United States Patent [19]

Wilson

[11] **3,887,080**

[45] **June 3, 1975**

[54] **CRANE STRUCTURE**

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[22] Filed: **June 29, 1973**

[21] Appl. No.: **374,924**

[52] **U.S. Cl.** **212/11;** 212/18; 212/127; 212/130

[51] **Int. Cl.** **B66c 17/06**

[58] **Field of Search** 212/10, 11, 18, 21, 127, 212/128, 130; 187/27

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[57] **ABSTRACT**

A crane structure in which a main crane frame moves along stationary elongated rails while a carriage is moveable laterally on the main frame of the crane. The carriage has mounted thereon a subcarriage, or carrier which can turn clockwise and counterclockwise on the carriage on a vertical axis, and suspended from the carrier by cables is a load unit, or load frame, in which winches are mounted to which the cables are attached. The load unit comprises load engaging means such as a hook for picking up loads. The load unit containing the winches and supporting the hook is adapted for being lowered to the floor for servicing of the winches and the drive motors therefor, and the like.

Power means are provided for causing the subcarriage, or carrier, to rotate, or turn clockwise and counterclockwise, on the carriage to locate the load unit in the proper angular position.

14 Claims, 13 Drawing Figures

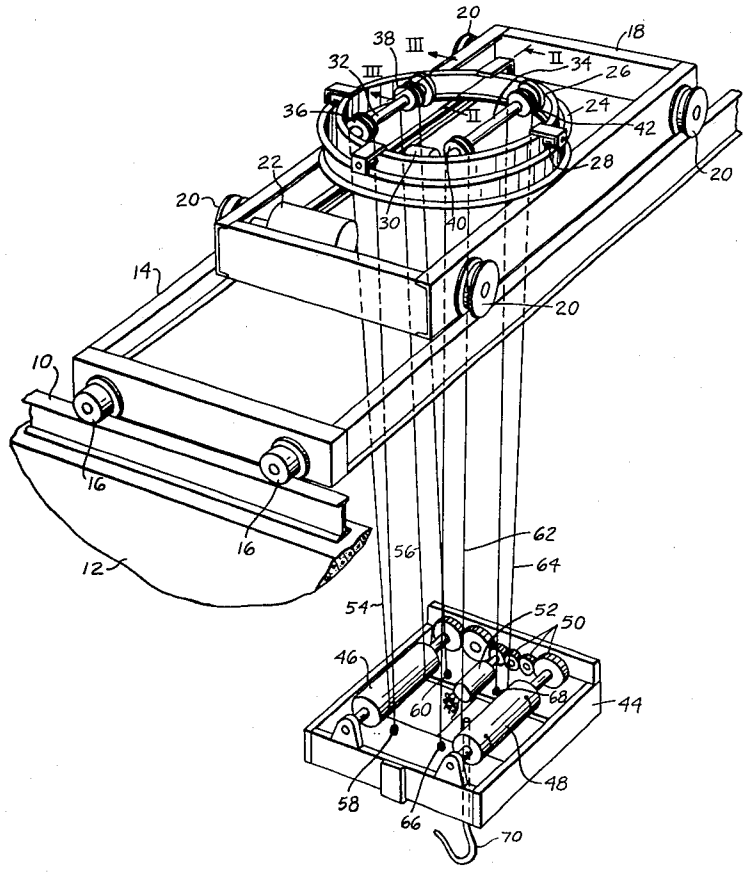


FIG-1

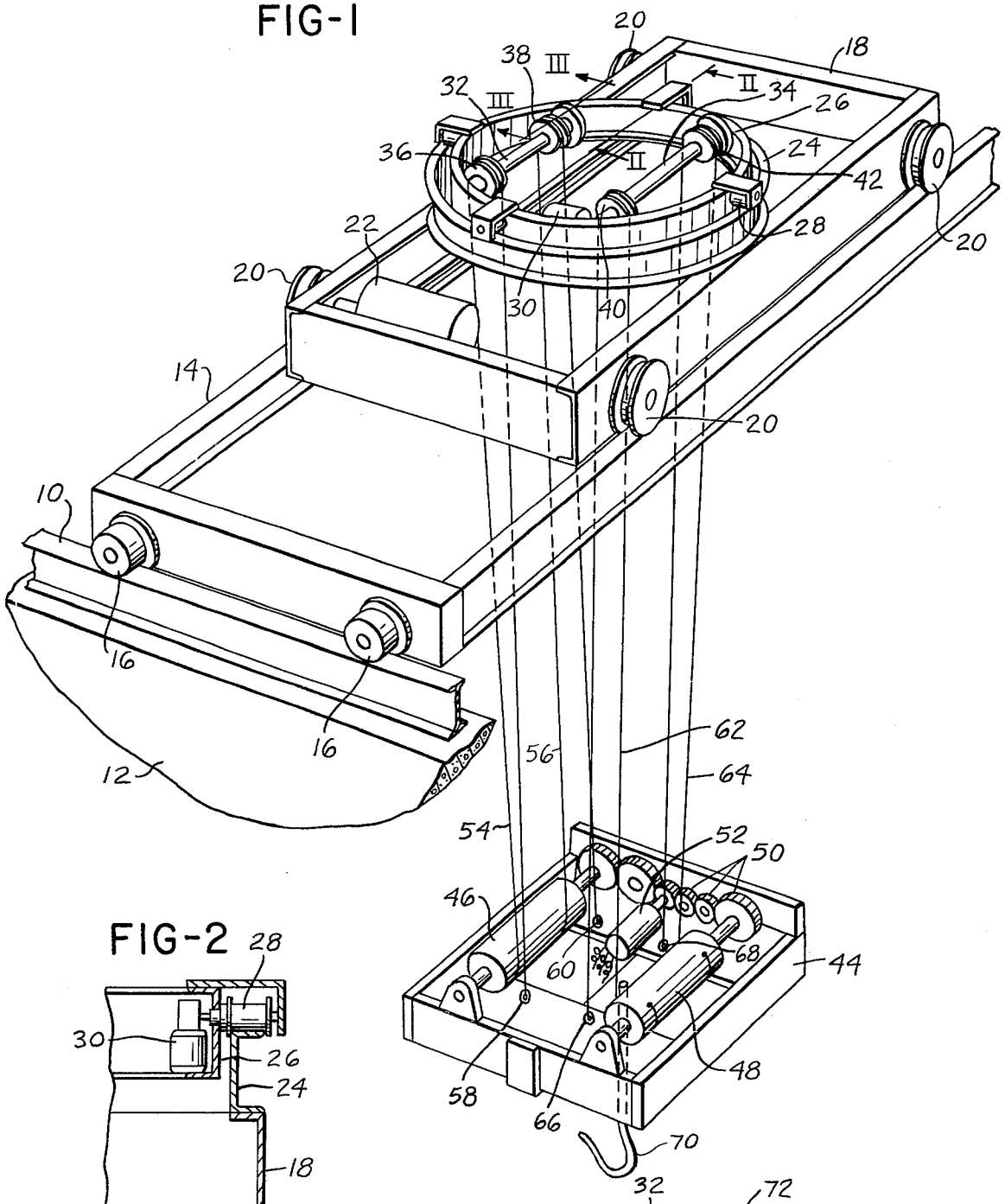


FIG-2

FIG-3

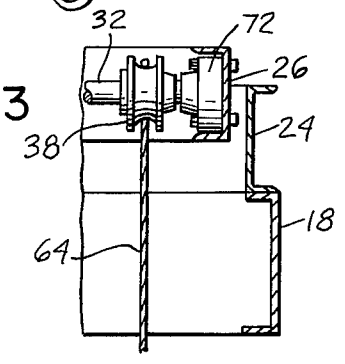


FIG-4

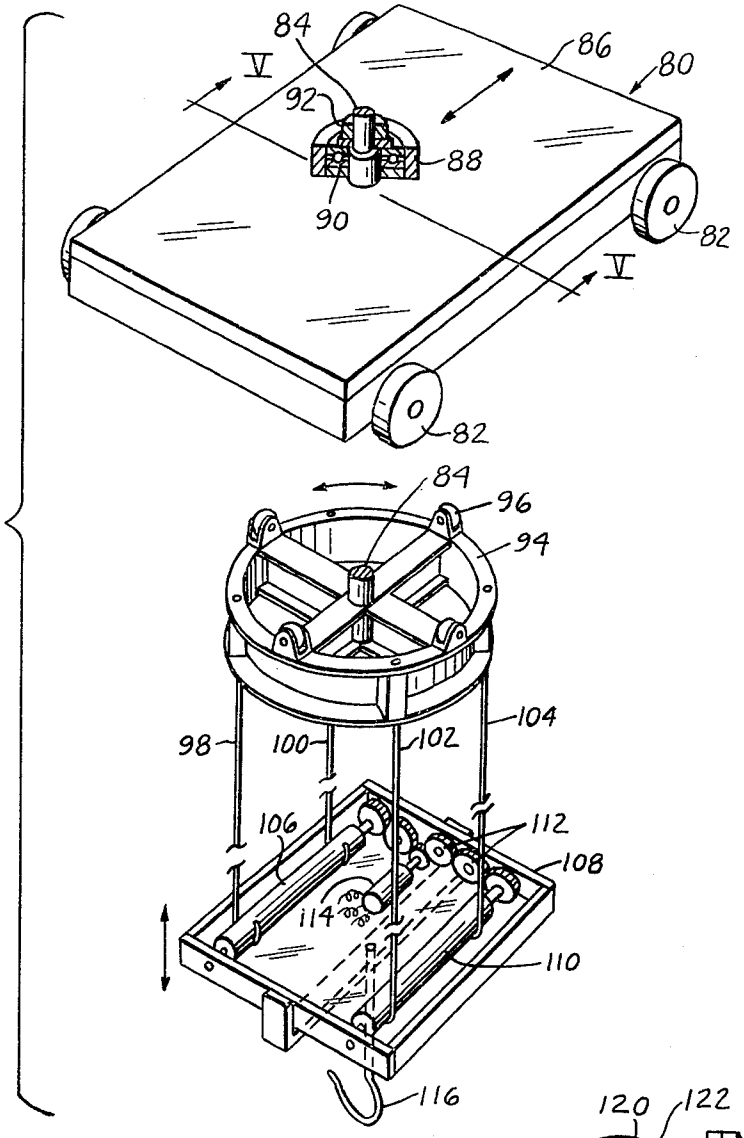


FIG-8

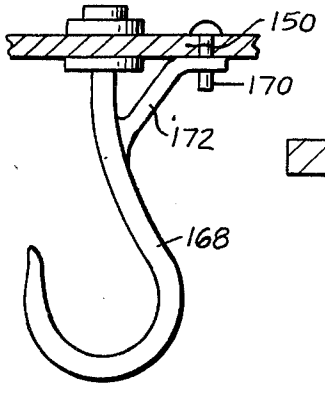


FIG-5

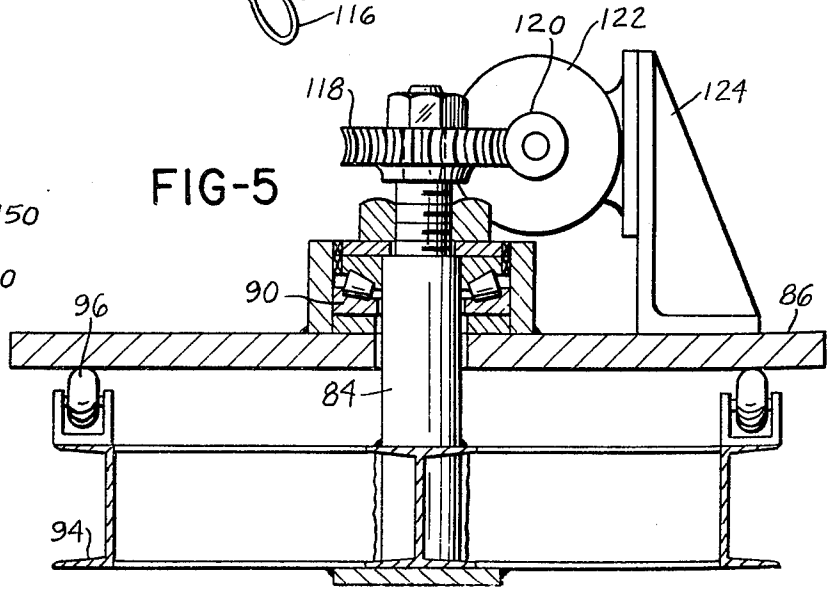


FIG-6

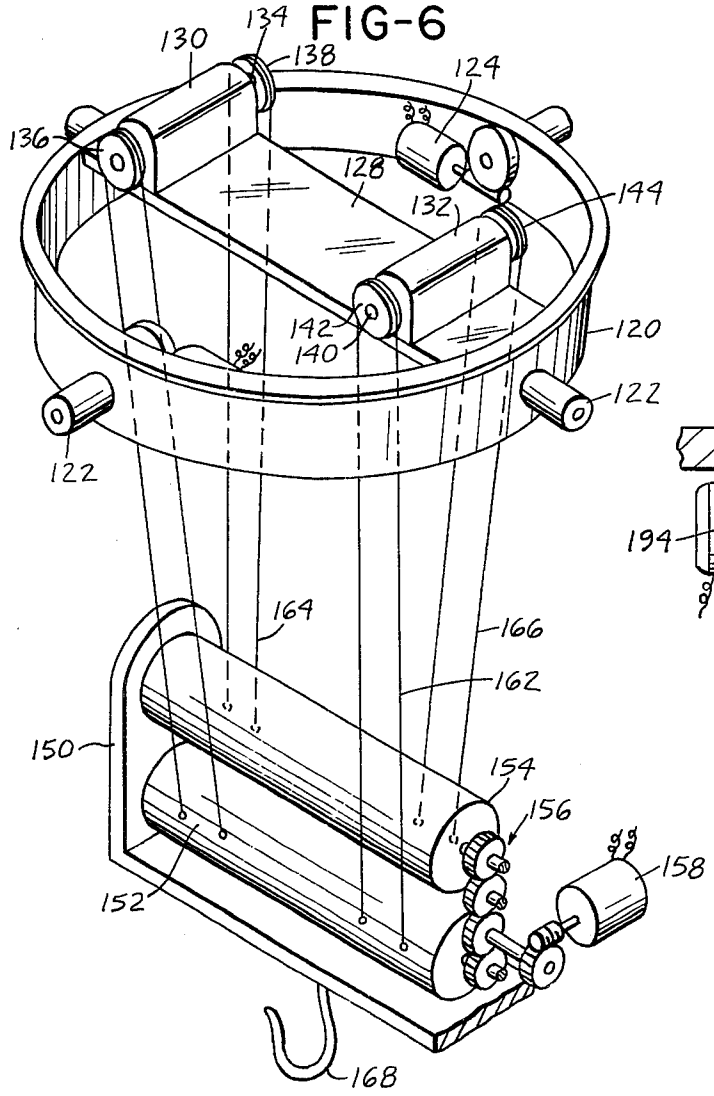


FIG-7

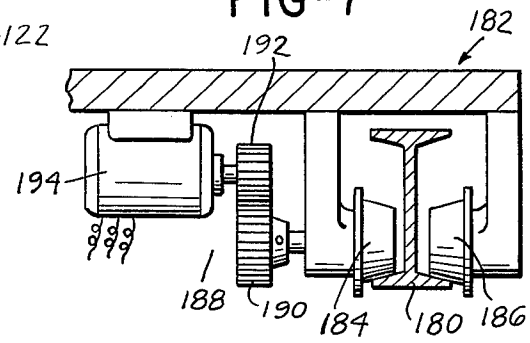


FIG-9

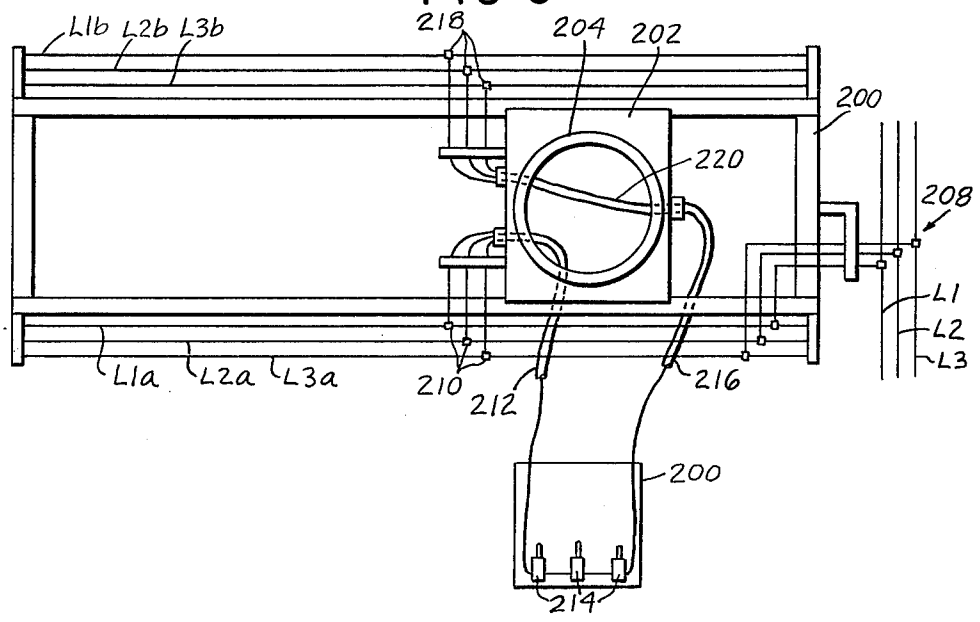


FIG-10

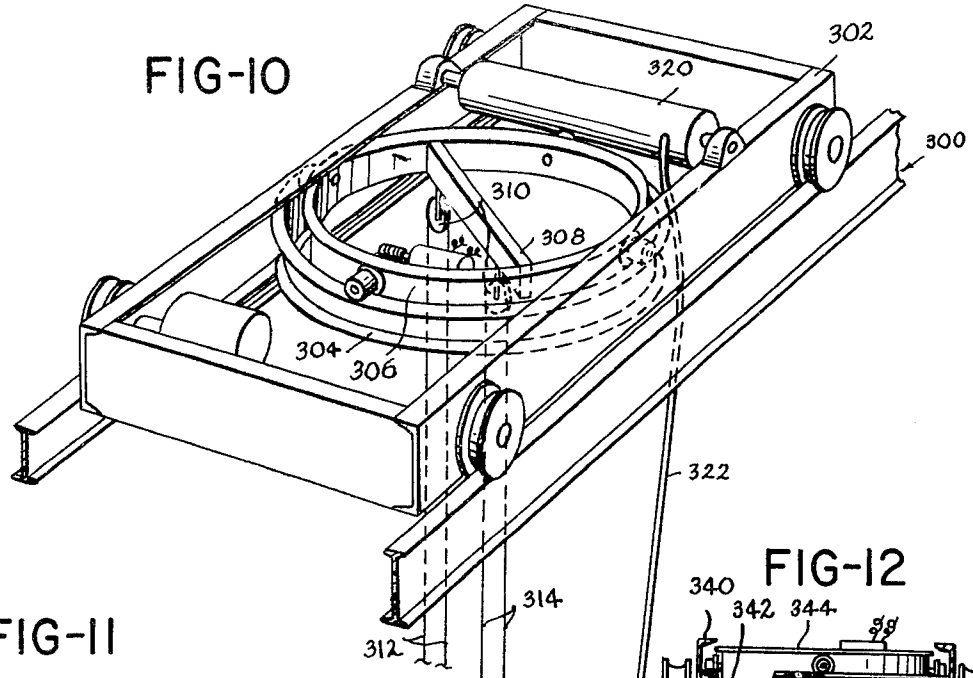
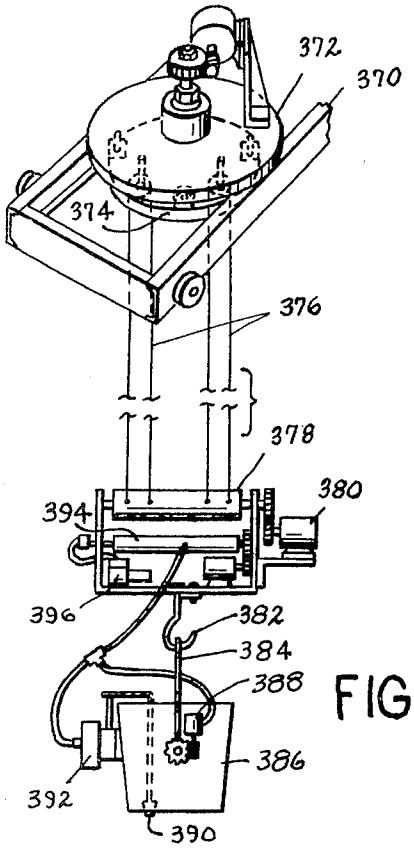


FIG-11



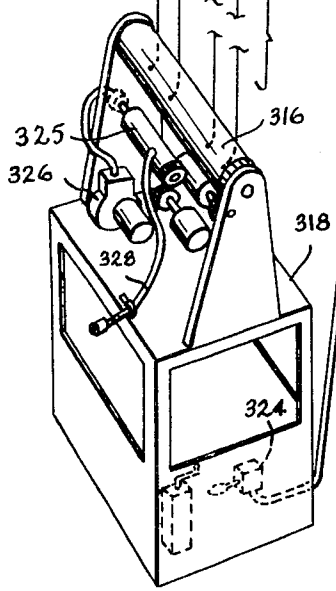


FIG-12

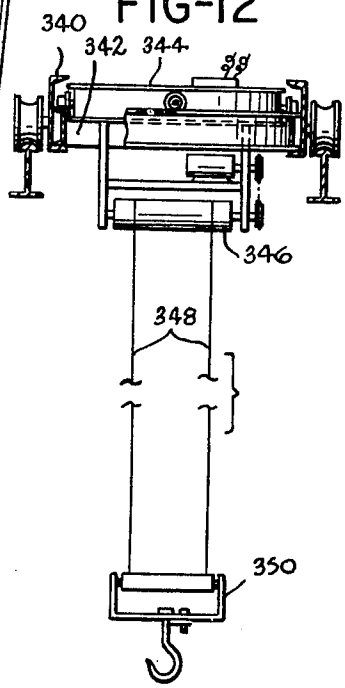
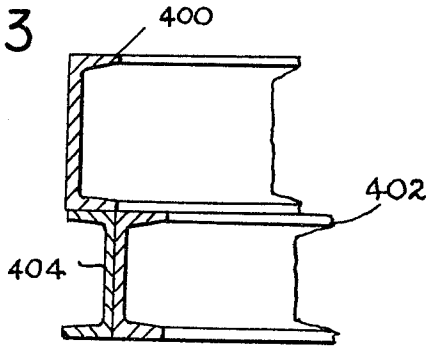


FIG-13



CRANE STRUCTURE

The present invention relates to cranes and is particularly concerned with a crane arrangement in which the power driven winch arrangements for elevating a load are carried in a load frame, or load unit, arrangement that is suspended by the load cables from the crane carriage so that the load frame carrying the winches can be lowered completely to the floor for servicing the winches and the drive motor, or motors therefor.

Cranes are, of course, well known, but heretofore have always had the power driven winch arrangements mounted in the carriages, or trolley, which moves along the main frame of the crane. This positions the winches and the drive motors therefor in a location that is relatively inaccessible so that maintenance and servicing thereof has always been somewhat difficult.

With the foregoing in mind, the primary objective of the present invention is to provide a crane structure which is easy to service.

Another object is the provision of a crane structure in which the winches and the drive therefor can readily be serviced.

Still another object is the provision of a crane structure in which the winches of the crane and the drive therefor can be lowered to floor level for inspection, servicing, and maintenance.

The foregoing objects of the invention as well as other objects and advantages thereof will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings, in which:

FIG. **1** is a perspective view, somewhat schematic, showing one crane arrangement according to the present invention.

FIG. **2** is a sectional view indicated by line II—II in FIG. **1** and drawn at somewhat enlarged scale.

FIG. **3** is a sectional view indicated by line III—III in FIG. **1** and drawn at somewhat enlarged scale.

FIG. **4** is an exploded perspective view showing a modification.

FIG. **5** is a sectional view indicated by line V—V in FIG. **4**, and drawn at enlarged scale.

FIG. **6** shows a modification.

FIG. **7** shows a modification pertaining to the trolley support.

FIG. **8** shows how the load hook can be held against rotation.

FIG. **9** shows a wiring diagram.

FIG. **10** is a schematic perspective view showing a modification.

FIG. **11** is a view like FIG. **10** but showing still another modification.

FIG. **12** is a transverse section showing a modification.

FIG. **13** is a fragmentary section showing a still further modification.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, a crane structure is provided having a main crane frame moveable on stationary rails and a crane carriage or trolley moveable along the main crane frame. Mounted on the trolley or carriage is a subcarriage or carrier and from which a load frame, or load unit, is suspended by load cables and having load engaging means thereon. The carrier

can turn clockwise and counterclockwise about a vertical axis on the trolley. According to the present invention, the load winches are mounted in the load frame together with the drive therefor so that this portion of the crane structure can be lowered to floor level at any time that servicing is required.

The main crane frame is power driven on the main stationary rails and the crane trolley is power driven along the main frame of the crane and the subcarriage or carrier is reversibly driven in rotation on the train trolley.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings more in detail, in FIG. **1**, reference numeral **10** indicates one of a pair of elongated parallel rails which are stationarily supported as by building walls **12.**

Supported on rails **10** is a main crane carriage **14** which includes support rollers **16** engaging the elongated main rails **10.** One, or more, of rollers **16** is driven for moving the main crane **14** along rails **10** in a more or less conventional manner. Frame **14** is itself in the form of elongated rails extending perpendicularly to the rails **10** and mounted on the rails of the main frame **14** is a crane carriage **18** which has rollers **20** engaging the main frame **14** with one, or more, of these rollers being reversibly driven by a motor **22.**

The motor **22** can be either electric or hydraulic, as desired, and by driving one or more of the rollers **20,** carriage **18** can be caused to take any desired position along the main frame **14,** while main frame **14** can take any desired position along rails **10.**

Mounted on carriage **18** is circular track **24** which is fixed thereto in any suitable manner, as by welding. Circular track **24** is adequately strong and is so supported on carriage **18** that it can sustain the loads for which the crane is designed. Rotatable on circular track **24** is a subcarriage, or carrier, **26** supported on track **24,** as by rollers **28.** One or more of the rollers **28** is adapted for being driven as by a motor **30** connected thereto, and which may be an electric or hydraulic motor, as desired. The provision of a drive for one or more of rollers **28** provides for rotating carriage or carrier **26** to any desired angular position on track **24.**

Mounted in carriage or carrier **26** are shafts **32** and **34** which carry respective pulleys **36, 38,** on shaft **32** and **40, 42** on shaft **34.**

Vertically beneath frame or carriage **26** is a further load frame **44** in which is mounted a pair of winch drums **46** and **48.** These drums are geared together as by gearing **50** and are adapted for being driven in counter-rotation by a reversible motor **52** which may be an electric motor or a hydraulic motor. Each winch drum has cables connected thereto which extend upwardly and about the pulleys in rotary carriage **26** and then back down to frame **44** for connection therewtih. For example, winch drum **46** has connected thereto cables **54** and **56** which pass upwardly and about pulleys **36,** 38, respectively, and back downwardly for connection to points **58** and **60,** respectively, on load frame, or load unit, **44.**

Similarly, winch drum **48** has connected thereto cables **62** and **64** which pass upwardly and about pulleys **40** and **42,** respectively, and then back downwardly to frame **44** to be fixedly connected thereto at points **66** and **68,** respectively. Depending from the bottom of

frame **44** is a load engaging member which may be in the form of a hook **70.**

FIG. **2** shows how motor **30** may be connected to carriage or carrier **26** for driving a roller **28** which rests on the circular track **24** fixed to the top of the frame of carriage **18.**

FIG. **3** shows how shaft **32** can be journalled in a bearing **72** fixed to the inside of rotary carriage **26** so that the pulley **38** is supported for sustaining the stresses imposed on the cable **64** entrained thereabout. Each pulley on shafts **32** and **34** is adjacent a respective bearing **72** and thereby the load on the cables entrained over the pulleys is transmitted to the frame of the rotary carriage **26** closely adjacent the said frame.

In the arrangement of FIG. **4,** a carriage **80** is provided having wheels, or rollers, **82** adapted for resting on the frame of the main carriage of the crane for movement therealong. In the FIG. **4** modification, the carriage includes a supporting arrangement for a vertical shaft **84.** The supporting arrangement may comprise a solid plate or it may comprise any other suitable supporting structure. In the particular modification illustrated, the top of carriage **80** is in the form of a heavy plate **86.** Upstanding from the top of heavy plate **86** in about the center is a sleeve member **88** within which is mounted heavy duty thrust bearing **90.** The shaft **84** is fixed to the thrust bearings in load transmitting relation thereto by a nut or other connecting device **92.** On the underside of plate **86** shaft **84** is connected to a rotary carriage **94** which has circumferentially distributed wheels **96** thereon engaging the bottom of plate **86** thereby to prevent tilting of rotary carriage **94** relative to the plate. The provision of rollers **96** prevents shaft **84** from being bent and stressed laterally and insures that the load on thrust bearing **90** will always be in the vertical, or axial, direction.

Connected to space points about rotary carriage **90** are cables **98, 100, 102** and **104.** Cables **98** and **100** lead downwardly and are connected to a winch drum **106** rotatable in a load frame **108.** Similarly, cables **102** and **104** lead downwardly and are connected to a second winch drum **110** in frame **108.**

The winch drums **106** and **110** are connected by gearing **112** for counterrotation and a motor, either electric or hydraulic, indicated at **114,** is drivingly connected to the gearing.

Advantageously, a load hook, or the like, **116,** is secured to and dependant from load frame **108.**

The aforementioned shaft **84** will be seen in FIG. **5** to have a worm wheel **118** fixed thereto above the top of plate **86** and meshing with a worm **120** driven by a reversible motor **122** carried on a bracket **124** mounted on top of plate **86.**

The entire structure of the rotatable carriage **94** and the shaft **84** and the thrust bearing **90** and plate **86** is such that all rated loads that might be placed on load hook **116** are adequately supported by the aforementioned structure.

FIG. **6** shows a modification in which the carrier or carriage **120** is rotatably supported on the trolley of the crane structure as by rollers **122,** two of which may be reversibly driven as by the reversible motors **124** and **126.** Carriage **120** has a support member **128** fixed thereto on which is mounted bearing members **130** and **132.** Bearing member **130** carries a shaft **134** on the opposite ends of which are mounted the pulleys **136** and **138.**

Similarly, bearing member **132** carries a shaft **140** which has on the opposite ends the pulleys **142** and **144.** Beneath the carriage **120** is a load frame **150** having a lower winch member **152** and directly thereabove an upper winch member **154.** The winch members are interconnected by a gearing **156** and are reversibly driven for counterrotation by a motor **158.** A first cable **160** has its opposite ends connected to winch member **152** and is entrained over pulley **136.** A second cable **162** is also connected to winch member **152** and is entrained over pulley **142.**

A still further cable member **164** has its ends connected to winch member **154** and is entrained over pulley **138** and still another cable member **166** has its ends connected to winch member **154** and is entrained over pulley **144.** The described arrangement gives a uniform load distribution when the winch members are operated to lift the load and which may be suspended on the load hook **168** dependent from the bottom of frame **150.**

The hook member, as will be seen in FIG. **8,** is advantageously provided with a latching arrangement for preventing rotation thereof on frame **150,** said latching arrangement taking the form of a pin **170** removably mounted in frame **150** and engaging an arm element **172** fixed to hood **168.**

FIG. **7** shows a modified manner in which the trolley can be supported on the main frame of the crane. In FIG. **7,** which is a fragmentary view, reference numeral **180** indicates a rail of the main crane frame and reference numeral **182** generally indicates the trolley of the crane. In the modification of FIG. **7,** the support rollers for the trolley are arranged in pairs, one roller **184** rolling on the inside of the rail **180** and the other roller **186** rolling on the outside thereof. By this arrangement, twisting of the main frame of the crane is prevented due to heavy loads imposed on the crane trolley.

A pair of the inner rollers **184** may be interconncted by a shaft **188** on which is mounted a gear **190** driven by the pinion **192** on the output shaft of a reversible motor **194.**

While the carrier, or subcarrige, has been referred to as being rotatably supported on the trolley, it will be understood that the carrier, in fact, turns clockwise and counterclockwise from a rest position, thereby simplifying the connection of wires to motors pertaining thereto. FIG. **9** schematically illustrates one way in which the crane arrangement can be provided with electric power. In FIG. **9,** all of the parts of the crane are shown quite schematically with **200** representing the main crane frame, **202** representing the crane trolley and **204** indicating the carrier or subcarriage oscillatably mounted on the trolley. Carried either on the main crane frame or on the trolley is a cab **206** for the crane operator.

Power is supplied to the crane by power lines **L1, L2** and **L3** on which slippers generally indicated at **208** slide and which slippers are connected to the main crane frame. These slippers are connected to wires **L1***a*, **L2***a* and **L3***a* carried by the main frame of the crane and extending longitudinally thereof. Further slippers generally indicated at **210** and carried by crane trolley **202** slidably engage the lines **L1***a*, **L2***a* and **L3***a*. These last mentioned slippers are connected by a cable **212** with cab **206** and in the cab are connected to controllers generally indicated at **214.**

From the controllers, a further cable **216** returns to the crane trolley for connection to motors pertaining thereto. The main crane of the frame may also carry longitudinally extending lines L1*b*, L2*b* and L3*b* which may be engaged by further slippers generally indicated at **218** and which are connected by a cable **220** with at least some of the wires in cable **216.** Wires. L1*b*, L2*b* and L3*b* may be connected in circuit with the main drive motors for the crane frame. In the manner described above, connections can easily be made to all of the electrical components of the crane structure.

FIGS. **10** through **13** schematically illustrate modified arrangements. In FIG. **10, 300** is the main crane frame and **302** is a trolley moveable therealong. Trolley **302** has mounted therein suspended beneath the top a circular track **304** on which a carriage **306** is rotatable. Carriage **306** has a transverse bar **308** fixed therein from which are suspended pulleys **310** about which are entrained cables **312** and **314** that lead downwardly to a motor driven drum **316** carried on top of cab **318.** Pressure drum **320** is rotatable on trolley **302** and leading therefrom is a hose **322** that extends downwardly to a controller **324** in the cab. Hose **322** could be an electric cable.

Another pressure drum **325** is rotatable in the structure on top of the cab and is supplied with hydraulic pressure by a motor driven pump **326.** The hose **328** is connected to drum **325** and leads therefrom.

FIG. **12** shows an arrangement in which trolley frame **340** has a circular track **342** therein on which is rotatably mounted a carriage **344** suspended beneath which is a motor driven cable drum **346** having cables **348** connected thereto and leading downwardly to a load hook structure **350.**

In FIG. **11,** trolley **370** has a heavy plate **372** mounted thereon and suspended therebeneath is a carriage or carrier member **374** constructed and arranged similarly to the carriage shown in FIGS. **4** and **5.** Pulleys suspended beneath the carriage and cables **376** connected thereto leading downwardly to a cable drum **378** which is reversibly driven by a motor **380.** Cable drum **378** is mounted in a load frame that includes a load hook **382** adapted for engaging the bail **384** of a ladle **386.**

Ladle **386** is adapted for being turned by a fluid motor **388** while the stopper **390** of the ladle is adapted for actuation by a fluid motor **392** to move the ladle upside down to dispose of unwanted material. Hoses lead from the fluid motors to a rotatable pressure drum **394** to which fluid under pressure is supplied by a motor driven pump **396.** The valve and the controls therefor to control the operation of the fluid motors are not illustrated.

In FIG. **13** member **400** represents the trolley which is moveably supported on the main crane frame while suspended therebeneath is a circular track **402** supportingly held on the trolley as by brackets **404,** one only of which is shown in FIG. **13.**

The various actuating motors and controls and the like employed in the modifications of FIGS. **10** to **13** have not been specifically described and designated because they correspond to such motors and controls previously described in respect of the other modifications.

Modifications may be made within the scope of the appended claims.

What is claimed is:

1. In a crane structure having a main frame moveable along stationary rails in one direction and a trolley moveable along the main frame in another direction; a load frame, drum means rotatable in said load frame, cable means connected to said drum means and leading upwardly therefrom, a carrier member adjacent said trolley, first means connecting said cable means to said carrier member in load transmitting relation thereto, and second means rotatably supporting said carrier member on said trolley, said second means being disposed beneath the top of said trolley and fixedly connected thereto.

2. A crane structure according to claim **1** in which said drum means comprises a pair of drums in horizontally spaced parallel relation in said load frame, motor means for driving said drums in rotation, said cable means comprising a pair of cables connected to each drum and connected in load transmitting relation to spaced points of said carrier member thereby providing for distributed support of said load member.

3. A crane structure according to claim **2** in which said first means comprises a pulley rotatable on said carrier member for each cable, each cable leading from the respective drum upwardly to the pertaining pulley and over the pertaining pulley and then back down to a point of connection on said load frame.

4. A crane structure according to claim **1** in which each said cable is fixedly connected to said carrier member and leads downwardly therefrom to the respective drum.

5. A crane structure according to claim **1** in which said first means comprises a circular track on said carrier member and rollers distributed circumferentially on said carrier member and engaging said track.

6. A crane structure according to claim **5** which includes reversible motor means drivingly connected to at least one of said rollers.

7. A crane structure according to claim **1** in which said first means comprises a vertical shaft fixed to said carrier member and supported for rotation by said member.

8. A crane structure according to claim **7** in which said carrier member comprises a horizontal plate element through which said shaft extends and which is disposed immediately above said carrier member, and roller means in circumferentially distributed relation on the carrier member engaging the underside of said plate element in a region spaced radially from the axis of said shaft and supporting said carrier member against tilting relative to said plate element.

9. A crane structure according to claim **1** in which said first means comprises a vertical shaft fixed to said carrier member, a thrust bearing on said carrier member supporting said shaft, and reversible motor means drivingly connected to said shaft for driving the shaft in rotation in the carrier member.

10. A crane structure according to claim **1** in which said second means is a circular track disposed beneath said trolley, and bracket means connecting said circular track to said trolley and supporting the track on said trolley, said carrier member having roller means engaging said track. l

11. A crane structure according to claim **10** which includes a motor driven cable drum rotatably supported by said carrier member and cables leading downwardly therefrom for engagement with a load.

12. A crane structure in combination according to claim 1 in which said main frame includes beams forming the rails on which the trolley is supported, said trolley having pairs of rollers thereon with the rollers of each pair engaging opposite sides of a respective one of said beams, and at least one of the said rollers being reversibly driven for moving said trolley along said main frame.

13. A crane structure in combination according to claim 1 in which said main frame comprises spaced rails, and rollers on said trolley engaging said rails, said rollers comprising pairs of rollers, one roller of each pair engaging one side of a respective rail of said main frame and the other roller of each pair engaging the other side of the respective rail.

14. In a crane structure having a main frame moveable along stationary rails in one direction and a trolley moveable along the main frame in another direction; a load frame, drum means rotatable in said load frame, cable means connected to said drum means and leading upwardly therefrom, a carrier member adjacent said trolley, first means connecting said cable means to said carrier member in load transmitting relation thereto, and second means rotatably supporting said carrier member on said trolley, said second means being disposed beneath the top of said trolley and fixedly connected thereto, pulleys on said carrier member, cables leading downwardly from said pulleys, an operator's cab structure, and a rotatable cable drum on top of the cab structure engaging said cables.

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