D. S. ANDREWS.

HOISTING AND CONVEYING DEVICE.

APPLICATION FILED SEPT. 4, 1920.

1,367,907.

Patented Feb. 8, 1921.

5 SHEETS—SHEET 1.

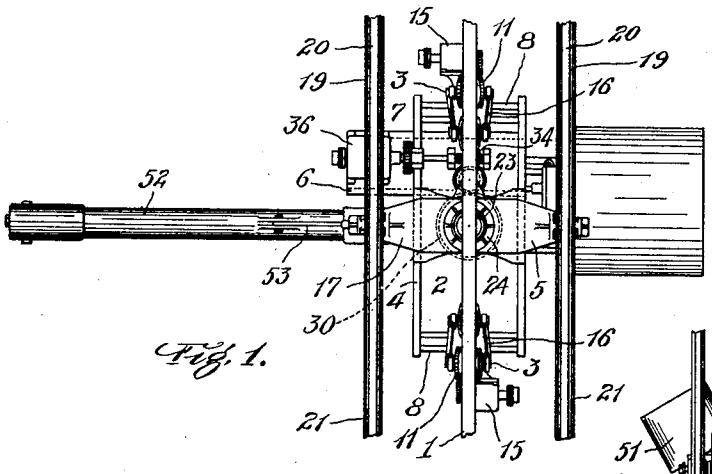

Fig. 1.

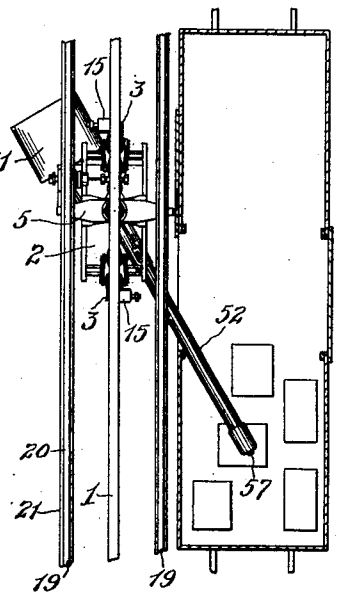

Fig. 3.

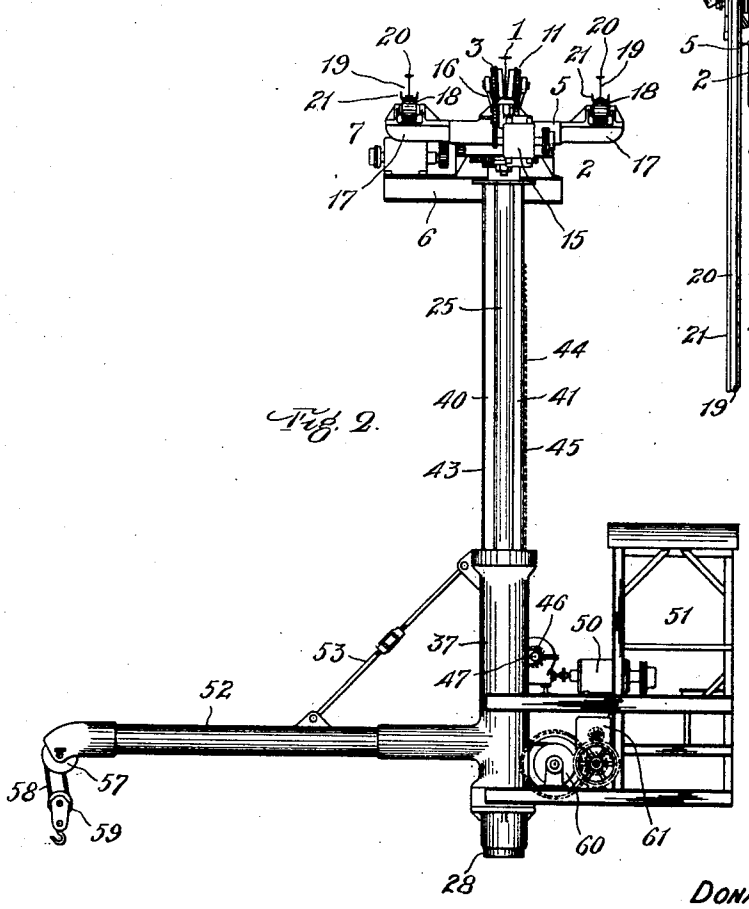

Fig. 2.

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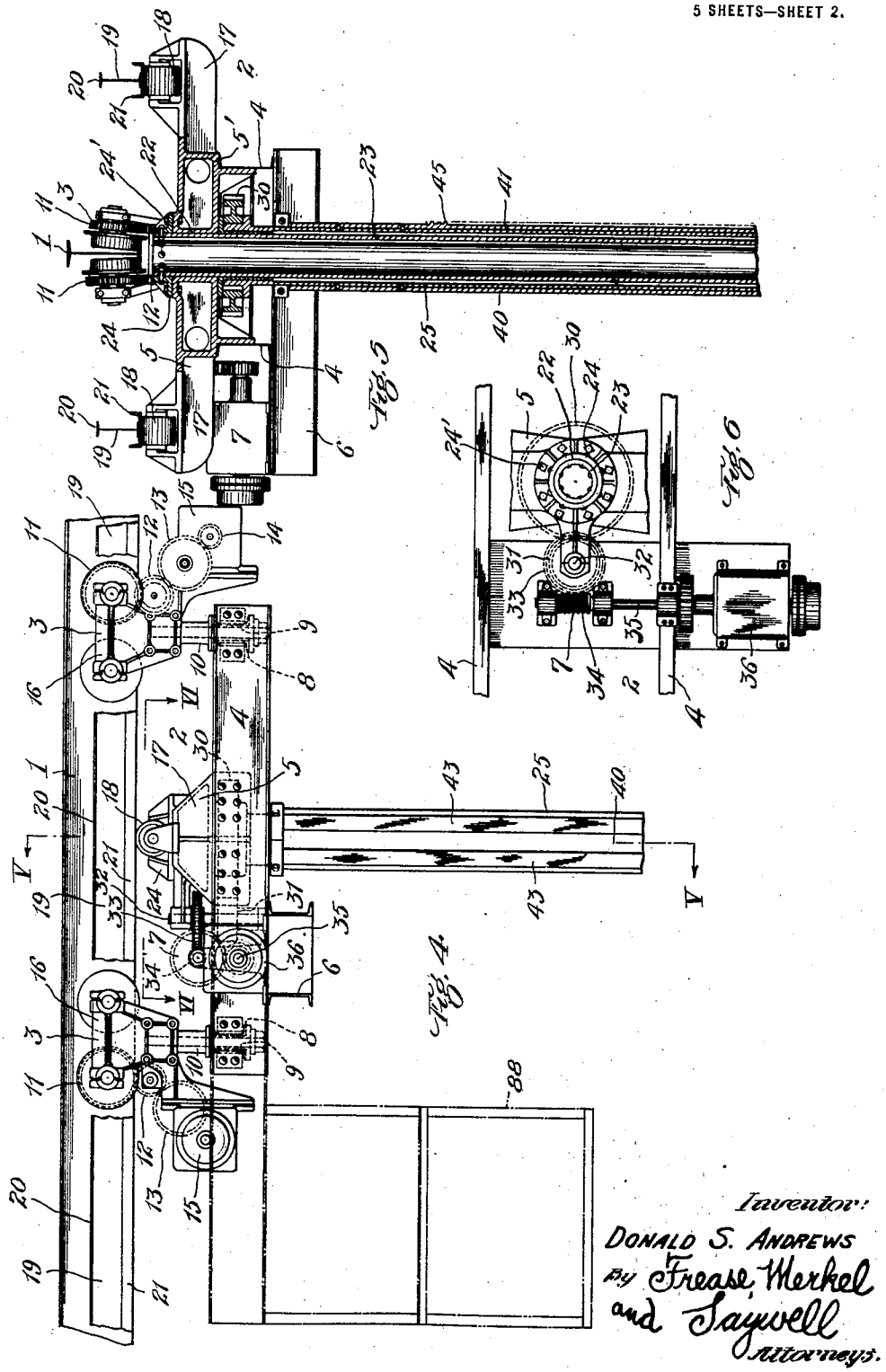

Fig. 5



Fig. 6



Fig. 4

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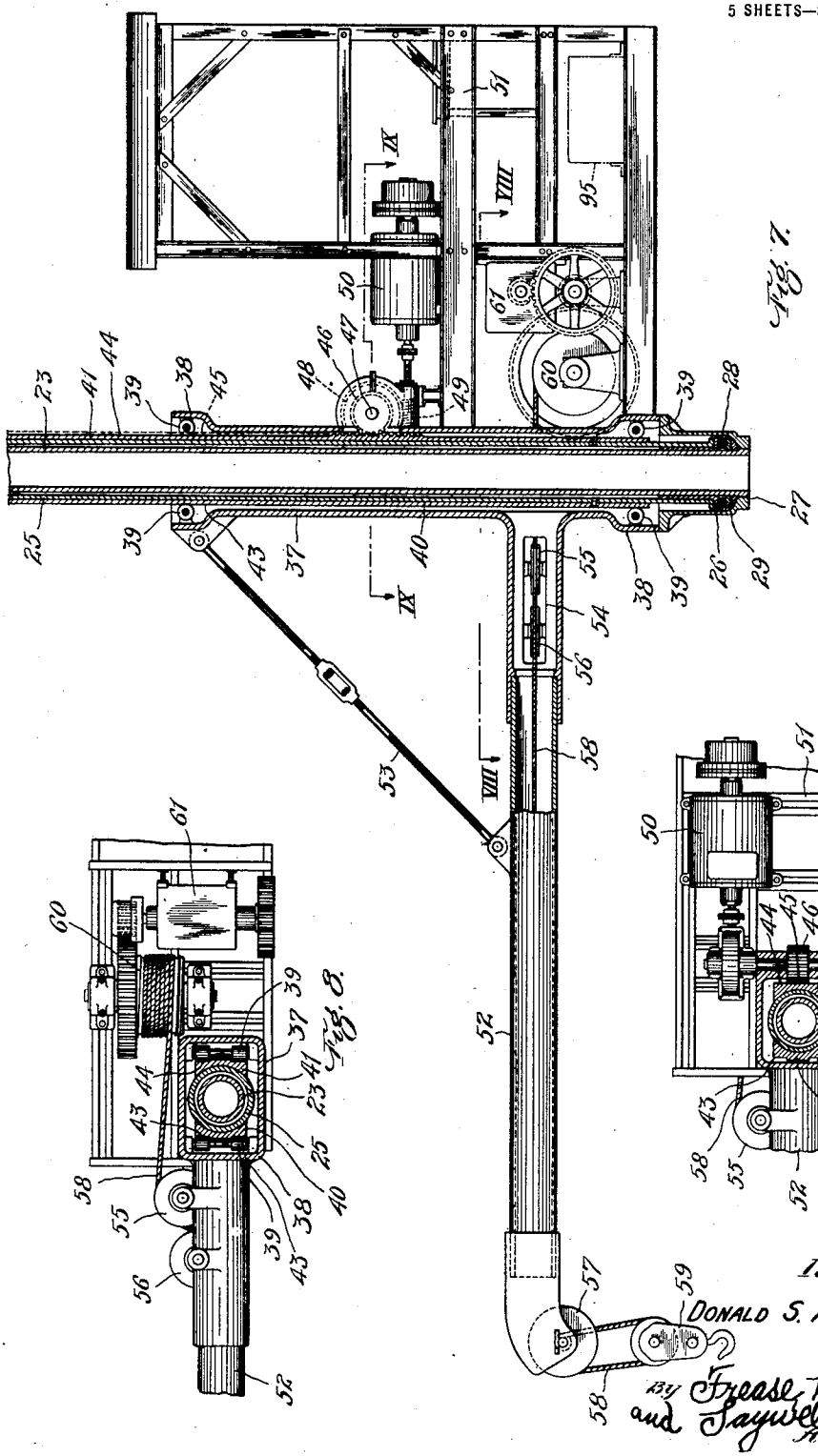


Fig. 7.

Fig. 8.

Fig. 9.

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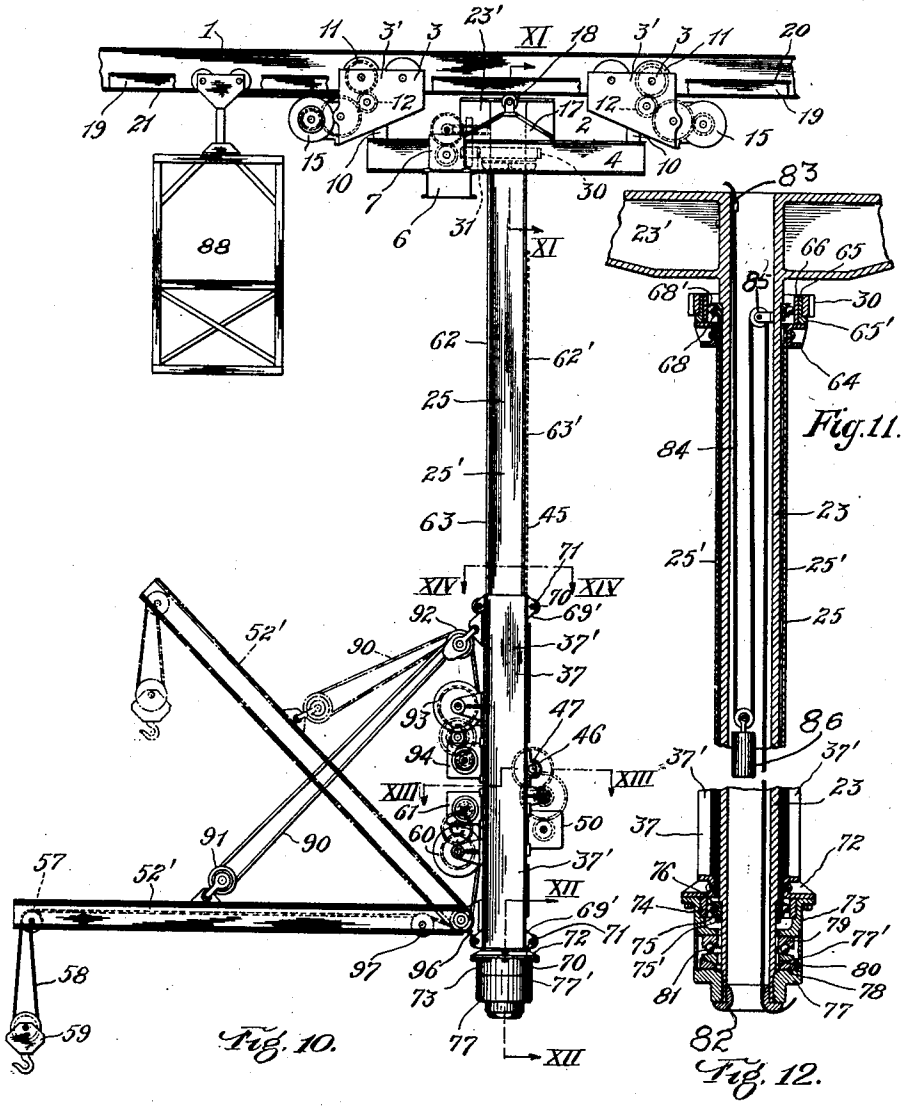

Fig. 11.

Fig. 10.

Fig. 12.

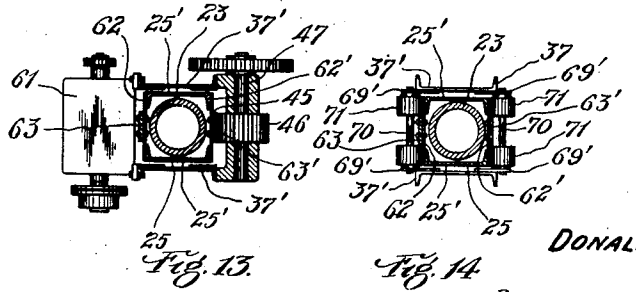

Fig. 13.

Fig. 14.

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5 SHEETS—SHEET 5.

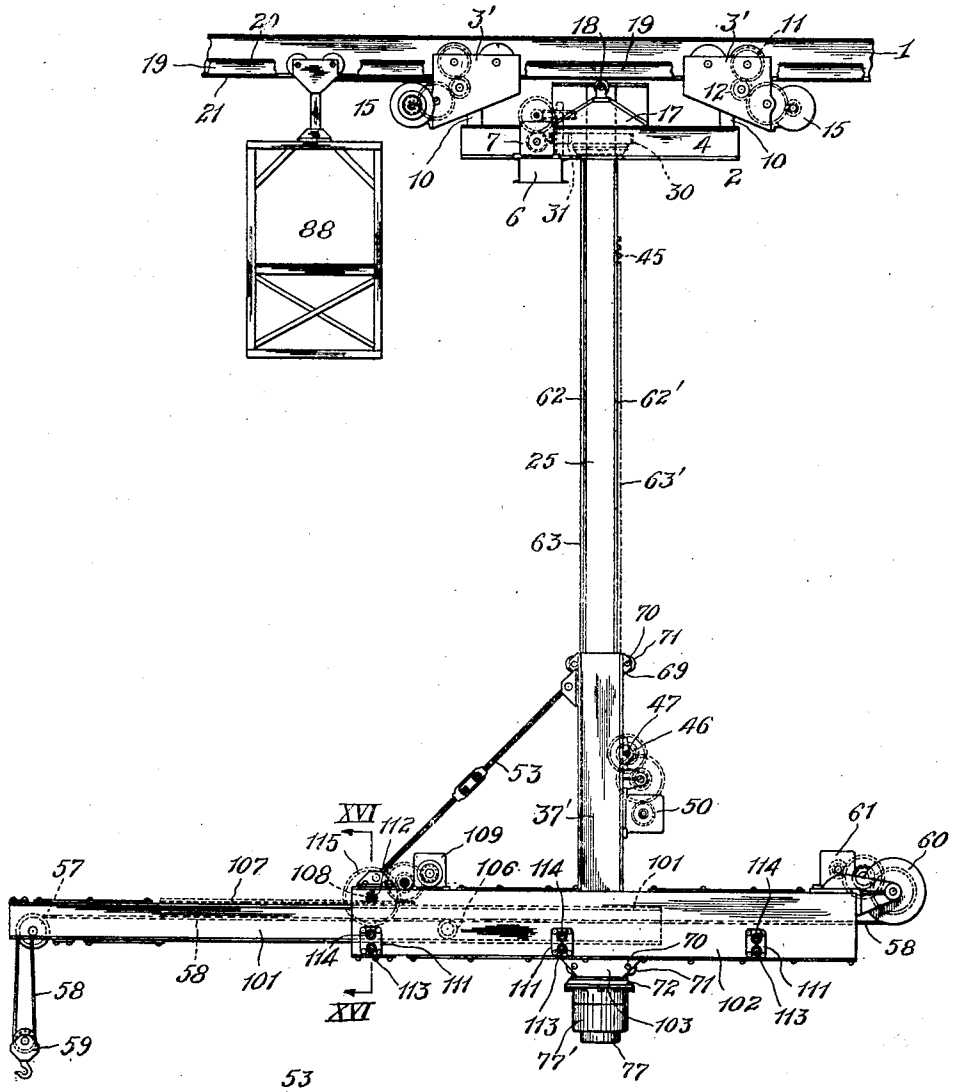


Fig. 15

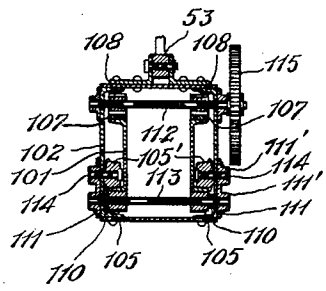

Fig. 16.

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# UNITED STATES PATENT OFFICE.

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## HOISTING AND CONVEYING DEVICE.

1,367,907. Specification of Letters Patent. Patented Feb. 8, 1921.

Application filed September 4, 1920. Serial No. 408,156.

*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 Devices, 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 devices, and particularly to that class thereof known in the art as "telphers." These devices are characterized by the fact that an overhead track system is employed with suitable switches, upon which is mounted a hoisting device, whereby articles may be transferred from one portion of a building or dock to another and deposited wherever desired.

The object of my invention is to provide a flexible hoisting and conveying device of this character which will embody simplicity of structure with economy of operation and whose construction and support is such that a clear working floor will be provided.

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

The present invention comprises a telpher construction in which a vertical mast is suspended from a trolley running upon a suitable track, upon which mast is mounted a boom having a movement about a vertical axis coinciding with the axis of the mast, the boom being also so arranged that it may travel in a vertical path and also may rotate about the mast, suitable mechanism being provided for effecting these movements and the boom being provided with suitable tackle, all as will be hereinafter more fully and specifically described. The boom may be extensible if desired, and, also, its inner end may be pivoted upon a horizontal axis so that the outer end can be raised and lowered.

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 employed.

In said annexed drawings:

Figure 1 represents a plan of a device embodying my invention.

Fig. 2 represents an end elevation.

Fig. 3 represents, upon a reduced scale, a plan of the device showing it in conjunction with a box car and illustrating its relationship thereto during the operation of loading or unloading such car.

Fig. 4 represents, upon an enlarged scale, a side elevation of the upper portion of the device.

Fig. 5 represents a section taken upon the plane indicated by line V—V, Fig. 4.

Fig. 6 represents a fragmentary plan of the upper end of the structure with the trolley removed, as viewed from the plane indicated by line VI—VI, in Fig. 4.

Fig. 7 represents a section and elevation of the lower end of the device, the section being taken upon the plane indicated by line V—V, in Fig. 4.

Fig. 8 represents a fragmentary section taken upon the plane indicated by line VIII—VIII in Fig. 7.

Fig. 9 represents a fragmentary section taken upon the plane indicated by lines IX—IX in Fig. 7.

Fig. 10 represents a side elevation of a form of my invention, of structural shapes being substituted for certain castings in the form disclosed in Figs. 1 to 9; as also, certain other detailed differences which will hereinafter be fully explained;

Fig. 11 represents a fragmentary vertical transverse section, taken in the plane indicated by the line XI—XI, Fig. 10;

Fig. 12 represents a like section, taken in the plane indicated by the line XII—XII, Fig. 10;

Figs. 13 and 14 represent horizontal sections, taken in the planes, respectively, indicated by the lines XIII—XIII and XIV—XIV, Fig. 10;

Fig. 15 represents a side elevation of a second modified form of my invention; and

Fig. 16 represents a vertical section, taken in the plane indicated by the line XVI—XVI, Fig. 15.

Referring to Figs. 1 to 9, inclusive, showing an embodiment of my invention in

which castings are largely used, the same comprises a track 1 preferably consisting of an I-beam, suitably supported. Upon this track is mounted and travels a trolley 2. This trolley comprises primarily two trucks 3—3, a main frame 4, a transverse member 5, a secondary frame 6, and operating mechanism 7, all as shown in Figs. 4 and 5. The main frame 4 also includes transverse struts 8—8, these latter supporting bearings 9—9 for two swivels 10—10, which depend from the trucks 3. These swivel bearings are located centrally of the main frame 4, as shown. Each truck comprises two pairs of wheels, one pair of each truck being provided with the gears 11 fixed thereto. These gears mesh with pinions 12 which are connected by means of suitable gears 13 and 14 with electrically operated motors 15. These motors are mounted upon downwardly extending brackets 16 forming a part of the frame work of the trucks.

The operation of the motors, therefore, will effect the required travel of the trolley along the track, as will be readily understood. An overhead bridge crane of the usual type can be utilized, if desired, instead of the trolley shown and described.

The transverse member 5 consists of a casting mounted upon the channel side members of the main frame, and is provided with lateral extensions 17—17, upon the upper surface of each of which is mounted an anti-friction roller 18. These rollers respectively engage the lower surfaces of rails 19, which, as shown, consist of I-beams 20 and channel bars 21, see Fig. 5, suitably supported.

Centrally of the member 5 is formed a cylindrical opening 22 through which projects a vertical tubular mast-member 23. The upper end of this member projects from this opening, and has secured thereto an annular plate 24 which is suitably bolted to the central casting portion 5′ by bolts 24′ and thus fixes the member 23 to the casting 5 from which it depends. Below the member 5 and loosely surrounding fixed member 23 is a hollow tubular member or sleeve 25. The lower end of this member 25, Fig. 7, is provided with a bearing plate 26, which is formed with a ball race-way. The lower end of the sleeve 23 is threaded, as at 27, and secured upon these threads is a bottom cap 28 upon the interior of which is seated a bearing plate 29 also formed with a ball race-way. Balls are interposed between the plates 26 and 29. The plate 26 rests upon these balls which receive the weight of the sleeve 25, a thrust bearing for the latter being thus formed and rotation of such member 25 being permitted. The upper end of sleeve 25 has secured thereto a gear 30, Fig. 5. This gear meshes with a pinion 31, Fig. 6, which is mounted upon a shaft 32, which also carries a worm wheel 33 meshing with a worm 34. This worm is mounted upon a shaft 35 driven by a motor 36, which is mounted upon the secondary frame 6, as shown in Fig. 6. The operation of this motor, therefore, will effect the rotation of the tubular rotatable sleeve 25.

Members 23 and 25 together form a mast upon which, as will be hereinafter described, the boom is supported. Side sway or oscillation of this mast, particularly in the position of the boom shown in Fig. 7, is counteracted by the engagement of the rollers 18 with the rails 19, as will be readily understood.

Surrounding the rotatable sleeve 25 is a boom sleeve 37 which is of rectangular section and of suitable dimensions to permit the sleeve 25 to run free. The upper and lower ends of this sleeve 37 are expanded as at 38, and mounted in this expanded portion are two sets of anti-friction rollers 39. Upon opposite sides of the rotatable mast member 25 are secured two plates 40 and 41 respectively. Plate 40 is provided with two guide-ways 43—43, Fig. 9, in which the adjacent rollers 39 run. The plate 41 is similarly provided with guide-ways 44 in which the opposite rollers 39 run, and is furthermore provided with a centrally located vertical rack 45. This rack is engaged by a pinion 46, which is mounted upon a shaft 47 upon which is mounted a worm gear 48, engaging a worm 49 driven by an electrically operated motor 50. This motor is mounted upon a cage or frame 51, which itself is carried by the boom sleeve 37.

Projecting laterally from the sleeve 37 is the boom proper 52, preferably made of hollow tubing. It will, therefore, be seen that the operation of the motor 50 will cause the boom and its attached sleeve to travel vertically along the rotatable sleeve 25.

The boom 52 is further supported by a tension rod 53 and, in one side of the boom, near the sleeve 37, is an opening 54, Fig. 7, in which are mounted pulleys 55 and 56. At the end of the boom is mounted a pulley 57 and over these pulleys passes the hoisting cable 58 carrying the block 59. This cable is wound upon a drum 60, Fig. 8, which is rotated by an electrically driven motor 61, through suitable gearing, such drum or driving means being all mounted upon the cage or frame 51, as shown in Fig. 7. I have shown a counterweight 95 supported by the frame 51, Fig. 7, but the same is indicated in dotted lines to show that I do not consider it material whether or not this feature is a part of my device.

Although I have disclosed means for raising and lowering the boom, comprising a rack and pinion and associated elements, I consider other means of raising the boom to be within the spirit of the invention, such

as the utilization of a screw, or cables, or to raise it hydraulically or pneumatically.

Referring to the forms of device shown in Figs. 10 to 16 inclusive, certain differences between these forms and that disclosed in Figs. 1 to 9 inclusive, consist in the substitution of structural shapes for certain castings. For instance, Figs. 10 and 15, structural plates 3′ are utilized for supporting the operating mechanism of the trucks 3, instead of the castings shown in Fig. 4. Furthermore, the vertical tubular mast member 23 is supported by means of a head 23′ which takes the place of the frame member 5, in the construction shown for supporting this mast member in Fig. 5. In these forms of device, shown in Figs. 10 and 15, the outer rotatable mast member 25 consists of oppositely disposed channels 25′, Figs. 13 and 14, spaced from the tubular member 23 and secured together by means of plates 62 and 62′, thus forming a rectangular outer mast member. The rotation of this outer mast member is effected by means of the gear 30 and associated mechanisms, the connection of the gear 30 to the members 25′ being effected as follows: Secured to the top of the members 25′ is an annularly channeled member 64 in turn secured to the annular plate 65 having a shoulder 65′ on which is secured the gear 30, said plate 65 being formed with a bearing plate 66 which coöperates with a race-way 68 secured to the tubular member 23, and a series of balls 68′ which together form an upper roller bearing. Lower roller bearings are provided, one to act as a radial thrust member and the other to act as a vertical thrust member, and the same are comprised of the following details, plainly shown in Fig. 12. Secured to the bottom of the outer mast members 25′ is a flange 72 similar to the flange or channel member 64, to the under surface of which is bolted a cap 73 formed with a vertical bearing plate 74 coöperating with a ball race 75 and balls 76. A collar 75′ is secured to the tubular member 23 adjacently below the race-way 75. Secured to the exteriorly threaded lower end of the mast member 23 is the cap 77 having an upwardly extended shell portion 77′ engaging the cap 73 and forming a support for a second roller bearing comprising upper and lower race-ways 79 and 80 associated with balls 81, a bearing plate 78 being mounted upon the cap 77 adjacently below the race-way 79. This detail is all plainly shown in Fig. 12.

Also, the boom sleeves 37, of the form of device shown in Fig. 2, are replaced by oppositely disposed channels 37′, Figs. 13 and 14, formed with upper and lower ears 69′ within which are journaled shafts 70 having secured adjacently their respective ends, rollers 71. These rollers travel in guide-ways formed by bearing plates 63 and 63′, Fig. 13, secured to the side plates 62 and 62′ of the vertically movable mast member 25′. The plate 63′ is formed with a rack portion 45 similar to that disclosed in Fig. 7, and the rotation of the sleeve 37′ by means of this rack 45 and its associated mechanism is similar to that hereinbefore described as regards the operation of the device shown in Fig. 7.

Referring particularly to the device shown in Figs. 10 to 14, it is contemplated that the boom shall have an additional path of movement. This is effected by pivoting the boom upon plates 96 secured to the members 37′. By this means, the tackle end of the boom is given a field of operation within which it could not oftentimes otherwise work, both because of the higher field to which it may be adjusted, and because the distance from the mast to the tackle end of the boom is considerably less in the dotted line position shown in Fig. 10 than it is in the full line position, which results in a practical operation of the boom within a narrowed field which would not be possible if the effective length of the boom could not thus be decreased. These vertical adjustments of the boom are effected through the medium of the cable 90, pulleys 91 and 92, drum 93, motor 94 and associated mechanisms, all as plainly shown in Fig. 10. In this form of device, the boom 52 made of hollow tubing, shown in Fig. 7, is replaced by a boom 52′ formed of structural channel members. The rearward pair of pulleys for the hoisting cable 58, are arranged in the position indicated by the ordinal 97, Fig. 10, and the drum 60 and motor 61 are supported upon the sleeve 37′. In this form of device, the cage indicated by the ordinal 88 is suspended from wheels running upon the track 1, and the counterweight 95 is dispensed with.

In the form of device shown in Figs. 15 and 16, in addition to the substitution of structural shapes for certain castings as has been described with reference to the device of Fig. 10, the following differences also apply. The boom comprises two telescoping elements 101 and 102, of which only element 101 is a moving element. Both of these elements are formed of oppositely disposed channel members, as plainly shown in Fig. 16. Intersecting the respective channel members of the exterior stationary boom element 102 are a pair of shafts 112 and 113, to the upper one of which, 112, are secured a pair of pinions 108 adapted to coöperate with two rack segments 107 secured to the top of the channel parts of the inner movable element 101. Secured to the lower shaft 113 and contiguously to the lower faces of the lower flanges of the boom parts 101 are a pair of rollers 105 separated from the

boom elements 102 by the spacing blocks 110. Secured to the lower outer faces of the boom parts 120 are a pair of plates 111, each provided with a pair of bosses 111′, adapted, respectively, to receive the outer ends of the shaft 113 and the outer ends of a pair of pins 114 intersecting the boom parts 102. Upon the inner ends of the pins 114 and intermediately the boom parts 101 and 102 are mounted a pair of rollers 105′, these rollers being adapted to run upon the inner faces of the lower flanges of the boom part 101. A plurality of sets of these rollers 105 and 105′ are provided, there being three such sets shown in Fig. 15 by way of illustration. Secured to the shaft 112 is a gear 115 adapted, by means of associated mechanism, to be operated by the motor 109. It is evident that the motor and its associated mechanisms will cause the boom parts 101 to travel inwardly or outwardly of the boom parts 102 to provide the desired effective boom length. In this form of construction, the boom rests upon the flange 72 by means of the plates 103, which are bolted to the members 102, as plainly shown in Fig. 15. The plates 103 form a base for the boom support 37′, when the boom is in its lowermost position. A guide for the hoisting cable 58 is provided by the pulley 106, and the cable is wound upon the drum 60 by means of the motor 61, the latter elements, in this form of device, being mounted upon the boom element 102. It is not intended that the boom elements 101 should pass outwardly beyond the intermediate of the three sets of rollers 105, 105′, whereby the boom elements 101 would get out of alinement, and this restraint is imposed upon the boom elements 101 by means of a limit switch provided upon the motor 109. During the hoisting operation, there might be a thrust in a horizontal direction on the part of the boom elements 101 and, in order that this thrust may not be effected, a restraint is imposed upon the rack 107 by means of the motor brake.

In Fig. 12, I have shown means forming a take-up for the slack of the electrical cable 84. This take-up is located within the tubular mast member 23 and includes the suspended weight 86 and the fixed pulley 85. The cable 84 is anchored at 83, as it enters the mast at the top, and I provide a rounded bushing 82 at the bottom of the mast to allow the cable to come through without being damaged.

What I claim is:

1. In a hoisting and conveying device, the combination of a track; a trolley mounted upon the latter; a mast suspended from said trolley; a boom mounted upon said mast; and means for moving said boom along and revolving same about said mast.

2. In a hoisting and conveying device, the combination of a track; a trolley mounted upon the latter; a mast suspended from said trolley; a boom mounted upon said mast; means for moving said boom along and revolving same about said mast; and means for oscillating said boom about a horizontal axis.

3. In a hoisting and conveying device, the combination of a track; a trolley mounted upon the latter; a mast suspended from said trolley; a laterally extending and vertically movable boom mounted upon said mast; and a pair of rails parallel with and having its members upon opposite sides of said track, said trolley being provided with laterally extending members in engagement with said rails; whereby the tendency to oscillate is counteracted.

4. In a hoisting and conveying device, the combination of a track; a trolley mounted upon the latter and including a main frame and two trucks from which said main frame is suspended by swivels having vertical axes, and a centrally located transverse member mounted upon said main frame; a mast suspended from said transverse member; a boom mounted upon and movable along said mast; and two rails mounted respectively upon opposite sides of and parallel with said track, said transverse member extending beneath said rails and in engagement with same.

5. In a hoisting and conveying device, the combination of a track; a trolley mounted upon the latter and including a main frame and two trucks from which said main frame is suspended by swivels having vertical axes, and a centrally located transverse member mounted upon said main frame, said member being provided with a central cylindrical opening; a mast comprising an inner cylindrical member extending through said opening and fixedly secured to said transverse member, and an outer sleeve rotatable upon said mast and having a gear fixed thereto; a motor and gearing connected with said gear and mounted upon said main frame member, adapted to actuate said gear and rotate said outer sleeve; and a laterally extending boom mounted upon said sleeve.

6. In a hoisting and conveying device, the combination of a track; a trolley mounted upon the latter and including a main frame and two trucks from which said main frame is suspended by swivels having vertical axes, and a centrally located transverse member mounted upon said main frame, said member being provided with a central cylindrical opening; a mast comprising an inner cylindrical member extending through said opening and fixedly secured to said transverse member, and an outer sleeve rotatable upon said mast and having a gear fixed thereto; a motor and gearing connected with said gear and mounted upon said main frame member, adapted to actuate said gear

and rotate said outer sleeve, said inner fixed mast member forming a support for the lower end of said outer rotatable member; and a laterally extending boom mounted upon said sleeve.

7. In a hoisting and conveying device, the combination with a depending mast comprising a fixed inner member and a rotatable outer sleeve; of a boom rotatively fixed to said sleeve but movable longitudinally therealong.

8. In a hoisting and conveying device, the combination with a depending mast comprising a fixed inner member and a rotatable outer sleeve; of a boom rotatably fixed to said sleeve but movable longitudinally therealong, said fixed inner member forming a support for the lower end of said rotatable sleeve.

9. In a hoisting and conveying device, the combination of a depending mast comprising a fixed inner member and a rotatable outer sleeve; a boom including a laterally extending member and a sleeve surrounding and movable longitudinally of said rotatable sleeve; and means for effecting such longitudinal movement, said boom-sleeve being rotatively fixed with respect to said rotatable sleeve.

10. In a hoisting and conveying device, the combination of a depending mast comprising a fixed inner member and a rotatable outer sleeve; a boom rotatably fixed to said sleeve and movable longitudinally therealong, said sleeve being provided with a longitudinal rack; a frame supported by said boom; and operating means including a motor and a pinion engaging said rack for effecting such longitudinal movement.

11. In a hoisting and conveying device, the combination of a depending mast comprising a fixed inner member and a rotatable outer sleeve; a boom including a laterally extending member and a sleeve surrounding and movable longitudinally of said rotatable sleeve, the latter being provided with a longitudinal rack; a frame supported by said boom-sleeve; and operating means mounted upon said frame including a motor and a pinion engaging said rack for effecting such longitudinal movement.

12. In a hoisting and conveying device, the combination of a depending mast comprising a fixed inner member and a rotatable outer sleeve; a boom including a laterally extending member and a sleeve surrounding and movable longitudinally of said rotatable sleeve, said rotatable sleeve being provided with oppositely disposed longitudinal plates formed with parallel guide-ways, said boom-sleeve being provided with anti-friction guiding rollers engaging said guide-ways; and means for effecting such longitudinal movement.

13. In a hoisting and conveying device, the combination of a depending mast comprising a fixed inner member and a rotatable outer sleeve; a boom including a laterally extending member and a sleeve surrounding and movable longitudinally of said rotatable sleeve, said rotatable sleeve being provided with oppositely disposed longitudinal plates forming parallel guide-ways, one of said plates being provided with a longitudinal rack parallel with said ways, said boom-sleeve being provided with anti-friction rollers engaging said guide-ways; a frame mounted upon said boom-sleeve; and means mounted upon said frame including a motor and a pinion engaging said rack for effecting such longitudinal movement.

14. In a hoisting and conveying device, the combination of a vertical mast; an overhead support for said mast; a horizontal boom supported by said mast; means for moving said mast horizontally relatively to said support; means for moving said boom vertically relatively to said mast; and means for rotating said boom around said mast.

15. In combination, a track, a fixed depending member, arranged to be carried along said track; a sleeve supported by and turning about said fixed member; and a boom mounted to travel along said sleeve.

16. In a hoisting and conveying device, the combination of a boom; an overhead support for said boom from which support said boom depends; means for oscillating said boom about a horizontal axis; and means for rotating said boom through an arc of 360°, thus providing a clear working floor.

17. In a hoisting and conveying device the combination of an overhead track; a trolley on said track; a vertical mast depending from said trolley; a boom supported by said mast; means for moving the boom vertically along said mast; means for rotating the boom around the mast; and means for varying the effective radius of said boom with reference to the mast as a center.

Signed by me, this 27 day of August, 1920.

DONALD S. ANDREWS.