showing particularly the conveying device and the connection thereof with the hoisting means;

Figure 7 represents a vertical longitudinal section taken upon the planes indicated by the lines VII—VII, Figure 6;

Figures 8 and 9 represent vertical sections, taken upon the planes indicated by the lines VIII—VIII and IX—IX, respectively, Figure 7;

Figure 10 represents a side elevation of a modification of my hoisting and conveying machine, in which the boom is shown in an inverted position, which allows the use of high limits for the vertical working range;

Figure 11 represents a side elevation of a second modification in which the operation of a rotatable shovel is co-ordinated with that of the hoisting and conveying machine proper;

Figure 12 represents a fragmentary plan view, taken upon the plane indicated by the line XII—XII, Figure 11;

Figure 13 represents a side elevation of a third modification in which the operation of a dumping pan is co-ordinated with that of the hoisting and conveying machine proper;

Figure 14 represents upon an enlarged scale, a plan view of said pan;

Figure 15 represents a side elevation of said pan; and

Figure 16 represents a fragmentary rear elevation of the pan.

Referring to the annexed drawings, in which the several elements are indicated by the same ordinals in the different views, a monorail track is indicated by the ordinal 1, upon which travels a motor device represented by the tractor 2. Upon this tractor 2 is mounted a hoisting device 7, of which the details will be hereinafter fully described. An overhead suitably supported I-beam 3, a channel 4 secured to the bottom flange of said I-beam 3, and two angles 5 secured to the bottom of said channel 4 and forming bearing plates for an anti-friction roller 6, journaled upon the top of the hoisting device 7, serve to provide a guide for the hoist-

ing device as the tractor 2 moves longitudinally of the track 1 and to maintain the stability of the device and its load.

The details of the hoisting device 7 are as follows:

An outer rotatable vertical mast member 11 is provided, rectangular in cross-section, and formed of oppositely disposed structural channels 8 secured together by plates 10, Figures 4 and 5. Contained within this outer rotatable mast member is an inner fixed tubular mast member 9, spaced from the outer mast member 11. The rotation of the outer mast member 11, about the axis of the inner member 9, is effected by a gear 12 and associated mechanism, Figures 7 and 9, hereinafter described in detail. A boom 13, formed of structural channel members 14, is supported upon the outer rotatable mast member 11, and is capable of a movement longitudinally of said member 11 by means hereinafter fully described in detail.

Referring particularly to Figure 3, the anti-friction roller 6 is mounted upon the top of a shell member 24 secured interiorly of the fixed mast member 9, by means of a pin 25, the latter having an enlarged upper portion 26, forming a contact surface for said roller 6. Adjacent the top of the fixed mast member 9 is formed an annular external shoulder 27, upon which rests an annular ring 28, forming a bearing plate for balls 30 and held to position by a nut 29. A cap 16, having an annular shoulder 32, is secured by a bottom flange 34 to a channel 33, the latter also being secured to the members 8 and 10 of the outer rotatable mast member 11. The shoulder 32, of the cap 16, forms a stop for a ball race 31 accommodating the balls 30. It is evident that the detail just described provides for the rotation of the upper end of the outer mast 11 about the axis of the fixed mast member 9.

Referring now to Figure 6, the bottoms of the channels 8 of the rotatable mast member 11 are secured to a rotatable base 18 mounted upon the tractor 2 and rotated by means hereinafter described.

The bottom of the inner fixed mast member 9 is formed with an annular enlarged base portion 15, Figure 7, secured to channels fixed to the platform 23 of the tractor 2. A gear wheel 12 is secured to an annular plate 21. The enlarged base 15 of the mast member 9 is formed with a shoulder 19 upon which rests a horizontally disposed ball race 37, also with a shoulder 20 supporting a vertically disposed ball race 38. The annular plate 21 by means of an upper flange 42 holds a bearing plate 43 to the balls 40 resting in the race 38, to complete a bearing taking up the radial thrust and also holds a ball race 41 to the balls 39, thus taking up the vertical thrust. The gear wheel 12 is secured by its face to a lateral flange 35 of the annular plate 21 and the flange 42 of this plate 21 is secured to the base 18 of the mast member 11. It is evident that the details just described assuming that means are provided for rotating the gear wheel 12 are sufficient to effect the rotation of the outer mast member 11 about the fixed inner mast member 9.

The gear wheel 12 is rotated by a motor 51 mounted upon the tractor, by means of the following detail mechanisms.

Referring particularly to Figures 7 and 9, the gear 12 meshes with a pinion 44, secured to a vertically alined stub shaft 45, journaled in suitable boxes mounted on the tractor frame. Adjacent the top of said stub shaft 45 is secured a gear wheel 46 meshing with a worm 47, formed upon the rearwardly extending shaft 48 provided adjacent its rear end with a pinion 49, meshing with the pinion 50, secured to the shaft of the motor 51.

Referring particularly to Figures 1, 2 and 4, a rectangular casing is formed of plates 36 secured together by suitable angles, said casing being disposed exteriorly of the outer mast member 11. To one side of said casing 36 are secured boxes in which is journaled a shaft 52 carrying a pinion 58 meshing with a rack plate 53 secured to the external face of one of the plates 10 of the outer mast member 11. The plates 36 are formed with ears 54 within which are journaled shafts 55 provided adjacent their ends with anti-friction rollers 56. The channel members 14 of the boom 13 also support corresponding shafts 55, carrying anti-friction rollers 56. The shaft 52 is rotated from the motor 57 and its associated mechanisms, so that it is evident that the casing 36 will travel vertically of the axis of the mast members 9 and 11, the plates 10 of the outer mast member 11 serving as bearing plates for the travel of the anti-friction rollers 56, as plainly shown in Figure 5. The casing 36 forms a support for the boom 13, so that it is evident that the vertical movement of the housing 36 will serve to raise and lower said boom. The motor 57 and its associated mechanisms, as well as cage 59, are carried upon a rearward extension 41 of the boom 13, the whole serving as a counterbalance for the boom and load. The boom 13 is further supported and steadied by angles 60 and braces 61, Figures 1 and 4.

A pulley 62 is mounted intermediate the boom channels 14 and adjacent the ends thereof, over which runs a hoisting cable 63 carrying the tackle block 64. A rear pulley 65 is provided whence the hoisting cable runs to a drum 66 operated by a motor 67, said drum and motor and associated mechanisms being mounted upon one of the plates of the casing 36.

The following detailed mechanism is pro-

vided for operating the tractor 2. The tractor motor is indicated by the ordinal 68, Figures 6 and 7, and the same operates, through suitable reduction gears 69, a shaft 70 which positively drives the wheels 73 of the forward truck of the tractor and also, through a pair of bevel gears 71 and a longitudinal shaft 72, positively drives the wheels 73′ of the rearward truck. Inasmuch as the drive for the wheels of the two trucks are identically the same, only one of such drives will be described in detail, the same being indicated in said Figures 6 and 7 and also the section shown in Figure 8. Secured to the inner end of the shaft 70 is a bevel wheel 74, meshing with a bevel wheel 75, journaled upon a vertically disposed stub shaft 76. Upon an extended hub on the bevel wheel 75 is secured a bevel wheel 77, meshing with a bevel wheel 78, secured to a transversely disposed shaft 79. To the inner end of the shaft 79 is secured a gear wheel 80 meshing with two gears 81 secured to the axles 82 of the forward tractor wheels 73.

It is evident that the mechanisms hereinbefore described in detail effect the travel of the tractor 2 along the monorail track 1; and also effect the rotation of the boom 13 and the outer mast member 11 about the axis of the inner mast member 9; and the vertical travel of the boom 13 and its support along the outer mast member 11.

It is evident that the construction shown in Figures 1 to 9, inclusive, is best adapted to meet conditions where the operating requirements are satisfied by a low working range for the boom 13. Referring to Figure 10, a modification is therein disclosed in which the boom 13 and its support, which rotate about the inner mast member 9, are inverted so as to meet the requirements of high limits for the vertical working range of the boom.

Referring particularly to Figures 11 and 12, there is therein disclosed a second modification in which my improved hoisting and conveying machine is adapted for work upon bulk material through the provision of a rotatable shovel or other suitable bucket means. Supported by suspended channels 85 from the main boom 13 is an auxiliary boom 84 which is further supported by means of tension rods 86. Forwardly of the auxiliary boom 84 the shovel 87 is secured at its rear end to the forward end of a rearwardly extending shaft 88. By means of a suitable sprocket wheel (not shown) a chain 89 operatively connects said shaft 88 to an upper shaft 90, disposed intermediate the channels 14 of the main boom 13, to the rear end of which shaft 90 is secured a gear 91, meshing with the pinion 92, secured to a shaft (not shown), having a worm wheel meshing with the worm 93 formed upon the shaft of the motor 94. It is evident that the mechanisms just described will provide for the driving of the shovel 87 into the bulk material to fill the shovel and that the latter can be hoisted and conveyed as desired, and then dumped through the medium of the shafts 88 and 90, motor 94 and allied mechanisms.

Referring particularly to Figures 13 to 16, there is therein shown a third modification in which the general application of my hoisting and conveying machine is coordinated with that of an attachment providing a dumping pan. This dumping pan is indicated by the ordinal 96.

The forward end of the shaft 88, similar to the like-numbered shaft of Figures 11 and 12, is formed with a worm 97, meshing with a worm wheel 98, secured to a vertically disposed shaft 99, mounted at the end of boom 84. The dumping pan 96 is provided with a pair of trunnions 102—102 mounted in vertical extensions 101—101 formed on a frame 100. The pan 96 is of such a form and so hung that when empty it will by gravity assume the position shown in full lines in Fig. 13, but, when loaded, will automatically tend to discharge its load, as shown in dotted lines in said figure. To the bottom of the pan 96 and adjacent the rear thereof is secured a member 103 adapted to be engaged by a dog 104 pivotally mounted between arms 105 extending rearwardly from the frame 100. Journaled upon pins 108 disposed within vertical extensions 106 of the arms 105 are pulleys 107 forming a guide for a cable 109 running to the cage 59. It is evident from the construction just described that the pan 96 from any angle can be forced into the material to be conveyed and thus filled and that then the pin can be elevated and transported, as desired, and dumped at the proper place by releasing the dog 104 from the member 103 through the medium of operating cable 109.

It will be noted from the above that the rotation of the shaft 88 will effect the rotation of the worm 97, the shaft 99 and hence the rotation of the pan 96 upon the axis of said shaft.

While I have shown and illustrated overhead means for supporting and guiding the upper end of the mast so as to stabilize the latter and the load carried thereby, it will be obvious that such specific means may be dispensed with and the required stability supplied by increasing the width of the base of the device, as for instance, by supplying parallel rails and suitable trucks therefor.

What I claim is:

1. In a hoisting and conveying machine, the combination of a ground track; a car adapted to run upon and means for moving same along said track; overhead longitudinal guiding means; an upright supporting structure having its base mounted upon said car and having its upper portion en-

gaging said guiding means, whereby the stability of said supporting structure is maintained; a boom extending laterally from said supporting structure and movable longitudinally with reference thereto, said boom being rotatable with reference to the axis of said supporting structure and in a horizontal plane; and means for effecting said longitudinal and rotative movements.

2. In a hoisting and conveying machine, the combination of a ground track; a car adapted to run upon and means for moving the same along said track; overhead longitudinal guiding means; an upright mast having its base fixed to said car and having its upper portion engaged by said guide; a second mast forming a housing about said fixed mast and rotatable about same; a boom mounted upon said housing mast and movable vertically therealong.

3. In a hoisting and conveying machine, the combination of a ground track; a car and means for moving same along the track; an upright mast mounted upon the car; a horizontally swinging boom mounted upon said mast, said boom being adjustable vertically along said mast; overhead means engageable with said mast and adapted to maintain the stability thereof, and means for effecting such horizontally swinging and longitudinal movements of said boom.

4. In a hoisting and conveying machine, the combination of a ground track; a tractor adapted to run on said track; a fixed mast having its base secured to the tractor platform; a second mast mounted so as to be capable of rotation about the fixed mast; means mounted upon the tractor for effecting such rotation; a boom mounted upon said rotatable mast and movable vertically therealong; and means for imparting to the boom such vertical movement.

5. In a hoisting and conveying machine, the combination of a ground track; a tractor adapted to run on said track; a fixed mast having an enlarged base portion secured to the tractor platform; a second mast mounted so as to be capable of rotation about the fixed mast; means mounted upon the tractor for effecting said rotation; a boom mounted upon said rotatable mast; and means for imparting to the boom a movement along the rotatable mast.

6. In a hoisting and conveying machine, the combination of a ground track; a tractor adapted to run on said track; a fixed mast having an enlarged base portion secured to the tractor platform; a second mast mounted so as to be capable of rotation about the fixed mast; means mounted upon the tractor for effecting said rotation; a boom mounted upon said rotatable mast; means for imparting to the boom a movement along the rotatable mast; and means forming a channel to maintain the fixed mast substantially upright.

7. In a hoisting and conveying machine, the combination of a track; a tractor; a fixed mast having an enlarged base portion secured to the tractor platform; horizontal and vertical bearing plates laterally adjacent said base; a gear having an annular body portion surrounding said base horizontally adjacent said bearing plates; co-operating balls and ball races; a second mast secured to said gear body, said second mast forming a housing for said fixed mast, the two masts having co-operating bearing plates, balls and ball races adjacent their upper ends; operating means mounted upon the tractor, and including a pinion engaging said gear and a motor, for effecting the rotation of the housing-mast about the fixed mast; a boom mounted upon said rotatable mast; and means for imparting to the boom a movement along the rotatable mast.

8. In a hoisting and conveying machine, the combination of a track; a tractor; a fixed mast having an enlarged base portion secured to the tractor platform; horizontal and vertical bearing plates laterally adjacent said base; a gear having an annular body portion surrounding said base horizontally adjacent said bearing plates; co-operating balls and ball races; a second mast secured to said gear body, said second mast forming a housing for said fixed mast, the two masts having co-operating bearing plates, balls and ball races adjacent their upper ends; operating means mounted upon the tractor, and including a pinion engaging said gear and a motor, for effecting the rotation of the housing-mast about the fixed mast; a boom mounted upon said rotatable mast; means for imparting to the boom a movement along the rotatable mast; and means forming a channel to maintain the mast substantially upright.

9. In a hoisting and conveying machine, the combination of a ground track; a car and means for moving the same along the track; a mast mounted upon the car; and a boom and associated elements, including a sleeve surrounding the mast and supporting the boom, a pinion carried by the sleeve engaging a longitudinal rack secured to the mast, and a motor for driving said pinion mounted upon said sleeve, said boom being secured adjacent one end of the sleeve.

10. In a hoisting and conveying machine, the combination of a ground track; a car and means for moving the same along the track; a fixed mast mounted upon the car; a second mast mounted so as to be capable of rotation about the fixed mast; a boom and associated elements, including a sleeve surrounding the rotatable mast and supporting the boom, a pinion carried by said sleeve

engaging a longitudinal rack secured to the mast, and a motor for driving said pinion mounted upon said sleeve, said boom being secured adjacent one end of the sleeve.

11. In a hoisting and conveying machine, the combination of a track; a tractor; an upright mast mounted upon the tractor platform; a boom rotatably mounted for horizontal swinging movement upon the mast; a shovel mounted upon said boom; and means for dumping the shovel.

12. In a hoisting and conveying machine, the combination of a track; a car and means for moving the same along the track; an upright mast mounted upon the car; a boom rotatably mounted upon the mast; and a shovel rotatably mounted upon the boom.

13. In a hoisting and conveying machine, the combination of a track; a tractor; a mast mounted upon the tractor platform and comprising a fixed inner member and a rotatable outer housing; a boom rotatably fixed to said housing but movable longitudinally therealong; means for effecting said rotation and said longitudinal movement; a shovel pivotally mounted upon the boom; and means controlling the pivotal movement of the shovel.

14. In a hoisting and conveying machine, the combination of a track; a car and means for moving the same along the track; a mast mounted upon the car and comprising a fixed inner member and a rotatable outer housing; a boom rotatably fixed to said housing but movable longitudinally therealong; means for effecting said rotation and said longitudinal movement; a shovel base rotatably mounted upon the boom; a shovel pivotally mounted upon the base; and means controlling the rotary and pivotal movement of the shovel.

15. In a hoisting and conveying device; the combination with a carriage; of a horizontally swinging boom; means for adjusting said boom vertically; a shovel base rotatably mounted on said boom; a shovel pivotally mounted on said base; means for retaining said shovel in load carrying position; and means for releasing said retaining means.

16. In a hoisting and conveying machine; a ground track; a car mounted thereon; a vertical mast fixed to said car; a housing rotatably mounted on said mast; a boom carried by said housing; an axial roller mounted upon the top of the mast; and means forming a channel guide parallel with said track adapted to receive said roller.

Signed by me this 19th day of February, 1921.

DONALD S. ANDREWS.