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Wilson

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[54] **CRANE ARRANGEMENT AND LADLE STRUCTURE**

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[52] **U.S. Cl.** **212/21**, 212/11, 212/130

[51] **Int. Cl.** **B16c 17/10**

[58] **Field of Search** ..... 212/10, 11, 127, 128, 130, 212/18, 21; 254/186 R

[56] **References Cited**

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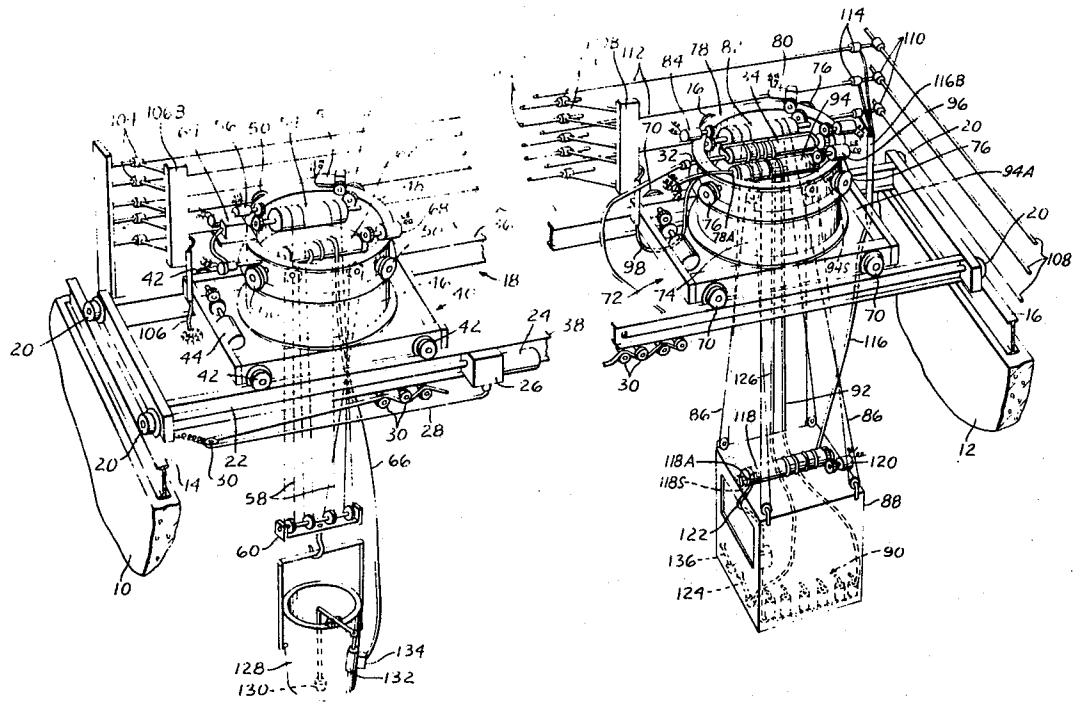
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Assistant Examiner—Jeffrey V. Nase
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[57] **ABSTRACT**

A crane structure having a rotatable load support and also having a rotatable cab support with a control system including electrical, pneumatic and hydraulic systems. There is also disclosed a multiple outlet ladle and a tilting arrangement for the ladle.

12 Claims, 8 Drawing Figures



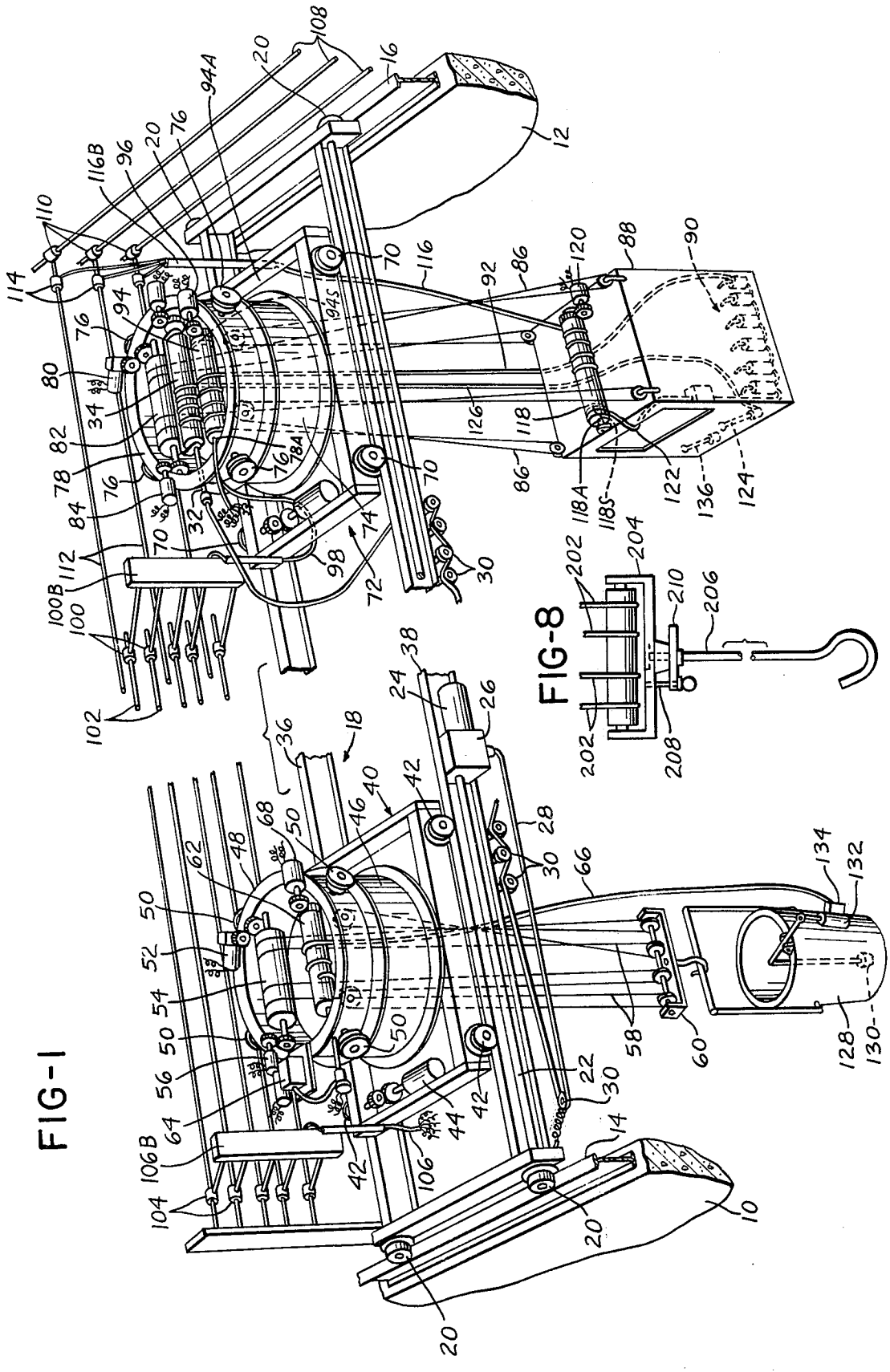


FIG-1

FIG-8

FIG-2

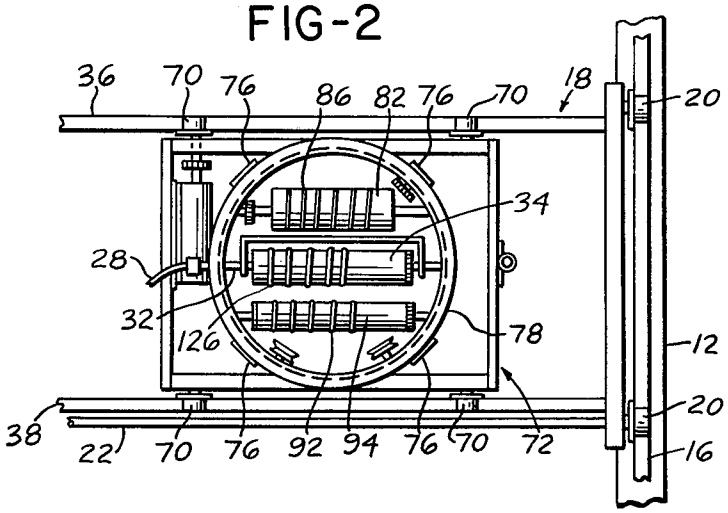


FIG-3

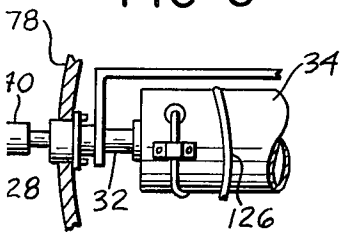


FIG-6

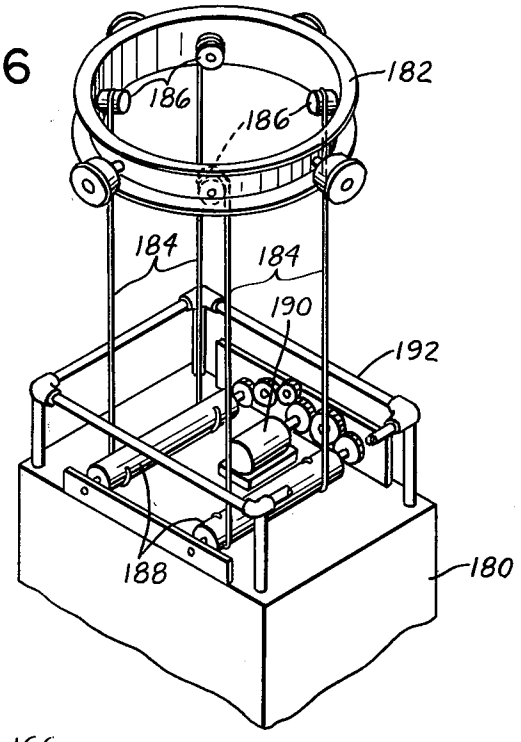


FIG-4

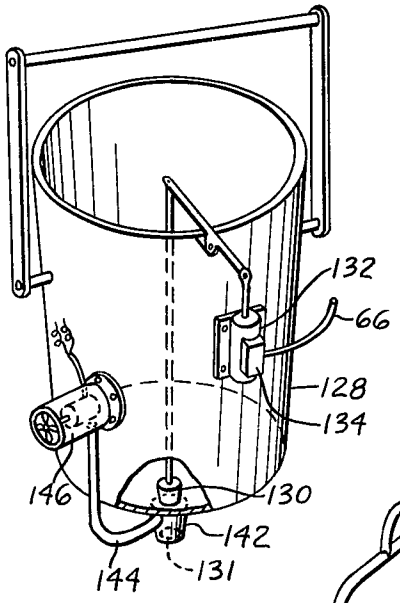


FIG-5

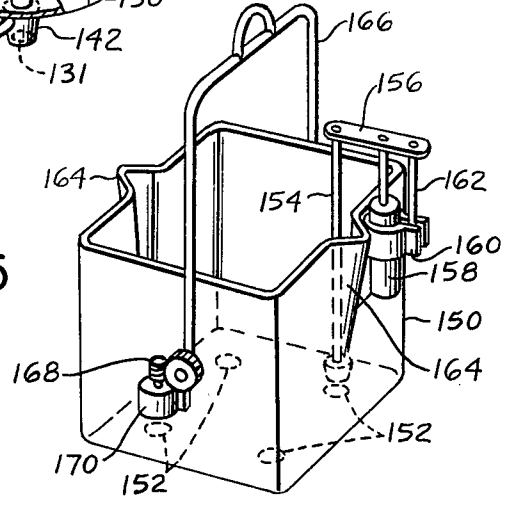
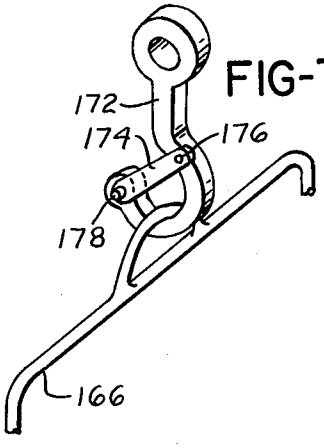


FIG-7



CRANE ARRANGEMENT AND LADLE STRUCTURE

The present invention relates to crane arrangements and is particularly concerned with a crane arrangement adapted for handling loads such as ladles in which molten metal is to be discharged.

Cranes of the type installed in buildings are, of course, known and, in general, consist of elongated rails fixed in a building structure and along which is moveable a main crane frame. Moveable in the main crane frame at right angles to the direction of travel of the main frame is a carriage which includes a winch from which cables lead downwardly to a load engaging device.

According to the present invention, the carriage has a rotatable structure thereon in which the load winch is mounted so that loads can be rotated relative to the crane carriage. The present invention also proposes a carriage also moveable on the frame of the crane and including a rotatable member from which the crane cab is supported and which is vertically moveable relative to the cab carriage. Electrical and pneumatic and hydraulic controls are provided with the controls including elements manipulated by the crane operator in the crane cab.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, a main crane frame is mounted on stationarily fixed parallel elongated rails for traversing the main crane frame over a working area. The main crane frame includes frame rails extending laterally to the main rails and mounted thereon is a first load trolley on which is rotatably mounted a load carriage and within which carriage is at least one load winch from which load cables lead downwardly to a load engaging device.

Preferably, the load carriage also includes a drum which is internally pressurized by a supply of compressed air thereto and to which is connected a hose that is wound up on the drum and which leads downwardly to a load carried at the lower end of the load cables.

Also mounted on the rails of the crane frame is a second trolley for supporting the operator's cab and rotatably mounted thereon is a cab carriage. In one form, the cab carriage contains a winch from which load cables lead downwardly to the cab by means of which the cab can be raised and lowered. The cab carriage also preferably includes at least one drum having slip rings therein and about which is wound an electric cable leading downwardly to the cab for connection to control switches.

The cab carriage can also include a drum about which a hose is wrapped and which is supplied with hydraulic pressure and which is employed for actuating a brake that can clamp the main crane frame in adjusted position along the main crane rails.

In another modification, the cab load cables are connected to the rotatable cab carriage and the winch or drums by means of which the cab is raised and lowered are mounted on top of the cab.

The primary object of the present invention is to provide a more useful and flexible crane arrangement and especially such an arrangement particularly adapted for handling ladles of molten metal for supplying molds into which the metal is to be poured.

A further object of the present invention is the provision of a crane structure of the nature referred to and a ladle therefor in which the ladle is provided with multiple outlets so that a plurality of molds can be filled at one time.

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

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

FIG. **2** is a plan view looking down on top of the cab trolley from which the operator's cab is suspended.

FIG. **3** is a fragmentary view showing the manner in which a hose drum mounted on the cab trolley can be supplied with fluid under pressure.

FIG. **4** is a perspective view, somewhat schematic in nature, showing one ladle arrangement.

FIG. **5** is a schematic view similar to FIG. **4** but showing a ladle arrangement with multiple outlets.

FIG. **6** is a fragmentary schematic view showing a modified arrangement for suspending the operator's cab from the rotatable carriage that is mounted on the cab trolley.

FIG. **7** is a schematic view showing a safety arrangement for preventing a load from becoming accidentally disengaged from the load hook.

FIG. **8** is a fragmentary view showing a modified hook arrangement, especially for ladles.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings somewhat more in detail, in FIG. **1, 10** and **12** indicate building walls or some other stationary supports to which are fixedly connected the elongated main rails **14** and **16.** A main crane frame **18** is provided with rollers **20** which rollingly engage the rails **14** and **16** so the crane frame can be moved in parallelism with itself along rails **14** and **16.**

At least one, and preferably an opposed pair, of rollers **20** are mounted on a shaft **22** adapted for being driven in rotation by a reversible electric motor **24.** Shaft **22** may also have associated therewith a hydraulic brake **26** which, when actuated by a supply of pressure thereto via conduit **28,** clamps shaft **22** against rotation and thus holds the main crane frame in its adjusted position on rails **14** and **16.**

Conduit **28,** which may be in the form of a flexible hose, is entrained about rollers **30** and leads to a hollow shaft **32** leading into a drum **34** which will be more fully described hereinafter.

Main crane frame **18** comprises parallel spaced rails **36** and **38** extending at right angles to rails **14** and **16** and mounted on rails **36** and **38** is a load trolley **40** supported by rollers **42** so as to be moveable in the direction of the length of rails **36** and **38.** At least one of the rollers **42** is driven as by a motor **44** for traversing the trolley **40** on rails **36** and **38** and a hydraulic brake may also be provided for clamping the trolley in position on rails **36** and **38** and may take the form of a brake associated with one of rollers **42.**

Trolley **40** has a circular member **46** mounted thereon forming a circular track on which a carriage **48** is supported as by rollers **50.** At least one of rollers **50** is adapted for being driven in rotation as by a motor **52** and a brake, preferably hydraulic, may be provided to

clamp carriage 48 to circular track 46 in adjusted positions if so desired.

Rotatably mounted in carriage 48 is a winch or cable drum 54 adapted for being reversibly driven as by motor 56 and to which drum is connected cable means 58 which lead downwardly and pass about sheaves forming a part of a load engaging device 60.

Also rotatably mounted in carriage 48 is a hose drum 62 which is hollow and which has a hollow shaft leading therein to which is connected a motor driven air compressor 64 so that the inside of drum 62 is maintained under pressure. A hose 66 has one end connected to the interior of drum 62 and is wrapped around the drum and leads downwardly for use in connection with the operation of an air cylinder or the like associated with a load connected to load engaging device 60. A motor 68 is provided for reversibly driving drum 62, but it is also possible to drive this drum by means of the motor 56 which drives cable drum 54.

Also mounted on rails 36 and 38, as by rollers 70, is a cab trolley 72 that has mounted thereon a member 74 forming a circular track which supports, as by means of rollers 76, a cab carriage 78. At least one of rollers 76 is driven as by motor 80 and a brake can be provided for clamping carriage 78 to member 74.

Mounted in carriage 78 in the FIG. 1 modification is a cable drum 82 adapted for being reversibly driven as by a motor 84 and to which drum cable means 86 is connected and which cable means lead downwardly and pass about sheaves carried by the cab 88.

The cab is provided with a group of controllers, generally indicated at 90, and at least some of which are connected as by the electric cable 92 with slip ring means 94S mounted within a drum 94 about which the cable 92 wraps and which drum is rotatable on a horizontal axis 78A defined by a shaft suitably journalled in the cab carriage 78. A motor 96 is provided for reversibly driving drum 94.

The slip ring means 94S within drum 94 serve to interconnect cable 92 with a further electric cable 98 leading into the drum 94 on the axis thereof on one end and at the other end being connected by buss means 100B with slippers 100 which are slidable on cables 102. Cables 102 extend longitudinally along main crane frame 18 and have further slippers 104 in sliding engagement therewith which lead by way of further buss means 106B to a cable 106 which is connected, in a manner not shown, to the several electric motors associated with the load trolley and carriage.

The main power supply derives from supply cables 108 stationarily mounted in the building and extending parallel and adjacent to one of rails 14 and 16. These cables are engaged by slippers 110 connected to cables 112 which are arranged to move with the main crane frame and which are, in turn, engaged by further slippers 114 that move with the cab trolley and which are connected by way of further buss means 116B to an electric cable 116 leading downwardly and winding about a drum 118 rotatable on a horizontal axis 118A defined by a shaft suitably journalled inside cab 88 and adapted for being reversibly driven by an electric motor 120.

The drum 118 contains slip ring means 118S and leading therefrom is a cable 122 that extends downwardly to the aforementioned controllers 90. In the aforesaid manner, the supply of power from stationary supply cables 108 to the several motors associated with the two trolleys and carriages is arranged to be under the control of the operator in cab 88.

There may also be included within the cab control elements, one of which is shown at 124, which is connected as by hose 126 to drum 34, previously mentioned, so that control element 124 can control the actuation of hydraulic brake 26. Other controls may be provided if so desired.

In FIG. 1, the particular load supported by load engaging device 60 is a ladle 128 having a stopper 130 under the control of a pneumatic cylinder 132 to which the aforementioned compressed air hose 66 is connected. The fluid supply from hose 66 to cylinder 132 is under the control of an electric valve 134 and which is connected, as by wires leading from cable 106 to a control element 136 mounted in cab 88. The electric wiring leading from valve 134 may be associated with air hose 66 and a slip ring means arrangement 62S carried by hose drum 62 so that the wires do not fall slack as the load is raised and lowered.

FIG. 2 shows somewhat more in detail the cab trolley and cab carriage arrangement and the drums mounted therein.

FIG. 3 is a fragmentary view showing the support of hose drum 34 at one end and showing that hose 28 may be connected thereto via a rotary joint 140 which may, advantageously, be a quick disconnected coupling.

FIG. 4 shows that the ladle 128 may have a suction fitting 142 associated with the discharge opening 131 and to which suction fitting is connected a conduit 144 leading to a motor driven suction device 146.

FIG. 5 schematically illustrates a modified ladle arrangement 150 which has four discharge outlets 152 each having a stopper connected by a rod 154 and arm 156 adapted for being moved vertically by a respective fluid cylinder 158. Each cylinder 158 may have an adjustable guide bracket 160 engaging a guide rod 162 fixed to arm 156 so that proper alignment of the respective stopper with its discharge opening can be effected.

Further, cylinders 158 may be supported on the ladle for vertical adjustability thereon. Ladle 150 preferably has oppositely directed pouring spouts 164 and is supported on its support bail 166 in such a manner as to be tiltable thereon and which can be accomplished by the gearing 168 driven by a tilting motor 170.

A feature of the present invention is illustrated in FIG. 7 which shows that the bail 166 pertaining to the ladle may be engaged by the hook 172 on the load engaging device in such a manner that the ladle bail is prevented from becoming disengaged from the hook in case the ladle is lowered to the point that the bottom engages a stationary member, such as the floor.

The locking of the bail to the hook is accomplished, for example, by a latch bar 174 pivoted at 176 to hook 172 and adapted to move onto hook closing position and to be held in hook closing position as by a pin 178. The pin can be withdrawn to disengage the hook from the bail, but when the hook is engaging the bail and latch bar 174 is in the position shown with pin 178 in place, it is not possible to disengage the hook from the bar.

FIG. 6 shows, schematically, a modification in which a cab 180 is supported on a rotatable cab carriage 182 by cables 184 having the upper ends fixedly connected to carriage 182 as at 186 while at the cab ends, the cables are connected to the drums 188 that are rotatably

supported on top of the cab. Drums **188** are adapted for being reversibly driven by a motor **190** mounted on top of the cab **180.**

For the purpose of protecting the cab **188** against damage from being moved too far upwardly, and also to protect the drums **188** and the drive mechanism therefor, the cab may have protective railing **192** upstanding from the upper side and surrounding the aforementioned drums and the drive mechanism therefor. Railing **192** may include an arrangement for actuating a stop switch in the event the cab is elevated too far so that the power supplied to the cab elevating motor **190** will be interrupted in the event the cab is raised beyond an allowable limit.

FIG. **8** schematically illustrates a modified hook arrangement, especially adapted for use as a ladle hook. In FIG. **8,** reference numeral **200** shows a cable pulley about which cable means **202** are entrained. A frame **204** rotatably supports pulley **200** and has pivotally suspended therefrom an elongated hook **206.** Hook **206** is adapted for being locked in one or more rotated positions by a pin member **208** receivable in bores in a collar **210** fixed to the hook and in the frame **204.**

As mentioned, hook **206** is elongated over conventional hooks and for this reason, especially when handling ladles, no intermediate hook element is required between the crane hook and the ladle bail. By eliminating any intermediate hook, the possibility of the crane hook becoming disengaged from the ladle bail is greatly reduced.

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

What is claimed is:

1. In a crane structure a main crane frame comprising parallel rails, a set of support rollers on said main frame for the support thereof on stationary mounted main track members which are parallel to each other and perpendicular to said frame rails, a load trolley having a set of support rollers thereon engaging said frame rails, a first circular track on said load trolley, a load carriage having a set of support rollers thereon engaging said first circular track, drum means rotatable on horizontal axes in said load carriage, load cable means connected to said drum means and leading downwardly therefrom for supporting a load, a cab trolley having a set of support rollers thereon engaging said frame rails a second circular track on said cab trolley, a cab carriage having a set of support rollers thereon engaging said second circular track, a cab beneath said cab carriage, cable means supportingly connecting said cab to said cab carriage, and winch means engaging said cable means and operable for changing the length of said cable means to raise and lower said cab relative to said cab carriage, individual electric motors connected to at least one roller of each set of supporting rollers and means for selectively engaging said motors, a control element in said cab for controlling the energization of each of said motors, a first electric cable leading from said control elements, a rotatably first drum in said cab carriage about which said electric cable is entrained, a second electric cable leading from said first drum to said motors, first slip ring means carried by said first drum and electrically connecting said first cable to said second cable, a third electric cable connected to said control elements, a rotatable second drum about which said third cable is entrained, a fourth electric cable leading from a stationary power supply to said second drum, and second slip ring means carried by said second drum and electrically connecting said third cable to said fourth cable.

2. A crane structure according to claim **1** in which said winch means includes drum means mounted on horizontal axis means in said cab carriage.

3. A crane structure according to claim **1** in which said second drum is rotatable on a horizontal axis on said cab.

4. A crane structure according to claim **1** which includes a fluid operated brake between said load trolley and said main frame, a hose drum rotatable on a horizontal axis in said cab carriage and a hose entrained thereabout and leading into said cab, a control member in the cab connected to said hose, a conduit leading from said hose drum to said brake, and a source of pressure for said brake under the control of said control member.

5. A crane structure according to claim **1** which includes load engaging means supported by said load cable means and having a hook, and means selectively adjustable for closing said hook to prevent disengagement thereof from a load.

6. A crane structure according to claim **1** which includes load engaging means supported by said load cable means and having a hook, a ladle for molten metal and having a bail engaged by said hook, and discharge means in the bottom of said ladle.

7. A crane structure according to claim **6** which includes a rotatable hollow drum on said load carriage, compressor means on said load carriage connected with the inside of said hollow drum, a flexible conduit having one end connected to the inside of said hollow drum and entrained about the hollow drum and leading downwardly therefrom, a valve at the lower end of said conduit, and means operable in said cab for controlling said valve.

8. A crane structure according to claim **7** in which said ladle has a plurality of discharge openings in the bottom, a stopper for each opening, a fluid cylinder on the ladle for each stopper, and means in said cab for selectively controlling said cylinders.

9. A crane structure according to claim **8** in which said ladle includes means tiltably connecting the ladle to the supporting bail thereof, and means for tilting said ladle on said bail.

10. A crane structure according to claim **9** in which said ladle includes pouring spout means at the top.

11. A crane structure according to claim **1** which includes a control element in said cab for controlling the energization of each of said motors, a first electric cable leading from said control elements, a rotatable first drum in said cab carriage about which said first cable is entrained, buss means on said main frame parallel to the rails thereof, a second electric cable having first slipper means engaging said buss means and leading to said first drum, first slip ring means carried by said first drum and electrically interconnecting said first and second cables, second slipper means connected to said load trolley and engaging said buss means, and a third electric cable connected to said second slipper means and leading to the said motors pertaining to said load trolley and load carriage.

12. A cable structure according to claim **11** which includes supply busses parallel to said tracks, third slippers engaging said supply busses, further busses on said crane frame and connected to said third slippers, fourth

slippers carried by the cab trolley and engaging said further busses, a fourth electric cable connected to said fourth slippers and leading to said cab, a further cable drum rotatable on said cab and about which said fourth cable is entrained, a fifth cable leading to said control elements, and slip ring means in said further drum interconnecting said fourth and fifth cables.

* * * * *